

Abstracts and Programme

Euroanaesthesia 2004

**Joint Meeting of the European Society of Anaesthesiologists and
European Academy of Anaesthesiology**

Lisbon, Portugal,
5–8 June 2004



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EUROANAESTHESIA 2004

Joint Meeting of the
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Lisbon, Portugal, 5–8 June 2004

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A-1

Acute hyperinsulinemia restrains endotoxin induced systemic inflammatory response – an experimental study in a porcine model

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The work was performed at the Institute of Experimental Clinical Research (IECR), Aarhus University Hospital, Denmark.

Background and Goal of Study: Intensive insulin therapy in critically ill patients appears to reduce morbidity and mortality (Van den Berghe). The present study elucidate whether acute hyperinsulinemia *per se* could attenuate the systemic cytokine response and improve neutrophil function during endotoxin (lipopolysaccharide (LPS)) induced sepsis in a porcine model.

Materials and Methods: Pigs were anesthetized, mechanically ventilated and randomised into 4 groups and followed for 570 minutes: Group 1 (anesthesia solely, n = 10), Group 2 (hyperinsulinemic-euglycemic-clamp (HEC, n = 9)), Group 3 (LPS, n = 10) and Group 4 (LPS-HEC, n = 9). Groups 3 and 4 were given a 180 min infusion of LPS (total 10 µg/kg). Groups 2 and 4 were clamped (p-glucose: 5 mM/l, insulin infusion rate 0.6 mU kg⁻¹ min⁻¹) throughout the study period. Changes in pulmonary and hemodynamic function, circulating cytokines, free fatty acids (FFA), glucagon, and neutrophil chemotaxis were monitored.

Results and Discussion: TNF-α and IL-6 were significantly reduced in the LPS-HEC group compared to the LPS group (both p = 0.04). LPS induced a significant increase in glucagon (p = 0.01), and this response was significantly reduced in the LPS-HEC group (p = 0.01). FFA levels were decreased in animals exposed to the HEC and LPS-HEC. Animals receiving LPS showed an increase in pulmonary pressure (p = 0.00), but otherwise there were no major changes in pulmonary or hemodynamic function. Neutrophil function was impaired during LPS-sepsis.

In this experimental study we demonstrated that short-term hyperinsulinemia together with normoglycemia vastly reduced the systemic inflammatory and metabolic responses to LPS-induced sepsis in a porcine model. It was clearly demonstrated that maintenance of hyperinsulinemia reduced plasma levels of glucagon and TNF-α, the latter supporting the hypothesis that insulin has antiinflammatory effects (Das). As expected the neutrophil function was impaired during LPS-sepsis. In contrast to most clinical courses of severe sepsis, the septic insult was well defined with respect to time and LPS dose and controlled in this set up. The clinical response is highly reproducible in the pigs, and analogue to the human septic response.

Conclusion(s): Hyperinsulinemia concomitant with normoglycemia reduces plasma levels of TNF-α and the catabolic hormone glucagon in LPS-induced sepsis in a porcine model. The exogenous insulin acutely modulates the innate immune system by decreasing an inappropriate proinflammatory response, restoring normal glucose-levels and decreasing FFA and glucagons – playing an antiinflammatory action. Longer term effects of hyperinsulinemia on the proinflammatory cytokine response remains to be determined.

References:

- 1 Van den Berghe G, Wouters R, Weekers F et al. *N Engl J Med* 2001; 345: 1359–67.
- 2 Das UN. *Nutrition* 2001; 17: 409–13.

Acknowledgements: The Danish Research Council and the Aarhus University Research Foundation.

A-2

Activated protein C ameliorates endotoxin-induced lung injury in sheep

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Background and Goal of Study: Acute lung injury (ALI) often develops after sepsis due to release of endotoxin (lipopolysaccharide – LPS) to the blood.

We hypothesized that recombinant human activated protein C (APC), which has reduced mortality from severe sepsis with 6.1% (1) could antagonize LPS-induced ALI. Our goal was to assess the effect of APC on pulmonary hemodynamics, extravascular lung water content, and markers of coagulation and inflammation in endotoxemic sheep.

Materials and Methods: Sheep were instrumented (2) and randomized to three groups: An APC group (n = 4) had an infusion of APC 24 µg/kg/hr (Xigris®, Eli Lilly & CO, USA) from 4 to 24 h; a LPS group (n = 9) received *Escherichia coli* LPS 15 ng/kg/min intravenously from 0 to 24 h; a LPS + APC group (n = 9) received LPS and was treated with APC from 4 to 24 h. All sheep received isotonic saline 3 mL/kg/h intravenously.

Results: Continuously infused APC alone caused no changes. During endotoxemia, APC reduced the increments in pulmonary microvessel pressure and extravascular lung water index (EVLWI) by 60% and 75%, respectively, paralleled by improved gas exchange. As compared to LPS alone, APC treatment lowered the plasma level of TNF-α by 83% and reversed the decrease in protein C and fibrinogen by 25%. Moreover, APC blocked the LPS-induced translocation of α- and ε-isoforms of protein kinase C in the lungs.

Conclusions: In conscious sheep, continuously infused APC alleviate LPS-induced ALI, as characterized by reduced lung microvascular pressure and EVLWI, improved gas exchange and attenuation of the coagulation and the inflammation dysfunctions.

References:

- 1 Bernard GR et al. *N Engl J Med* 2001; 344: 699–709
- 2 Kirov MY et al. *Am J Respir Crit Care Med* 2002; 166(11): 1436–42.

A-3

Vasopressin, but not fluid resuscitation, enhances survival in a liver trauma model with uncontrolled and otherwise lethal hemorrhagic shock in pigs

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Background: We compared the effects of vasopressin vs. fluid resuscitation on survival in a liver trauma model with uncontrolled and otherwise lethal hemorrhagic shock in pigs.

Methods: A midline laparotomy was performed on twenty-three domestic pigs, followed by an incision, and subsequent finger fracture across the right medial liver lobe. During hemorrhagic shock, animals were randomly assigned to receive either 0.4 U/kg vasopressin (n = 9), or fluid resuscitation (n = 7), or saline placebo (n = 7), respectively. A continuous infusion of 0.08 U/kg/min vasopressin in the vasopressin group, or normal saline was subsequently administered in the fluid resuscitation and saline placebo group, respectively. After 30 min of experimental therapy, bleeding was controlled by surgical intervention, and blood transfusion as well as rapid fluid infusion was subsequently performed.

Results: Maximum mean arterial blood pressure during experimental therapy in the vasopressin-treated animals was significantly higher than in the fluid resuscitation and saline placebo groups (mean ± SD, 72 ± 26 vs. 38 ± 16 vs. 11 ± 7 mmHg, respectively; P < 0.05). Subsequently, mean arterial blood pressure remained at ~40 mmHg in all vasopressin-treated animals, whereas mean arterial blood pressure in all fluid resuscitation and saline placebo pigs was close to aortic hydrostatic pressure (~15 mmHg) within ~20 min of experimental therapy initiation. Total blood loss was significantly higher in the fluid resuscitation pigs compared with vasopressin or saline placebo after 10 min of experimental therapy (65 ± 6 vs. 42 ± 4 vs. 43 ± 6 mL/kg, respectively; P < 0.05). Seven of seven fluid resuscitation, and seven of seven saline placebo pigs died within ~20 min of experimental therapy, while 8 of 9 vasopressin animals survived over a period of seven days (P < 0.05).

Conclusions: Vasopressin, but not fluid resuscitation or saline placebo, ensured survival with full recovery in this liver trauma model with uncontrolled and otherwise lethal hemorrhagic shock in pigs.

ESA Best Abstract Prize Competition

A-4

Patient satisfaction with anaesthesia care: when to ask the patient?

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Background and Goal of Study: There is still a lack of information about the effect of time in the judgment of the quality of care by the patient. Sociological studies describe different results: response rate decreasing, problem score constant or U-shaped with time in a period of up to 12 weeks (1,2). The goal of this study was to compare the patient's judgement of anaesthesia care after 3 different periods of time since discharge from hospital.

Materials and Methods: After ethics approval 3 groups of patients were randomly assigned to receive a standardized, validated psychometric questionnaire (3) either 1, 5 or 9 weeks after their discharge. If after 2 weeks no reply was received an identical reminder questionnaire was sent once to enhance response rate. We measured response rate and the total mean problem score of the underlying 6 dimensions. Data are presented as means in % (95% confidence interval). * $p < 0.05$ for the comparison of the means was considered significant.

Results and Discussions: The randomization was successful. In group one, two and three 748, 743 and 723 questionnaires respectively were sent out. Response rate including the reminder was 67%, 65% and 59%* respectively. Total mean problem score for group one, two and three was 17(1)%, 17(1)% and 15(1)%* respectively which was explained mainly by significant changes in the dimension continuity of care by the anaesthetist. The other dimensions information/participation, respect/confidence, delays, care in the recovery area and pain management only showed inconsistent changes.

Conclusion(s): The response rate and description of problems decrease when asking patients 9 weeks after discharge compared to 1 and 5 weeks. Questionnaires asking patients about the quality of anaesthesia care should be sent within 5 weeks to avoid lower response rates and false low problem scores.

References:

- 1 Raspe H et al. *Das Gesundheitswesen*. 1998;60:75–79.
- 2 Ley P et al. *Br J Soc Clin Psychol*. 1976;15:403–413.
- 3 Heidegger T et al. *Brit J Anaesth*. 2002;89(6):863–872.

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A-5

Return hospital contacts in two Danish day surgery units. Readmission, morbidity and mortality

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Background and Goal of Study: Large population studies show that day surgery is a safe practice (1,2,3). Return hospital visit rates and associated morbidity following discharge from day surgery may serve as a local indicator of outcome and quality. In a Danish population we examined the frequency of all day surgery related surgical and medical return hospital contacts and the related morbidity rates of specific diagnose groups.

Materials and Methods: From two University Hospitals 13.906 patients undergoing day surgery during 1996–2000 (gynecology, orthopedics, urology, gastroenterology and mamma surgery) were retrospectively examined. Their individual civil identification number identified patients. Data of any hospital contact within 60 days after surgery were extracted from The Danish National Registry of patients. The Register delivers informations about date, type of contact and locality (amb, emergency room (ER) or inpatient) and diagnosis according to ICD10 including death. The medical records of all contacts with selected codes were assessed to decide whether the contact was definitely related, definitely not related or possibly related to day surgery.

Results and Discussions: Of 149 contacts 64 (0.5%) were definitely related (amb 1:1986, ER 1:993, inpatients 1:323). The table shows diagnose groups with N. No related deaths occurred. Sixty-five percent of the contacts happened from the 5th–20th day. The most common diagnose was wound infection (1:356).

Myocardial infarction	0	Airway infection	1
Myocardial ischemia	0	Wound infection	39
Deep phlebothrombosis	5	Wound rupture	5
Pulmonary emboli	2	Arthritis	5
Haematoma	7	Cerebro-vascular	0
Airway bleeding	4	Other	5

Conclusions: Day surgery in Denmark is a safe practice and readmission to hospital compares well to international centres (1,3).

References:

- 1 Twersky R, Fishman D, Homel P. *Anesth Analg* 1997; 84: 319–324.
- 2 Mezei G, Chung F. *Ann Surg* 1999; 230: 721–727.
- 3 Coley KC, Williams BA, DaPos SV, et al. *J Clin Anesth* 2002; 14: 349–353.

A-6

Heart rate variability predicts severe hypotension after spinal anaesthesia for elective cesarean section

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Backgrounds: Routine administration of spinal anaesthesia (SPA) for elective cesarean section is safe, nevertheless hypotension due to sympatholysis is a potential harm (1). Heart rate variability (HRV) can determine autonomic control and might be feasible to detect patients with high sympathetic tone and therefore at risk for hypotension after SPA.

Materials and Methods: After IRB approval 5 HRV analysis were performed in 41 patients (G1:13, G2:11, G3:17). I: before volume preload (VP), II: after VP, III: after SPA, IV: 5 minutes after SPA, V: 10 minutes after SPA. Relative low frequency (LF), indicating sympathetic drive, relative high frequency (HF), indicating parasympathetic drive, and LF/HF ratio, reflecting autonomic control (2,3) were analysed. Depending on the severity of hypotension patients were assigned into three groups (G). G1 remained stable, G2 showed moderate, and G3 severe hypotension. Statistics: Two Way Anova for analysis of matched pairs, Mann-Whitney-U test and Wilcoxon-Rank test for comparison between and within groups, $p < 0.05$.

Results and Discussions: Demographic data showed no significant differences. Systolic blood pressure of G1 (112 ± 11 mmHg) remained significant higher compared to G2 (97 ± 9 mmHg) and G3 (78 ± 9 mmHg). LF/HF(II) was significant lower in G1 (1.4 ± 0.7) compared to G2 (3.3 ± 2.2) and G3 (3.2 ± 1.9). This findings were confirmed by a significant lower LF and higher HF of G1 compared to G2 and G3 at event I. Within groups LF/HF decreased significantly after VP in G2 to 1.9 ± 0.9 whereas it decreased slightly in G3 after VP but decreased significantly after SPA (II: 2.6 ± 1.3 ; III: 1.4 ± 0.6). These data indicate a higher sympathetic drive preoperatively in patients with severe hypotension after SPA. Patients of G2 responded significantly to VP in terms of decrease of sympathetic drive before SPA, thus alleviating hypotension. G3 did not respond to VP, sympatholysis after SPA leads to severe hypotension.

Conclusions: HRV might be a tool to detect patients at high risk for hypotension preoperatively and might be feasible to modulate preoperative VP.

References:

- 1 Chestnut D: *Obstetric anesthesia. Principles and practice*, 1999.
- 2 Pomeranz B, et al.: *Am J Physiol*, 1985.
- 3 Pagani M, et al.: *Circ Res*, 1986.

A-7

Pulmonary vascular reactivity: new insights from transgenic mice with excessive erythrocytosis

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Background and Goal of Study: Pulmonary vascular remodeling during chronic hypoxia may be the result of either oxygen deprivation or erythrocytosis. To examine the effect of a chronically elevated hematocrit unconnected to hypoxia on the pulmonary vascular reactivity, we investigated transgenic mice over-expressing erythropoietin (1). These mice, reaching a hematocrit of 0.85 (2) without signs of thrombosis or embolism (3), had a significantly increased pulmonary artery pressure (PAP) in vivo (transgenic: 22.4 ± 2.8 mmHg, wild type: 14.4 ± 4 mmHg).

Materials and Methods: Since the significantly elevated blood viscosity of transgenic mice could have masked the PAP decrease from pulmonary

vasodilation, a saline perfused isolated lung setup was used to investigate pulmonary vascular reactivity.

Results and Discussions: Under ex-vivo conditions, the significantly reduced baseline PAP indicated that there was chronic pulmonary vasodilation in transgenic mice. When the thromboxane agonist U46619 was added following inhibition of cyclooxygenase and/or endothelial nitric oxide synthase (eNOS), transgenic mice were found to have a significantly smaller rise in PAP compared to wild type mice, consistent with increased perfusate prostacyclin concentrations (transgenic vs. wild type, 160 ± 112 pg/ml vs. 42 ± 37 pg/ml) and eNOS protein on immunohistochemistry.

Conclusion(s): Surprisingly, in erythropoietin transgenic mice pulmonary vascular smooth muscle thickness was significantly reduced. The effects of an isolated chronic erythrocytosis on the pulmonary vascular bed consisted of an increased production of vasodilator substances and a reduced smooth muscle thickness in the pulmonary vessels. These findings indicate, that hypoxia and not erythrocytosis per se markedly contributes to the pulmonary vascular remodeling present in chronic obstructive lung disease.

References:

- 1 Ruschitzka F. et al., *PNAS* 2000, 97: 11609–11613.
- 2 Wagner K. et al., *Blood* 2001, 97: 536–542.
- 3 Shibata J. et al., *Blood* 2003, 101: 4416–4422.

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A-8

Perfluorohexane exposure does not result in impaired leukocyte phagocytosis in vitro

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Background and Goal of Study: Liquid ventilation with perfluorocarbons (PFC) was successfully applied in experimental and human lung injury. Antiinflammatory properties of PFC may contribute to the beneficial effects but also raise concerns regarding a compromised host defense. Therefore, this study evaluated the phagocytosis capacity of PFC-exposed human leukocytes in an *in vitro* model.

Materials and Methods: Whole blood of human volunteers was pre-exposed to 25% [v/v] perfluorohexane (PFH) for 1 or 4 h with and without subsequent PFH removal. Respective controls consisted of blood incubated in the absence of water-immiscible PFH. After samples were incubated for 10 min with opsonized FITC-labeled *E. coli*, extracellular bacteria were quenched with a staining solution and phagocytosis was determined by flow fluorocytometry. Additional aliquots not subjected to the quenching procedure were used to calculate the amount of bacteria bound to the cell surface membrane. Cell morphology of *E. coli*-stimulated leukocytes with and without PFH exposure was analyzed using fluorescence microscopy and electron microscopy.

Results and Discussions: During the incubation period, 82–95% of the neutrophils and 65–81% of the monocytes actively phagocytosed *E. coli*. In all groups, there was no significant difference between PFH-exposed samples and respective controls. PFH pre-exposure for 1 and 4 h and removal of the agent prior to *E. coli* addition did not influence the degree of bacterial

adherence and phagocytosis. When PFH was present during *E. coli* challenge, mean fluorescence of adherent bacteria was significantly decreased in neutrophils by about 20% compared to control ($p < 0.05$) and tended to be lower in monocytes ($p = 0.11$). However, in these groups, neutrophil phagocytic capacity was not impaired and monocytic phagocytosis of *E. coli* was even promoted significantly ($p < 0.05$). Cell morphology of PFH treated samples showed variable quantities of ingested PFH particles but was equivalent to controls otherwise.

Conclusions: Perfluorohexane does not result in impaired leukocyte phagocytosis capacity. This result provides further evidence for a safe pulmonary administration of PFC and argues against concerns about PFC impairing host defense.

A-9

Cyclic GMP infusion prevents endothelial dysfunction and acute lung injury induced by cardiopulmonary bypass

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Background and Goal of Study: Cardiopulmonary bypass (CPB) causes dysfunction of the endothelium by reducing endogenous nitric oxide (NO) [1]. In the lung, endothelial dysfunction increases vascular permeability, induces alveolar oedema, hypoxaemia and pulmonary hypertension. We investigated the effects cGMP, the *second messenger* of NO, on endothelial dysfunction and acute lung injury in an experimental model of CPB.

Materials and Methods: Twelve anaesthetized and mechanically ventilated pigs were studied in two groups of six: Group 1 (control) and group 2 (cGMP). All animals were on CPB for 2 hours. Group 1 received no treatment and group 2 received an infusion of $5 \mu\text{g kg min}^{-1}$ of cGMP before, during and after CPB. Acute lung injury was assessed by arterial blood gases and pulmonary haemodynamics. Pulmonary vascular resistance change to acetylcholine (endothelial-dependent relaxation) and to sodium nitroprusside (endothelial-independent relaxation) was used to assess endothelial function. All measurements were performed before and after 2 hours of CPB.

Results: Pulmonary vascular resistance (PVR) changes, PaO_2 , and mean pulmonary artery pressure are shown in the table.

PVR change	Group 1		Group 2	
	Before	After CPB	Before	After CPB
ACH (%)	-31 ± 27	$+8 \pm 7^*$	-52 ± 25	$-40 \pm 9^{\#}$
SNP (%)	-33 ± 3	-26 ± 9	-44 ± 17	-35 ± 15
PaO_2 (mmHg)	214 ± 23	$94 \pm 11^*$	230 ± 22	$217 \pm 17^{\#}$
mPAP (mmHg)	18 ± 2.0	$23 \pm 1.8^*$	16 ± 1.5	$14 \pm 1.3^{\#}$

Mean \pm SD, ANOVA & Bonferroni, * $P < 0.05$ vs. before, $^{\#}$ vs. group 1. ACH (acetylcholine), SNP (sodium nitroprusside).

CPB impaired pulmonary endothelial-dependent relaxation, causing hypoxaemia and pulmonary hypertension. All these effects were totally prevented by cGMP infusion.

Conclusions: In this experimental model of CPB the infusion of cGMP prevented endothelial dysfunction and acute lung injury.

Reference:

- 1 Morita K, Ihnken K, Buckerg GD et al. *Ann Thorac Surg* 1996; 61: 1775–1780.

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Evidence-Based Practice and Quality Assurance

A-10

Comparison of prophylactic antiemetic efficacy of dexamethasone and droperidol: a retrospective study

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Background and Goal of Study: Postoperative nausea and vomiting (PONV) are frequent and disturbing adverse effects of laparoscopic cholecystectomy and the antiemetic prophylaxis is strongly recommended (1). Goal of this retrospective study was to compare prophylactic antiemetic effect of dexamethasone and droperidol in patients undergoing laparoscopic cholecystectomy.

Materials and Methods: A total of 114 ASA I or II patients undergoing laparoscopic cholecystectomy were included in study. All patients received TIVA with propofol, fentanyl and rocuronium. After tracheal intubation, patients received

either iv dexamethasone 4 mg (Group DEX, $n = 40$), droperidol 1 mg (Group DRO, $n = 37$) or saline 1 ml (Group C, $n = 37$). Nausea and vomiting on a 3-point ordinal scale (0 = none; 1 = nausea; 2 = vomiting) and the need for rescue antiemetic treatment were evaluated during 0–4 h (early PONV) and 4–24 h (late PONV) periods postoperatively. Data were analysed by Kruskal-Wallis and Fisher's exact test (significance level $P < 0.05$).

Results and Discussions: Groups were comparable with respect to demographic data, anaesthesia time and anaesthetic drug dosage. Both dexamethasone and droperidol significantly decreased the incidence of early PONV when compared to saline, with an incidence of 2%, 3% and 22%, respectively ($P < 0.05$). The incidence of late PONV was 43% in Group C compared to 20% in Group DEX ($P = 0.04$) and 27% in Group DRO ($P = 0.22$). Late nausea was experienced in 5%, 3% and 16% and late emetic episodes occurred in 15%, 24% and 27% patients in Group DEX, DRO and C, respectively. The proportion of patients who required antiemetic treatment during 24-h period was 19% in Group C compared to 3% in Group DEX

($P = 0.03$) and 8% in Group DRO ($P = 0.30$). No clinically important side-effects related to the use of dexamethasone and droperidol were found.

Conclusion(s): Both dexamethasone and droperidol significantly reduced early PONV (0–4 h) but only dexamethasone significantly reduced the incidence of late PONV (4–24 h). The need for rescue antiemetic treatment during 24-h period postoperatively was significantly lower in dexamethasone, but not in droperidol group.

Reference:

1 Thune A, Appelgren L, Haglind E. *Eur J Surg* 1995;161:265–268.

A-11

Effect of oxygenation and suction in monitored anaesthesia care of eye surgery

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Background and Goal of Study: Hypoxia and carbondioxide rebreathing are the main factors effecting patient comfort in eye surgery. We aimed to investigate the role and effect of oxygen application and suction of carbondioxide rich air in monitored anaesthesia care of eye surgery.

Materials and Methods: Following ethic committee approval and written informed consent, 100 patients (ASA I–II) scheduled for elective eye surgery were randomly divided into four groups. In Group I patients suction under drapes and nasal oxygen (2 l/min), group II patients nasal oxygen (2 l/min), group III nothing and in group IV patients suction under drapes were used. Patients were first sedated by 2 mg midazolam and according to Ramsay scale were given 1 mg midazolam whenever required. Heart rate, mean arterial pressure, SpO₂, Ramsay scale, midazolam consumption through operation and, Aldrete scale, patient satisfaction, side-effects were postoperatively evaluated. Anova, Kruskal Wallis, Friedman, Student's t test and chi square were used as appropriate.

Results and Discussions: Patient demography, operation time, heart rate, mean arterial pressure, Ramsay scores, Aldrete scores and midazolam consumptions were similar in all groups. SpO₂ values were found to be higher in group I and in group II at first 10 mins of operation when compared with group III and IV ($p < 0.05$). At 20 mins to end of operation SpO₂ values were higher in group I when compared with other groups, and in group II was found to be higher when compared with groups III and IV ($p < 0.05$). Patient satisfaction was found higher in groups I and II when compared with groups II and IV ($p < 0.05$).

Conclusions: Nasal oxygen was ineffective after 10 mins of operation and only suction had no effect. Nasal oxygen with suction was the most effective through operation in preventing hypoxia with higher patient satisfaction. In eye operations where patients face is covered with drapes we suggest nasal oxygen and suction to improve patient comfort and decrease hypoxia.

A-12

Intraoperative core temperature changes and postoperative complications rate in colorectal cancer surgery. Comparison of two different methods of anaesthesia

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Background and Goal of Study: The purpose of our study is to compare combined general and epidural anaesthesia with general anaesthesia alone in respect to core temperature changes intraoperatively and to evaluate postoperative complication rate after major abdominal surgery.

Materials and Methods: One hundred patients scheduled to undergo elective colorectal cancer surgery were randomized to receive general anaesthesia (GA group) or combined general and epidural anaesthesia (GA + EA group) 50 patients in each group. Prior induction of anaesthesia, thoracic epidural catheter was inserted and block was established up to T4 level using bupivacaine 2.5 mg/ml and fentanyl 10 µg/ml mixture in GA + EA group. Induction and maintenance of general anaesthesia were performed the same way in both groups. Temperature in operating theatre was kept at $22 \pm 2^\circ\text{C}$ level in all cases. Intravenous infusion fluids were heated in thermostatic cupboard and their temperature was the same (36°C) in both groups. Core temperature in esophagus was started to measure every 5 min after induction of anaesthesia until the end of surgery registering the stage of operation. All postoperative complications were accurately registered.

Results: There were no significant differences between the groups in respect to patients' characteristics, operations carried out and duration of surgery. Core temperature decreased during surgery from $36.5 \pm 0.4^\circ\text{C}$ to $36.0 \pm 0.5^\circ\text{C}$ in GA group as compared with $36.3 \pm 0.4^\circ\text{C}$ to $35.7 \pm 0.6^\circ\text{C}$ in GA + EA group respectively ($p < 0.01$). Moreover, patients in GA + EA group became

significantly ($p < 0.01$) more hypothermic than in GA group. Surgical complications occurred to 4 (8%) patients in GA group and 11 (22%) in GA + EA group ($p = 0.07$).

Conclusions: Our study showed that: 1. Esophageal core temperature decreased in all patients, but heat lost was more profound in combined general and epidural anaesthesia group. 2. Hypothermia might be an important risk factor in postoperative surgical complications development after major abdominal surgery.

A-13

Is it necessary to use ondansetron during a total intravenous anaesthesia with propofol to reduce the incidence of postoperative nausea and vomiting (PONV)?

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Background and Goal of Study: Anaesthesia based in inhalation agents present a high incidence of postoperative nausea and vomiting (PONV). The use of propofol decreases this problem. Our goal was to estimate the incidence of PONV in patients with propofol–remifentanyl TIVA and to study if it is necessary the use of ondansetron for the prevention of PONV after TIVA.

Materials and Methods: 71 patients ASA I–II scheduled for lumbar or cervical discectomy were included in this double blinded prospective study. Patients were randomly assigned to received ondansetron 4mg iv or placebo at the end of the surgery. Ondansetron 4mg iv was used as rescue antiemetic agent. Both groups received propofol TCI combined with remifentanyl infusion. PONV were recorded at different times (60 min, 4, 8, 12 and 24 hours) after the end of surgery. Statistical analysis: chi-square test.

Results and Discussion: 37 patients received ondansetron and 34 placebo. 58 patients had a lumbar discectomy and 13 cervical discectomy. Mean (SD) propofol consume was 1114 mg (575.28) and for remifentanyl 3.38 mg (1.64). Nausea incidence was 9.8% (7 patients) and vomiting was 5.6% (4 patients). There were no significant differences between groups at different times.

Table 1. Incidence of PONV (nausea: n) (vomiting: v)

Times	60 min	4 hrs	8 hrs	12 hrs	24 hrs
Ondansetron	0	0	0	0	3 n + 1 v
Placebo	0	2 n	1 v	0	2 n + 2 v

Conclusion(s): The incidence of PONV after lumbar and cervical discectomy with propofol anaesthesia is low. Our study suggests there is no need to use ondansetron if general anaesthesia is maintained with propofol–remifentanyl TIVA.

Reference:

1 Tramèr MR. Efficacy, dose-response and safety of ondansetron in prevention of postoperative nausea and vomiting. *Anesthesiology* 1997; 87: 1277–1289.

A-14

Continuous infusion of urapidil in ENT surgery

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Background and Goal of Study: A moderate degree of controlled hypotension is recommended in ENT procedures. This method decreases bleeding in the surgical site and improve operating conditions. We evaluated the effectiveness and safety of continuous infusion of urapidil associated with remifentanyl, to maintain MAP within 20–30% of baseline MAP.

Materials and Methods: After written informed consent, 40 patients, 43 ± 18 yrs, ASA I–III, scheduled for elective ENT surgery were included in this prospective study. The patients were randomly assigned to one of 2 groups: Group U (urapidil, $n = 20$) received 0.3 mg kg^{-1} of urapidil followed by a constant infusion of $2 \mu\text{g kg}^{-1} \text{ min}^{-1}$, and Group C (control, $n = 20$) urapidil was substituted by saline. Anaesthesia was induced with propofol (TCI system) and remifentanyl at $0.4 \mu\text{g kg}^{-1} \text{ min}^{-1}$, and reduced to $0.2 \mu\text{g kg}^{-1} \text{ min}^{-1}$, after tracheal intubation. Urapidil infusion was titrated to maintain hypotension. We use nitro-glycerine (NTG) as a rescue medication if hypotension was not achieved. Haemodynamic parameters, percentage of patients with target MAP, percentage of dry operative field, and secondary effects were recorded during all procedure. Statistical analysis: independent Student's t-tests. Chi-square or Fisher's exact test, as appropriate. SPSS

Results and Discussions: Both groups were similar in demographic, ASA, preinduction haemodynamic parameters and surgical procedures. U Group showed a statistically significant difference in percentage of Target MAP ($p < 0.002$) respect C Group, and requested less NTG to get this target ($p < 0.0001$). Both groups presented a non statistically significant difference in percentage of Dry Field and requests of Ephedrine.

Conclusion(s): Urapidil combined with remifentanyl and propofol enabled controlled hypotension, provided good surgical conditions for ENT procedures with no need for additional nitro-glycerine. However, urapidil was associated with a greater non significant proportion of ephedrine administration, and this should be considered in high risk patients.

A-15

Volatile anaesthetics and prophylaxis of postoperative nausea and vomiting

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Background and Goal of Study: This study compares the effectiveness of 3 methods of traditional antiemetic prophylaxis (metoclopramide vs metoclopramide enhanced with dexamethasone vs metoclopramide plus dexamethasone plus ondansetron). The purpose was to achieve a cheap and good method of eliminating PONV in patients scheduled for gynaecologic laparoscopy.

Materials and Methods: With approval of the local ethics committee for this 8 yrs lasting trial, the ASA I and ASA II patients, aged 15–45, received a standardized general anaesthesia (propofol, fentanyl and succinylcholine after 3 min oxygenation, 66% nitrous oxide in oxygen, atracurium; IPPV supplied patients with 10 mL kg⁻¹ of tidal volume via endotracheal tube; during the 1995–98 years halothane and isoflurane were used as supplemental volatile anaesthetics while in 1999–2002 both were replaced with sevoflurane). Before the emergence from anaesthesia the patients were blindly randomized to be administered i.v. either metoclopramide 10 mg (group 1), or metoclopramide plus dexamethasone 8 mg (group 2), or metoclopramide, dexamethasone and ondansetron 8 mg (group 3). The patients were followed up for emetic symptoms for 24 hrs. Data were analyzed using chi-square and the logrank tests.

Results: The demographic parameters were similar between the groups.

No PONV within 24 hrs (%)	Group 1	Group 2	Group 3
Halothane group	34%	65%	82%
Isoflurane group	38%	71%	84%
Sevoflurane group	41%	74%	89%

The examined population in the groups was between 460 and 1680; total number = 5700 cases. Incidence of early PONV (up to 2 hrs after the procedure) was higher in the halothane group ($p > 0,05$). The synergistic multifactorial treatment appeared to be highly effective ($p < 0,001$).

Conclusions: Satisfactory effect can be observed after administration of metoclopramide and dexamethasone. The additional use of ondansetron 8 mg actually eliminates PONV in a high-risk group of patients.

A-16

Comparing combined general/lumbar epidural anaesthesia to balanced general anaesthesia for major vascular surgery: a retrospective study

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Introduction: The value of combined general/epidural anaesthesia (c.a.) compared to 'balanced' general anaesthesia (g.a.) in diminishing the body's stress response and thus intra- and postoperative (i.o. and p.o.) cardiac complications of major vascular surgery has been a topic of discussion. We retrospectively evaluated the rate of complications in patients submitted to elective surgery of the abdominal aorta for both anaesthetic protocols.

Materials and Methods: 142 clinical charts were reviewed. Patients that received c.a. with p.o. lumbar epidural anaesthesia were put in A group ($n = 76$). Group B consisted of patients submitted to g.a. with p.o. i.v. analgesia ($n = 66$). I.o. and p.o. cardiac, renal and respiratory morbidity as well as mortality and number of days of hospitalization were compared between the 2 groups.

Results: Neither i.o. and p.o. cardiac morbidity (manifested as myocardial ischemia, infarction and heart failure: $p = 0,18$; $p = 0,9$; $p = 0,25$ resp.) nor i.o. hemodynamic instability ($p = 0,03$) and p.o. renal failure ($p = 0,68$) were significantly different between A and B. Although respiratory complications occurred less in A (11,8% vs 16,7% in B) it also failed to be significant ($p = 0,07$). Mortality rates were not significantly different (10,5% A vs 12,1% B) but duration of hospitalization was (15 days A vs 19 days B, $p = 0,01$).

Conclusions: In our population, the choice of anaesthetic protocol did not alter the intra- and postoperative morbidity or mortality rate, but reduced the

duration of hospitalization when combined anaesthesia was chosen. This may be translated into reduction of overall medical costs.

A-17

Amiodarone has antibacterial effect in vitro

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Background and Goal of Study: Infection is a serious complication in intensive or coronary care units. One of the possible sources of bacterial infections is the contaminated infusion of drugs. The detail of infections due to infusion therapy is described elsewhere (1). Amiodarone is a frequently used antiarrhythmic infusion. In this study we investigated the impact of amiodarone on bacterial growth.

Materials and Methods: Isolates of *Staphylococcus aureus* (ATCC 23923), *Escherichia coli* (ATCC 25922), and *Pseudomonas aeruginosa* (ATCC 23923) were grown overnight and then diluted. 10 μ L bacterial suspension was inoculated into amiodarone hydrochloride (Chinoin, Budapest, Hungary) 0,6 mg mL⁻¹ in glucose 5% and kept at room temperature. At 0, 1, 2, 3, 4, 6, and 24 hours 10 μ L was plated on Mueller-Hinton agar. Having incubated for 24 hours at 37°C the colony forming units (cfu) were counted. The method was described in details elsewhere (2). Glucose 5% and Mueller-Hinton broth controls were also applied.

Results and Discussions: All of the examined strains grew in glucose 5% and MH broth. The initial inoculum size was $2-5 \times 10^1$ cfu mL⁻¹. Amiodarone immediately killed *E. coli* and *P. aeruginosa*. *Staphylococcus aureus* survived only for minutes. There were no bacterial growth following 1 hour incubation in amiodarone.

Conclusion(s): Our results suggest that amiodarone infusion diluted to 0,6 mg mL⁻¹ (as used in clinical practice) has strong antibacterial effect. The initial inoculum size was low that is similar to everyday contamination if occurs. The results show that amiodarone infusion is safe as far as infection control is concerned.

References:

- 1 Maki DG, Mermel LA: Infections due to infusion therapy, Hospital Infections, 4th edition. Edited by Bennett JV, Brachman PS. Philadelphia, Lippincott - Raven Publishers, 1998, pp 689–724.
- 2 *Anesth Analg* 1999; 89: 1570–1572.

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A-18

Operating room extubation in orthotopic liver transplantation: feasible and safe

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Background and Goal of Study: Endotracheal extubation in the operating room (EOR) in selected patients undergoing Orthotopic Liver Transplantation (OLT) may provide a greater patient comfort and facilitate earlier mobilization. It could reduce ICU length of stay and to be cost effective. Spontaneous breathing also avoids some potential decrease in liver blood flow and could aids in liver function recovery. Ultra fast track anaesthesia has been performed under remifentanyl-based anaesthesia (RA) successfully in different surgical procedures. The goal of study is to value the feasibility and safety of this technique under remifentanyl-based anaesthesia¹.

Materials and Methods: Thirteen adult patients schedule on OLT fulfilling preoperative (age, child score, without encephalopathy or coexisting disease) and intraoperative (liver function, transfusions needs, no acidosis and core temperature above 36°C) criteria for EOR. Anaesthetic management was based on remifentanyl and sevoflurane. Tracheal extubation was performed on the basis of standardized criteria. Variables measured were intervention length, extubated patients number, ICU length of stay, postoperative enzymatic peak, serial arterial blood gases, re-intubation need and postoperative mechanical ventilation.

Results and Discussions: Accordingly to our criteria 9 patients (69,23%) were extubated in the OR and 4 were not (30,76%). None of them in the EOR group need re-intubation or postoperative mechanical ventilation. None of the measured variables were statistically different between groups. The reason for not to extubate patients fulfilling criteria was only the anesthesiologist choice. There were no complications.

Conclusion(s): Our results indicate that extubation in the operating room can be achieved safely in patients been operated on orthotopic Liver Transplantation fulfilling a criteria set.

Reference:

- 1 Engoren M et al. *Anesth Analg*. 2001;93(4):859–864.

A-19

How secure is your tube?

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Background and Goal of Study: A secure airway is a prerequisite for safe neurosurgical anaesthesia. This is usually achieved by a tracheal tube secured to the patient's face. A variety of techniques are adopted by different anaesthetists, including use of fabric adhesive tape (Elastoplast™), waterproof adhesive tape (Sleek™) or, in patients with beards or on intensive care, a cotton tie. Previous studies have not used a mannekin to simulate theatre conditions in assessment of tube fixation (1). We sought to test the null hypothesis that the efficacy of 3 different methods of securing tracheal tubes was equal.

Materials and Methods: The peak load required to displace a tracheal tube 50 mm from a Laerdal Airway Management Trainer (intubatable mannekin) was measured. Three methods of fixation of the tracheal tube were used: (1) two pieces of 300 × 25 mm Elastoplast wrapped around the tube and secured to the upper and lower jaw, (2) two pieces of Elastoplast as in 1) but with the addition of two overlying pieces of 150 × 170 mm Sleek, (3) simple tie with 12 mm cotton tape.

Results and Discussions: The results were analysed using ANOVA. The mean (95% confidence interval) peak load required to displace the tracheal tube 50 mm in each series was (1) 72N (62–82) (2) 100N (91–108) (3) 99N (91–106) with $n = 7$ in each group. The addition of Sleek to Elastoplast increased the peak load required to displace the tube by a mean of 39%. There was no significant difference between simple tie (method 3) and Elastoplast combined with Sleek (method 2).

Conclusions: Addition of Sleek to Elastoplast produces a statistically significant increase in the peak load required to displace a tracheal tube, and a simple cotton tie is equally effective.

Reference:

1 Patel N, Smith CE, Pinchac AC et al. *Can J Anaesth* 1997;44(3):330–6.

Acknowledgements: Dr A Farmery, Consultant Anaesthetist, Radcliffe Infirmary, Oxford.

A-20

Impact of calcium channel inhibitors on perianesthetic risks and outcomes of pheochromocytoma and paraganglioma resection

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Background and Goal of Study: Resection of catecholamine-secreting pheochromocytoma or paraganglioma is often curative, although surgical procedure can be life threatening. This study was conducted to evaluate the impact of calcium channel antagonists on perioperative management and on postoperative morbi-mortality in patients undergoing resection of pheochromocytoma or paraganglioma.

Materials and Methods: The medical records of 105 patients operated on pheochromocytoma or paraganglioma during 1991–2002 were retrospectively analyzed. For all patients, calcium channel antagonist nicardipine was used for pre and intraoperative management of hemodynamic variations induced by catecholamine release. Preoperative risk factors, intraoperative hemodynamic variations, postoperative complications, intensive care unit (ICU) and hospital length of stay were registered. Analyze of predictive factors for postoperative complications was performed by the ranked sum test and Fisher's exact test.

Results and Discussions: Of the 105 patients reviewed, 29 (27.6%) exhibited perioperative complications. Sustained hypotension [systolic blood pressure (SBP) < 80 mmHg for > 10 consecutive min.] which occurred after clamping of central tumor venous was the most common adverse effect (13 patients). Prolonged hypertension (SBP > 80 mmHg for > 10 consecutive min.) was only observed in 4 patients (2.8%). The incidence of postoperative complications was 10.4% (11 patients) with myocardial infarction and septic shock as the most common adverse effects (6 patients). Death occurred in 3 patients (2.8%) but only one (0.9%) was directly related to hemodynamic variation induced by pheochromocytoma resection. Median (range) ICU and hospital length of stay were respectively 1 (0–7) day and 10 (2–35) days. Finally, there were no preoperative predictive factors associated with adverse perioperative events. In particular, size tumor and type of catecholamine-secreting did not appear as predictive factors.

Conclusion: Perioperative used of calcium channel antagonists as nicardipine allows an efficient control of the hemodynamic changes induced by pheochromocytoma resection. This perioperative management was associated with low morbi-mortality.

A-21

Continuation of the patients medication on the day of surgery

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Background and Goal of Study: It is important to continue the patient's usual medication on the day of surgery (1,2). Ward staff should administer the medication with a sip of water even when the patient is fasted for surgery. In special cases the anesthetist may comment on certain drugs, which should be omitted or added to the patient's usual regime.

Materials and Methods: We asked anesthetists in theatre to check the patient prescription sheet and fill in a questionnaire indicating if the patient's usual medication has been given on the day of the operation. There was room for comments and reasons for not administering certain or all drugs.

Results and Discussions: 147 questionnaires were returned during the audit period. Out of 113 elective cases 20 patients (18%) did not receive their usual medication. The most common reason given was 'nil by mouth' (35%). In one case (5%) the patient's medication was not prescribed by the junior ward doctor. Out of 34 emergency cases 12 patients (35%) did not receive their usual medication. In 5 cases (41%) the reason was 'nil by mouth'. In 2 cases (17%) the junior ward doctor didn't prescribe the patients medication on the hospital's prescription sheet.

Conclusion(s): A significant number of patients don't get their usual medication prior to surgery. This is even more the case for emergency procedures. Omitting the patient's medication can contribute to intra- and postoperative complications. Improved education of nursing staff and junior doctors about fasting regulations and drug administration prior to surgery is required. The hospital routine before surgery should be reviewed to minimize these system failures.

References:

- 1 Sear JW, Higham H. Issues in the perioperative management of the elderly patient with cardiovascular disease. *Drugs Aging* 2002; 19: 429–51.
- 2 Stucki A, Bollinger CT. Evaluation of surgical risk in patients with COPD. *Therapeutische Umschau* 1999; 56: 151–6.

A-22

The effect of N-acetylcysteine on the rate of neutrophil apoptosis among anaesthetists

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Background and Goal of Study: Chronic exposure to low concentrations of volatile anaesthetics has been reported to increase incidence of carcinogenesis and teratogenesis in which apoptosis has a basic role (1,2). The rate of neutrophil apoptosis among anaesthetists and the effect of N-acetylcysteine (NAC) were investigated.

Materials and Methods: Following ethics committee approval and informed consent, 20 anaesthetists and 10 volunteers unexposed to volatile anaesthetics were recruited. Neutrophils were isolated by centrifugation in Ficoll-Hystopaque at 400 g for 35 minutes to pellet granulocytes. Neutrophils were divided into two groups, NAC (+) and NAC (–). 10^{-3} M NAC was added to NAC (+) group and incubated at 37°C with 5% CO₂ and 95% humidity for 24 hours. After incubation neutrophils (1×10^6 cells mL⁻¹) were dual stained with propidium iodide and annexin V-FITC and analysed by FACS Calibur flow cytometer equipped with CellQuest software. T-test for independent samples, t-test for dependent samples and Mann-Whitney U test were used for statistics.

Results and Discussions: The results (mean ± SD, 95% confidence interval) are shown in the table: (* $p < 0.05$).

	Exposure time (year)	Apoptotic neutrophils (%)	Apoptotic neutrophils (%) after incubation with NAC
Anaesthetists (n = 20)	7,18 ± 6,74	33,53 ± 16,18	55,74 ± 22,43*
Unexposed volunteers (n = 10)	–	72,19 ± 8,95*	79,43 ± 7,41*

The change in apoptosis after NAC is statistically significant in anaesthetists group.

Conclusion(s): Chronic exposure to volatile anaesthetics inhibits neutrophil apoptosis. NAC may be used for protection from adverse effects of volatile anaesthetics but larger studies are needed.

References:

- 1 Guirguis SS, Pelmeur PL, Roy ML et al. *Br J Ind Med* 1990; 47: 490–7.
- 2 Tyther R, Halligan M, Wang J et al. *Eur J Anaesthesiol* 2002; 19: 604–8.

A-23**Patients satisfaction with anaesthesia and family satisfaction with care in intensive therapy unit**

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Background and Goal of Study: Satisfaction is one of the basic factors evaluating quality of care. Satisfaction of anaesthesia ought to be measured with subjective methods and concern perioperative period (1). Satisfaction with intensive care is important value of the quality of care not only to patients but also to their family members. We evaluated patients' satisfaction in different periods and types of anaesthesia, the factors influencing on high and low satisfaction and monitored the family member satisfaction with care in ICU.

Materials and Methods: 250 patients on 1st and 2nd day after anaesthesia filled the questionnaire of satisfaction (rr 70%). Satisfaction with Anaesthesia Scales Questions (IOWA) was used among 46 patients after regional anaesthesia. 83 family members after one week critical care of their relatives returned questionnaires (rr 60%).

Results and Discussions: 93% of patients were satisfied both general and regional anaesthesia. Satisfaction factors were as follow: kindness of anaesthetic team (95%), positive atmosphere in anaesthetic assessment clinic and operation theatre (95%), safe feeling (85,6%), decrease of stress and fear after anaesthesiologist visit (65%). The factors lowering satisfaction in recovery room were: difficulty with breathing (74%), nausea and vomitings (71%), feeling of cold and shivering (63%) and pain (54%). In IOWA scale after epidural anaesthesia satisfaction was on high level – $22 \pm 6,29$ and $20,25 \pm 6,6$. Decrease of satisfaction was in course with VAS increase. Satisfaction with anaesthesia was higher when postoperative pain was lower (Spearman coefficient $r = 0,997$ $p < 0,05$). Atmosphere in ICU and waiting room was positively evaluated; care and cure, medical decisions were highly satisfied to family. The communication with nurses and physicians was unsatisfying in 36% of families as well as invade of intimacy (48% of answers).

Conclusion(s): The factors influencing on anaesthesia satisfaction are adequate to preanaesthesia care, safe and good atmosphere in operation theatre. The pain in perioperative period decreases the satisfaction of patient. Family satisfaction is important method for evaluation and improvement the quality of critical care.

Reference:

1 Dexter F, Aker J., Development of Measure of Satisfaction with Monitored Anaesthesia Care, *Anaesthesiology* 1997,87,865–873.

A-24**Evaluation of two widely used anesthetic techniques in laparoscopic cholecystectomy with modified Aldrete post anesthetic recovery score**

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Background and Goal of Study: To compare the post anesthetic recovery score between two widely used anesthetic techniques for laparoscopic cholecystectomy: total intravenous anesthesia with Propofol and Remifentanyl and balanced anesthesia with Propofol, Sevoflurane and Remifentanyl.

Materials and Methods: 60 patients 30–82 years, ASA I–II were randomized to receive either total intravenous anesthesia with Remifentanyl and Propofol (TIVA group, $n = 30$) or Propofol for induction and Remifentanyl and Sevoflurane for maintenance of anesthesia (SF group, $n = 30$). Both groups received Tropisetron 5 mg IV, Ketoprofen 100 mg IM and pethidine 50 mg IM 30 min before the end of the operation. All the patients were scored one minute after extubation at the operating table (T_0) and 30 min after, at the recovery room (T_{30}), using a modified Aldrete's post anesthetic recovery score based on eight major criteria: mobility, respiration, circulation, consciousness, surgical bleeding, pain, nausea/vomiting and O_2 saturation. Each criterion assigns a score of 0, 1 or 2.

Results and Discussions: There were no significant differences between the two groups in demographic characteristics, ASA class, and the duration of surgery. The post anesthetic recovery scores for pain were slightly better in TIVA group (33% had moderate pain at T_{30} compared to 40% in SF group). Nausea/vomiting were observed at 16% in SF group compared at 6% in TIVA group at T_0 . 33% of patients in SF group were arousable on calling at T_0 compared with 16% in TIVA group. Statistically significant differences were not found between the two groups regarding mobility, respiration, circulation and surgical bleeding. 93% of patients at T_{30} in both groups were able to maintain O_2 saturation $> 92\%$ while breathing room air.

Conclusion(s): In laparoscopic cholecystectomy, both anesthetic techniques appear to be effective, offering fast recovery and discharge. TIVA group is associated with lower incidence of nausea/vomiting.

Reference:

Aldrete JA, Kroulik D. A postanesthetic recovery score. *Anesth Analg* 1970; 49:924–34.

A-25**National quality assurance in anaesthesiology: The Dutch Peer Audit Program**

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Background and Objective: To present the results of a national quality audit performed in all general hospitals in the Netherlands in the period 1993–2003.

Materials and Methods: All 114 non-academic general and 3 specialized hospitals in the Netherlands were visited by a peer group of anaesthesiologists, implementing the requirement from the Society of Anaesthesiology that each anaesthesiology department is to be audited at least once every five years. Seventy eight hospitals were visited at least twice. The committee is empowered to give binding recommendations when minimal safety standards are not adhered to, if there exist structural deficiencies in allocation of personnel or if any aspect of care does not conform to applicable laws. Binding recommendations can be used by anaesthesiology departments in negotiations with hospital management when lack of funding is responsible for material or personnel deficiencies.

Results: The first round of audits resulted in 145 binding recommendations in 90 hospitals. In a second round, 120 of these had been implemented. Yet another 162 binding recommendations were given based on new criteria, such as the requirement to have a 24 hour recovery facility. The recommendations can be ranked in frequency of occurrence: operating theatre 33%, departmental organisation 24%, post-operative care 21%, pre-operative care 15%, teamwork 4%, pain therapy 1%, and ICU 1%. The top 4 were: (1) even in the care team setting, an anaesthesiologist should always be present during emergence (45 departments), (2) Staffing must be commensurate with work-load (29), (3) Pre-operative screening and consent should conform to national standards (44) and (4) A twenty-four hour recovery facility must be available (29).

Conclusion: Since 83% of the recommendations were implemented within 2 years, we conclude that a national quality audit program is an effective tool to boost quality of anaesthesia care.

A-26**Assesment of family satisfaction in the intensive care unit**

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Background and Goal of Study: The assesment of family satisfaction as a measure of quality care in our Anesthesiology Intensive Care Unit (AICU) was aimed.

Materials and Methods: Critical Care Family Satisfaction Surveys (CCFSS) were given to one family member of all the patients admitted to AICU within a year. CCFSS, specifically validated for intensive care units, included questions related to the need for realistic and timely information, to be assured for a desired outcome (assurance), personal contact, to be physically and emotionally near the patient, the support given to the family members and family members' personal comfort (1). When the patient was discharged from the intensive care unit, family members were requested to rate their satisfaction regarding these 20 questions as unsatisfied (1 point) to very satisfied (5 points). Student's t test and one way ANOVA were used for statistical analysis.

Results and Discussion: 88 of 103 family members, included to our study, returned the survey. Mean patient age was 47 ± 26 yrs (36 male/52 female) and mean Simplified Acute Physiology Score II at admission was 35 ± 20 . The representative was the spouse in 20%, the parents in 28% and were the children in 38%. Mean age of representatives was 43 ± 14 yrs (47 male/41 female). Mean satisfaction score was 86 ± 11 . More than 90% of family members were satisfied with staff's honesty, quality of care provided, ease in knowing nurses, doctors' sensitivity to needs whereas $>80\%$ of family members were satisfied with 14 items. 24% of family members were dissatisfied with waiting room atmosphere and 21% were dissatisfied with sharing in decisions regarding the patient care. Family satisfaction with assurance increased with emergency admissions, satisfaction with support increased with longer ICU stay and previous ICU stay were associated with increased satisfaction with comfort.

Conclusion(s): We conclude that most family members were highly satisfied with the intensive care provided to them. Efforts to make our waiting room to be more comfortable and family conferences to share in decisions regarding the patient care were planned.

Reference:

- 1 Wasser T. *Crit Care Med* 2001;29:1654–5.

A-27

Operative care from the patients viewpoint

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Background and Goal of Study: To assess patients' awareness about anaesthesia, perioperative and postoperative care, postoperative analgesia, fears and concerns about the outcome.

Materials and Methods: A questionnaire survey was developed and completed the 2nd day postoperatively by a total of 180 patients, 74 males and 106 females, ASA I–III, aged 14–83 years. Included were questions concerning the name of the surgeon and of the anaesthesiologist, their level of information about the anaesthetic process, their knowledge about postoperative analgesia and the use of morphine. Excluded from the day of preoperative evaluation were patients unable to cooperate.

Results and Discussions: 163 patients (90.5%) knew the name of the surgeon compared to 22 (12.2%) who knew the anaesthesiologist. When asked by whom the type of anaesthesia is to be decided, 67 (37.2%) replied the anaesthesiologist. In the question of whether they were thoroughly informed about the anaesthesiologic approach, 95 patients (52.8%) claimed yes. A considerable part (96 patients, 48.4%) did not have a clear view. 79 patients (43.9%) think that they should actually experience post-surgical pain and 52 (28.9%) are afraid of dependence by opioids. 163 of them (90.6%) were not aware of the existence of acute pain service.

Conclusion(s): We should be concerned about the opinion and the level of information of our patients about the various hospital procedures, as this will reflect on their cooperation.

A-28

Cardiac arrest in the operating theatre and its outcome: an analysis of 3,855,384 anesthetics over 4 years in Japanese Society of Anesthesiologists – Certified Training Hospitals

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Background and Goal of Study: We determined the incidence, causes, and outcome of cardiac arrest occurring in the operating theatre by analyzing data obtained from the annual surveys conducted by The Japanese Society of Anesthesiologists between 1999 and 2002.

Materials and Methods: The total number of anesthesia patients available for this analysis was 3,855,384. The causes of critical incidents were classified as follows: totally attributable to anesthetic management (AM), due mainly to intraoperative pathological events (IP), preoperative complications (PC), and surgical management (SM). Statistical analysis was performed by the chi-square test. A *p* value less than 0.05 was considered significant.

Results and Discussion: The incidence of cardiac arrest in the operating theatre was 6.34 per 10,000 anesthetics. AM, IP, PC and SM were responsible for 7.5%, 21.4%, 45.7% and 24.1% of cardiac arrests, respectively. Seven-day mortality after cardiac arrest was 9.8%, 31.2%, 71.0% and 52.3% for AM-, IP-, PC- and SM-related cardiac arrest, respectively. ASA-PS correlated well with the incidence of cardiac arrest and death, regardless of etiology (*p* < 0.05). The leading causes of cardiac arrest were hemorrhagic shock as PC (20.8%), myocardial ischemia/infarction (14.2%), hemorrhage by SM (12.9%), surgical problems other than hemorrhage (9.6%), AM (7.8%), and severe arrhythmias (6.6%). Human factors (AM and SM) were responsible for 31.6% of intraoperative cardiac arrest.

Conclusion: Much effort is required to reduce intraoperative cardiac arrest caused by human error, hemorrhage, and cardiovascular diseases.

A-29

Statins and β -blockers are independently associated with a reduced incidence of perioperative mortality in patients undergoing abdominal aortic aneurysm surgery

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Background and Goal of Study: Patients undergoing elective abdominal aortic aneurysm (AAA) surgery are at increased risk for perioperative mortality

and myocardial infarction (MI) [1]. The aim of this study was to explore the potential beneficial effect of statins on perioperative mortality and MI in patients undergoing abdominal aortic aneurysm surgery.

Materials and Methods: We studied 570 patients (mean age 69 ± 9 years, 486 males) who underwent AAA-surgery between 1991–2000 at the Erasmus MC. Patients were evaluated for clinical risk factors (age ≥ 70 years, prior MI, angina, diabetes mellitus, stroke, renal failure, heart failure and pulmonary disease), statin use and β -blocker therapy. The main outcome measure was a composite of all cause mortality and MI within 30 days of surgery.

Results and Discussions: Perioperative mortality or MI occurred in 51 (8.9%) patients. The incidence of the composite endpoint was significantly lower in statin users compared to non-statin users (3.7% vs. 11.0%; crude odds ratio: 0.31 and 95% CI, 0.13–0.74; *p* = 0.01). After correcting for other covariates, the association between statin use and reduced incidence of the composite endpoint remained unchanged (OR, 0.28, 95% CI, 0.10–0.81; *p* = 0.02). β -blocker use was also associated with a significant reduction in the composite endpoint (OR, 0.29, 95% CI, 0.13–0.63). Other multivariable predictors of the composite endpoint included renal insufficiency (OR, 7.5, 95% CI, 2.5–22.6), prior stroke (OR, 5.8, 95% CI, 2.8–12.0), prior MI (OR, 4.4, 95% CI, 2.1–9.2), pulmonary disease (OR, 3.8, 95% CI, 2.0–7.4), and age ≥ 70 years (OR, 2.3, 95% CI, 1.1–5.0). There was no evidence of an interaction between statin use and the composite endpoint in subgroup of patients according to the number of risk factors or β -blocker use.

Conclusion(s): Statin use in patients with AAA-surgery is associated with a reduced incidence of perioperative mortality and nonfatal MI.

Reference:

- 1 Boersma E, Poldermans D, Bax JJ, et al. Predictors of cardiac events after major vascular surgery: Role of clinical characteristics, dobutamine echocardiography, and beta-blocker therapy. *JAMA* 2001; 285:1865–1873.

A-30

Insertion complications and line longevity in a case series of 99 femoral Hickman line insertions

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Background and Goal of Study: The femoral route is chosen for tunnelled Hickman-type catheters for long-term venous access in cancer patients when vascular access in the subclavian or internal jugular sites or anterior fossae are contraindicated or problematic, for example: bilateral breast cancer, mediastinal mass with superior vena cava obstruction, venous thrombosis or infection of previous Hickman sites.

Materials and Methods: Data were collected immediately post-insertion from a questionnaire filled in by the anaesthetists-operators for 99 femoral Hickman lines between 1993–1999. Data were collected retrospectively on complications leading to catheter removal from the medical records.

Results and Discussions: Ninety-nine femoral Hickman lines were inserted in 97 patients. Median age was 48 (1–81) in 70 females and 27 male patients. The majority had local anaesthesia and sedation. Guidewire displacement occurred in 8%, split sheath kinking in 5%, and arrhythmia occurred in 3%. Arterial puncture (11%) was unexpectedly high. The more senior anaesthetists had significantly fewer complications. Infection problems necessitating removal of catheter were 9%. The longevity of the catheter in our study was 87 days, which compares favourably with 91⁽¹⁾ and 121⁽²⁾ days in previous case series using the subclavian route.

Conclusion(s): Femoral long-term tunnelled catheters are a valuable alternative route for patients when other sites are contraindicated. In future, the routine use of ultrasound guidance should help reduce the incidence of arterial puncture at insertion.

References:

- 1 Ray S, Stacey R, Imrie M, Filshie J. *Anaesthesia* 1996;51(10):981–5.
- 2 Nightingale CE, Norman A, Cunningham D, et al. *Eur J Cancer* 1997;33(3):398–403.

A-31

Carotis endarterectomy: analysis of different factors on total costs of hospitalisation – a cohort study

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Background and Goal of Study: Endarterectomy is an often performed procedure. Therefore it is important to assess different factors with impact on hospitalisations costs. Identifying such factors based on standard costing assessment may help to optimise the revenues of a hospital without compromising quality of care or decision making of clinicians involved.

Materials and Methods: Costs of 121 consecutive patients were assessed without any influence by the study team on the care process. The following

standard costs were applied according to administrative data based on accounting figures: anaesthesia: 7.26 CHF/min; operation-room usage: 13.15 CHF/min; ICU care: 2374 CHF/day; hospitalisation cost 2040 CHF/day. The following factors with a potential of influencing hospital costs were assessed in a prospective manner: Type of anaesthesia, surgeons experience (resident surgeon versus staff surgeon), total duration of surgery and/or anaesthesia, duration of stay on PACU and/or ICU.

Results and Discussions: 43 patients under general anaesthesia (GA) and 77 under local anaesthesia (LA) were included, one data record was not complete and not included in this analysis. Surgical procedural times were independent of type of anaesthesia, but significantly influenced by surgeons experience ($p < 0.0012$): Under general anaesthesia (GA) mean 75 ± 17 minutes standard deviation (SD) and under LA mean 82 ± 24 SD. Anaesthesia time was significantly shorter under LA ($156 \text{ min} \pm 30 \text{ SD}$) than under GA ($171 \text{ min} \pm 25 \text{ SD}$); $p < 0.01$. Also the costs for PACU and/or ICU care differed between the two groups per case: GA $1658 \text{ CHF} \pm 1427 \text{ SD}$ vs. LA $896 \text{ CHF} \pm 1005 \text{ SD}$; $p < 0.001$. Total costs per case did not differ between the two groups (GA $10263 \text{ CHF} \pm 2877 \text{ SD}$ vs LA $9770 \text{ CHF} \pm 4566 \text{ SD}$), but variations was statistically significant higher under GA ($p < 0.001$). These variation was explainable using a generalised linear model by the influence of the surgeon's experience. Type of anaesthesia (LA vs. GA) had now influence on total length of stay (LOS): GA $4 \pm 1.4 \text{ days SD}$ versus LA $4.0 \pm 2.2 \text{ days SD}$. **Conclusion(s):** Anaesthesia time under local anaesthesia for surgical carotid endarterectomy was statistically significant shorter than under general anaesthesia, but with no impact total hospital costs. Only surgeons experience was identified as an important cost factor, but not type of anaesthesia.

A-32

A survey of ASA classification among Catalan anaesthesiologists

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Goal of Study: Within an extensive epidemiologic survey of anaesthesiology practices in Catalonia (ANESCAT), we evaluated inter-individual agreement of Catalan anaesthesiologists' application of ASA physical status (ASA PS) classifications.

Materials and Methods: Ten hypothetical patients were presented to anaesthesiologists, who were asked to grade them according to the ASA classification. We calculated the percentage of ASA grade allocations for each patient. We also compared the responses of residents with those of specialists using a Mann-Whitney test.

Results and Discussions: We collected 190 questionnaires. The distribution of ASA PS grade allocations, expressed as percentages, is shown in the table for each hypothetical patient. In two cases, residents (13%) assigned significantly higher ASA grades ($P < 0.05$).

ASA PS	1	2	3	4	5	6
Case 1	32,1	15,3	20	31,6	1,1	
Case 2	42,6	52,1	5,3			
Case 3		1,6	43,7	54,7		
Case 4		0,5	3,2	37,9	58,4	
Case 5	5,8	3,2	1,1	3,7	43,7	37,4
Case 6	2,1	31,6	53,7	12,1		
Case 7	54,7	41,6	2,6	0,5		
Case 8	2,1	68,8	29,1			
Case 9	2,1	29,6	66,1	2,1		
Case 10	86,1	13,9				

Conclusion(s): Our findings confirm previous reports of considerable differences in the allocation of ASA classifications. This variation should be considered when using this classification in epidemiologic studies or trials.

References:

Acta Anaesthesiol Scand 1997;41:629.
Anaesth Intensive Care 2002;30:633.

A-33

Prioritisation of topics for Cochrane systematic reviews: a consultation exercise

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Background and Goal of Study: The Cochrane Anaesthesia Review Group (CARG) prepares and maintains systematic reviews of interventions in anaesthesiology, intensive and perioperative medicine. With limited resources at CARG's disposal, it is important that reviewed topics are relevant to the users of the reviews. We aimed to solicit users' views on priority topics.

Materials and Methods: We emailed a questionnaire inviting respondents to list up to five topics in each of three areas: anaesthesiology, perioperative medicine and intensive care medicine. Here we report only the first two areas. Three groups were surveyed: (1) editors working within CARG, (2) anaesthetists from the developing world and (3) healthcare consumer representatives. Members were identified through mailing lists and contacts of CARG. The responses were categorized both by group of respondent and by clinical topics: regional anaesthesia, acute and chronic pain, obstetrics, cardiothoracic, neuroanaesthesia, transfusion medicine, paediatrics, pharmacology, preoperative care, intraoperative management, communication and continuity of care and patient safety. Topics with the greatest frequency were considered to be the highest priority.

Results and Discussions: We received 16 responses; 7 from group (1), 6 from group (2) and 3 from group (3). 147 topics were listed. Preoperative management was the most frequently listed topic across all groups. CARG editors and developing world anaesthetists also had high priority for regional anaesthesia, with specific topics of outcome of regional techniques compared with general anaesthesia, preoperative optimisation of comorbidity and targets and indications for blood transfusion. Pharmacology was also a high priority topic for CARG editors, particularly the outcome of intravenous anaesthesia compared with inhalational anaesthesia. Healthcare consumer representatives prioritised the involvement of primary care and the multidisciplinary team in preoperative assessment, the communication between members of the multidisciplinary team and patient safety.

Conclusion(s): This small survey has identified some topics of high priority for users of systematic reviews. The needs of different user groups may conflict.

A-34

Systematic reviews of relevance to anaesthesia – progress since 1999

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Background and Goal of Study: Systematic reviews are invaluable for keeping up to date with advances in practice. A previous survey [1] identified and quality appraised reviews of relevance to anaesthesia published from 1966 until June 1999. We aimed to update this work and identify the areas of anaesthetic practice subject to current reviews.

Methods: We searched MEDLINE, EMBASE, CINAHL and the Cochrane Library Issue 4, 2003 for systematic reviews in anaesthesia published between July 1999 and 5 December 2003. The following categories were then applied: anaesthetic subspecialties, complications, fluid therapy/transfusion medicine, pharmacology, preoperative care/assessment and intraoperative care.

Results and Discussion: Our search yielded 283 hits. There were 13 duplicate publications. Publications other than systematic reviews (21) and irrelevant topics (166) were excluded. The remaining 83 reviews dealt with the following topics: anaesthetic subspecialties (38) – of which 17 dealt with regional anaesthesia; complications (17); fluid therapy (1); pharmacology (8); preoperative care/assessment (7); intraoperative care (1). Rates of publication of systematic reviews appear roughly constant, with between 20 and 30 appearing in each of the last 3 years (final figure for 2003 awaited).

Conclusions: Publication rates of systematic reviews have remained fairly static. Distinguishing systematic reviews from other types of review can be difficult from abstracts. There is considerable unevenness in coverage of different aspects of anaesthetic practice.

Reference:

1 Choi P et al *Anesth Analg* 2002; 92: 700–9.

A-35

Anaesthetic records – analysis of a database

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Background and Goal of Study: Adequate anaesthetic documentation is fundamental for epidemiological research and clinical practice audit (1,2). This work examines the accuracy of text entries in a computer database of anaesthetic records.

Materials and Methods: A retrospective study was designed. Anaesthetic records (charts) were collected over 18 months (2002–2003), and 13 items relative to identification of patient and perioperative period were analysed. Each item was classified either as correctly filled or incorrectly filled (which include incorrect or absent data). In the comparison of proportions we used Qui-Square test on SPSS®.

Results and Discussions: Overall, 17625 anaesthetic records were analysed, including 229125 entries. We observed 96.7% correct entries, yet only 81.0% of the charts were complete – i.e., with all the 13 items correct.

Less correctly filled items were: Airway (7.7% incorrect), ASA status (5.8%) and Anaesthetic technique (5.4%). We found that incorrect data in the presence of resident was significantly lower compared to anaesthesiologist only (11.7% vs. 23.2%; $p < 0.001$). Procedures taking more than 1 hour had less incorrect data than those taking less than 1 hour (8.2% vs. 12.0%; $p < 0.001$). Procedures under general anaesthesia had less incorrect data than those under regional anaesthesia (8.4% vs. 14.6%; $p < 0.001$). Urgent procedures had less incorrect data than elective procedures (12.5% vs. 15.8%; $p < 0.001$).

Conclusion(s): The accuracy observed was not satisfactory, having in mind that all items analysed are part of any anaesthetic procedure. These results may reflect manual incorrect filling of anaesthetic chart in the operating room, errors in the transcription of data to the database and inadequacies of chart and database design.

References:

- 1 Falcon D, Francois P, Jacquot C, et al. *Ann Fr Anesth Reanim* 1999 Mar;18(3):360–7.
- 2 Rowe L, Galletly DC, Henderson RS. *BJA* 1992;68:381–7.

A-36

Risks perspective survey: anesthesiologists point of view

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Background and Goal of Study: Promoting professionals and patient safety are a fundamental to a good clinical practice. Mishaps, near mishaps, equipment failure, and poor performance products are important to identify trends and patterns that can lead to harm. Anesthesiologists have an undisclosed accumulated knowledge that can be used to reduce the risk and the impact of undesirable outcomes.

Materials and Methods: Interviews conducted at anesthesiologists of 4 general hospitals (including central and regional) aim at identifying events leading or presenting risk of undesirable outcomes based on their accumulated knowledge. Interviews were selected at random from the anesthesiologists staff of hospitals.

Results and Discussions: One of the major results of the data collected in the interviews identified 97.6% of the undesirable outcomes or near undesirable outcomes being due to human factors, with strong contributions of factors as: poor communication, lack of training, poor leadership, cost containment policies and production pressure.

Conclusion(s): Data emphasizes the need for a clear commitment of the different levels of leadership towards safety in clinical practice, focusing on anonymous communication of poor outcomes followed by the analyses of their causes and the implementation of non-punitive preventive and corrective actions.

References:

- 1 To Err Is Human: Building a Safer Health System (2000), Institute of Medicine.
- 2 Cooper J B, Newbower R S and all Preventable anesthesia mishaps: a study of human factors Quality and Safety in Health Care 2002;11:277–283.

A-37

Single-dose parenteral pharmacological interventions for the prevention of postoperative shivering – a quantitative systematic review of randomised controlled trials

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Background and Goal of Study: Shivering is a frequent complication in the postoperative period. The relative efficacy of pharmacological interventions to prevent this phenomenon is not well understood.

Materials and Methods: We performed a systematic search for full reports of randomised comparisons of prophylactic, parenteral, single-dose, anti-shivering interventions with inactive control (placebo or no treatment). Dichotomous data on absence of shivering were analyzed using relative risk (RR) and number-needed-to-treat (NNT) with 95% confidence interval (CI).

Results and Discussions: Data from 27 trials (1,348 adults received an anti-shivering intervention, 931 were controls) were analysed. The average incidence of shivering in controls was 52%. Clonidine 65–300 µg (1,078 patients), meperidine 12.5–35 mg (250), tramadol 35–220 mg (250), and nefopam 6.5–11 mg (204) were tested in at least three trials each. Each was more effective than control; for clonidine, meperidine, and nefopam, there was some weak evidence of dose-responsiveness. For low-dose clonidine (65–110 µg), RR for the prevention of shivering compared with control was 1.32 (95% CI, 1.16 to 1.51), for medium-dose (140–150 µg), RR was 1.83 (95% CI, 1.47 to 2.27), and for high-dose (220–300 µg), RR was 1.52 (95% CI, 1.30 to 1.78); the NNT for all clonidine regimens combined was 3.5. For all meperidine regimens combined, RR was 1.65 (95% CI, 1.38 to 1.97), NNT 3. For all tramadol regimens combined, RR was 1.93 (95% CI, 1.56 to 2.39),

NNT 2.2. For all nefopam regimens combined, RR was 2.62 (95% CI, 2.02 to 3.40), NNT 1.7. There were not enough data for methylphenidate, midazolam, dolasetron, ondansetron, physostigmine, urapidil, and flumazenil to draw meaningful conclusions.

Conclusion: In a population at a particularly high risk of postoperative shivering, less than four patients need to receive prophylactic clonidine for one not to shiver who would have done so had they not received clonidine. Other interventions may be more efficacious but are less well documented.

A-38

Evaluation of preoperative electrocardiography of patients older than 55 years of age in the year of 2000–2001 in a hospital of orthopedic center

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Background and Goal of Study: Electrocardiography has been recommended in the assessment of patients before operations to identify those at high risk of intraoperative and postoperative illness and death. In addition, it can provide a baseline tracing for comparison, if necessary, with a postoperative electrocardiogram (ECG). A 12 lead-ECG has been recommended for adult patients before various operations, as well as in adult patients on general hospital admission. However, opinion differs widely on specific guidelines for ordering this test in such patients. The key issue centers on whether the ECG should be ordered routinely or reserved for selected groups of patients.

Materials and Methods: The study was conducted at an orthopedic hospital center. In this retrospective, descriptive investigation, we evaluated the ECG of all patients more than fifty-five years of age that were scheduled for orthopedic operation because of different types of fractures. During a one year period, April 1, 2000 to April 1, 2001. These criteria were met by 286 patients. ECGs were coded with the use of the Minnesota code by the cardiologists. This code was used because it has been used in studies screening for heart and coronary artery diseases. The Minnesota code, classifies certain abnormalities, such as, Q wave, the ST segment and T wave according to severity, while for left axis deviation, atrial fibrillation, Accounts for their presence.

Results and Discussions: The preoperative ECG was normal for 46.8% (134/286) and abnormal for 53.2% (152/286) of the study population. The most common abnormalities were T waves and ST-segment abnormalities. Axis deviation and Q wave abnormality were the next common findings.

Conclusion(s): Some guidelines for ordering an ECG in adult patients is recommended: (1) ECG is not routinely indicated before non cardiac surgery. (2) Clinical judgement should guide the ordering of an ECG preoperatively.

A-39

Abdominal aortic aneurysm repair: can surgical technique influence outcome and cost?

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Background and Goal of Study: Abdominal aortic aneurysm (AAA) repair is one of most challenge surgeries for both surgeon and anaesthesiologist. Our hypothesis is that aortic endograft (AE), a less invasive but more expensive procedure, should be indicated in those patients at high risk of postoperative complication when performed in an open repair technique (OA). The aim of our study was to evaluate cost-efficiency of AE when compared to OA.

Material and Methods: 50 consecutive patients in whom a non-ruptured AAA was diagnosed were scheduled to one of two procedures (AE or OA) depending on surgeon decision. Coexisting diseases were specifically defined; co-morbidity was found in all patients. We applied the same anaesthetic protocol, which included first operative day in a High Dependency Unit. Patients were moved to ICU or ward the followed day. We have calculated cost from hospitalisation (OR, HDU, ICU, ward), from graft and from complementary explorations. The cost of one day-ward (**dw**) was chosen to refer all calculated costs. Values are expressed as median and range. Non parametric tests were applied.

Results and Discussion: There were not differences in demographic and risk data.

	AE, n = 19 patients	OA, n = 31 patients
Age (years)	70 (59–77)	69 (56–79)
Cost of hospitalization (dw units)	10.6 (8.6–43)	18.6 (12–660)*
Cost of graft (dw units)	56 (23–78)	4.9 (4.7–5.3)*
Total cost (dw units)	69 (36–107)	23.5 (18–665)*

*p value < 0.05.

One patient (5%) of the AE group required an open procedure. Four patients of the OA group, who had associated cardiac and respiratory risk, had surplus cost due to postoperative complications.

Conclusions: We conclude that a careful selection of patients is necessary. Surcharge may be produced by both an excessive and a defective AE procedure selection. Patients should be selected on basis of surgery feasibility but also on the presence of coexisting disease.

A-40

Implementation of a fast-tracking protocol into clinical practise

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Background and Goal of Study: This feasibility-study was performed to test the hypotheses that a fast-tracking protocol including high thoracic epidural analgesia speeds discharge from the ICU in patients undergoing aortic coronary bypass surgery (CABG).

Materials and Methods: 38 patients treated according to a fast-tracking protocol were compared with 41 control patients matched for biometric data, risk factors, preoperative health status, and type and duration of surgery. The latter received general anaesthesia with propofol, sufentanil and postoperative opioid analgesia on demand. The fast-tracking protocol includes a thoracic epidural catheter inserted at levels of Th₁–Th₄ the day before surgery. Anaesthesia was induced and maintained with propofol. Analgesia was provided by continuous epidural infusion of ropivacaine and sufentanil. Postoperative care was provided by the cardiac surgeons on a specialized ICU. Times until tracheal extubation and discharge from the ICU (both decisions were based on the clinical judgement of the attending surgeon not involved in this study) were defined as surrogate markers for fast-tracking eligibility.

Results: Due to a strict matched pair's technique, patients in both groups did not differ significantly with respect to any biometric or clinical variables. Times until tracheal extubation was significantly shorter in patients receiving the fast-tracking protocol ($p = 0.0002$; U-test). However, discharge from ICU was not faster in these patients ($p = 0.64$). All data are shown as median and 25th–75th percentile (in brackets).

Time [h] to ...	Fast-tracking	Control
... extubation	6 (1–14)	20 (11–18)
... discharge	67 (45–135)	85 (45–122)

Conclusion: A fast-tracking protocol including high thoracic epidural anaesthesia allows early tracheal extubation. This advantage was well accepted by the attending cardiac surgeons but not transferred into faster discharge from ICU. Obviously habitual clinical pathways hinder early postoperative transfer of patients to the ward before the third postoperative day. As a consequence of these results clinical implementation of a fast-tracking protocol must include binding instructions for postoperative care.

A-42

The antibacterial effect of EMLA-cream on skin flora compared to an alcohol containing skin disinfectant

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Background and Goal of Study: Cannula related infections are responsible for about half of nosocomial bacteremias and contribute to perioperative morbidity and mortality. The mechanism is multifactorial and skin flora influences its occurrence. Previously we reported that EMLA cream has antibacterial effects in vitro (1). In this study we compared the effects of EMLA and Skinsept on the bacterial count on the back of hand.

Materials and Methods: Following ethical committee approval ten healthy volunteers were included in the study. Bacterial samples were taken with contact Rodac Petri plates (60 mm diameter, tryptic soya agar) (Neomed, Italy). First the bacterial count was determined on both back of hands (colony forming units/cm²). Each of the volunteers served as his own control, with a random choice of EMLA [(lidocain 25 mg, prilocain 25 mg) (Astra, Södertälje, Sweden)] treated hand and opposing Skinsept [46% ethylalcohol, 27% propylalcohol, 1% benzylalcohol and 0.29% hydrogen peroxide) (Szeged, Hungary)] hand. Samples were taken before treatment (0 h), 1, 2, 3, 4, 6, 12 and 24 hours later. The method is described in details elsewhere (2).

Results and Discussions: Both EMLA and Skinsept reduced the skin flora below 5% of the original colony forming units (cfu) one hour following treatment. The cfu remained low till 6 hours post treatment. Then the number of

cfu increased faster in the Skinsept group than in the EMLA group. The difference between the two groups was not significant during the first 6 hours.

Conclusion(s): Our results suggest that the well-known local anesthetic EMLA cream reduces the number of bacteria on the venous puncture site as much as an alcohol containing skin disinfectant (Skinsept). EMLA cream is not only a good local anesthetic but may also reduce cannula related infections.

References:

- Hosp Inf (in press).
- Transfus Clin Biol 1997; 4: 523–31.

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A-43

PONV in cardiac surgery

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Background and Goal of Study: There is a lack of information about the incidence and prevention of postoperative nausea and vomiting (PONV) in cardiac surgery. The goal of this study was to determine the incidence of PONV in cardiac surgery and its relation to cardiopulmonary bypass (CPB) duration, and to study the efficacy of different antiemetic drugs for PONV prevention (1).

Materials and Methods: We studied 142 adult patients with left ventricle ejection fraction >45% undergoing coronary artery bypass grafting (CABG) with CPB in the double-blind prospective randomized trial (April–July 2001). Induction and maintenance of anaesthesia were standardized in all patients. The patients had no previous history of PONV; all risk factors for PONV were similar among groups. The patients were randomly allocated to receive droperidol 1.25 mg (group I, n = 27), thiethylperazine 6.5 mg (group II, n = 33), ondansetron 4 mg (group III, n = 34), or placebo (group IV, n = 48) 30 minutes before the end of procedure. The duration of CPB and number of PONV episodes during the first 12 hours in the ICU were recorded. PONV episodes were treated by metoclopramide. The results were evaluated by correlation coefficient (r) and chi-square test (p).

Results and Discussions: The duration of CPB in study groups (mean ± SD: 75.7 ± 15.9, 74.4 ± 13.1, 73.6 ± 17.1, and 72.7 ± 18.2 min, respectively) had no influence on the incidence of PONV in each group ($r = -0.080$), and all the groups together ($r = -0.081$). The incidence of PONV after pharmacological prevention (18.5, 18.0, 18.0%) was lower than in placebo group (27.1%), but not significantly ($p > 0.05$). The number of patients in groups I, II and III with more than one PONV episode (3.7, 9.0, 2.9%) was not reduced significantly ($p > 0.05$) compared to placebo group (10.4%).

Conclusions: The incidence of PONV in CABG patients is comparable to other types of surgery. There is no correlation between the duration of CPB and the incidence of PONV. The pharmacological prevention does not decrease incidence and the number of PONV episodes significantly.

Reference:

- Swiatkowski J, et al. *Eur J Anaesthesiol* 1999; 16: 766–772.

A-44

Tracheal intubation without muscle relaxant after induction with remifentanyl, S-ketamine and propofol

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Background and Goal of Study: Successful tracheal intubation using propofol and remifentanyl (3–4 µg·kg⁻¹) without muscle relaxants has been reported. In this study, the effects of S-ketamine (0.5 mg·kg⁻¹) on tracheal intubating conditions and the hemodynamic responses to induction and tracheal intubation were evaluated in patients administered remifentanyl 3 or 4 µg·kg⁻¹ with propofol 2 mg·kg⁻¹.

Materials and Methods: After Ethics Committee approval and patients' written, informed consent, 80 healthy patients, scheduled for elective surgery were studied. All patients were prehydrated with lactated Ringer's solution before the induction of anaesthesia. The patients were randomly allocated to one of four groups: group I received remifentanyl 3 µg·kg⁻¹, group II received remifentanyl 3 µg·kg⁻¹ and S-ketamine 0.5 mg·kg⁻¹, group III received remifentanyl 4 µg·kg⁻¹, and group IV received remifentanyl 4 µg·kg⁻¹ and S-ketamine 0.5 mg·kg⁻¹. S-ketamine 0.5 mg·kg⁻¹ and propofol 2 mg·kg⁻¹ was administered, respectively, fifteen and sixty seconds after beginning the remifentanyl

infusion. Ninety seconds after the administration of propofol, tracheal intubation were attempted and graded as excellent, good and poor. Mean arterial pressure (MAP), heart rate and SpO₂ and adverse events were recorded.

Results and Discussions: Good or excellent intubating conditions were provided in most patients in groups II (90%), III and IV (100%). Although not statistically significant, more patients in group I indicated poor intubating conditions. MAP was significantly lower in groups I and III compared with groups II and IV after the induction of anaesthesia. Significantly more patients in groups I (55%) and III (60%) required ephedrine for low MAP (>30% of baseline) than in the other two groups (10% and 15%, respectively) ($p < 0.05$).

Conclusion(s): The addition of S-ketamine 0.5 mg·kg⁻¹ to remifentanyl 3 or 4 µg·kg⁻¹ and propofol 2 mg·kg⁻¹ combinations reduces the incidence of hypotension and improves intubating conditions.

Reference:

Stevens JB, Wheatley L. *Anesth Analg* 1998; 86:45–9.

A-45

Cardiovascular effects, recovery time and stress response using low and high doses of propofol during major abdominal surgery

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Background and Goal of Study: The advantages of total intravenous anaesthesia has been widely proved for minor surgical procedures. In this

prospective, randomized study we evaluated cardiovascular effects, recovery time and stress response using low and high doses of propofol in association to remifentanyl in patients undergoing major abdominal surgery.

Materials and Methods: Obtained Ethic Committee approval and informed consent, 30 patients, ASA II–III, undergoing elective abdominal surgery were enrolled. Anaesthesia was induced with propofol administered by Diprifusor TCI, at target effect-site concentration of 6 µg/ml, remifentanyl at the infusion rate of 0.25 µg/kg/min and cis-atracurium 0.15 mg/kg. For the maintenance of anaesthesia patients were randomly assigned to two groups: group A received propofol at target effect site concentration of 3.5 µg/ml and group B at 4.5 µg/ml. Remifentanyl was administered at variable infusion rate in order to maintain BIS values in the range from 40 to 50. Invasive blood pressure and heart rate were continuously registered during intraoperative period. Arterial catecholamines were analyzed at different time during surgery. Mann-Whitney test was used for non-parametric data and independent-samples T-test for normally distributed values.

Results: Cardiovascular parameters showed lower values of heart rate, invasive blood pressure for patients of group B compared to group A. Recovery time were longer in group B than that in group A ($p < 0.05$). Remifentanyl total dose was greater in the group A ($p < 0.05$). Epinephrine response was always low in group A whereas increased during surgery in group B. Norepinephrine increased, reaching similar values, in both group during surgery.

Conclusions: In our study anaesthesia with lower target of propofol and greater remifentanyl doses improved cardiovascular parameters, reduced the recovery time and provided adequate suppression of the stress response.

Reference:

Myre K et al. *Acta Anaesthesiol Scand* 1998; 42: 343–7.

Ambulatory Anaesthesia

A-46

Advantages of the ProSeal laryngeal mask airway and the SLIPA airway compared to the tracheal tube in day case laparoscopic gynaecological procedures

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Background and Goal of Study: Can the use of some supraglottic airways instead of the traditional tracheal tube (T) for laparoscopies provide satisfactory ventilation and reduce theatre time as well as side-effects? Two supraglottic airways designed to minimize aspiration risk were chosen. These were the reusable ProSeal™ LMA (PL) and the SLIPA™ (Single-use LIner of the Pharynx Airway) S [1][2].

Materials and Methods: The two supraglottic airways were compared with each other and with tracheal tube in 150 patients undergoing laparoscopic gynaecological procedures. Atracurium 25 mg was used for tracheal tube placement but not used for the supraglottic airways.

Results and Discussions: The means (standard deviations), for an airway insertion score (0 = best, 5 = worst) [2] were for PL 0.36 (0.52) and S 0.2 (0.2) respectively and P value = 0.2. Airway sealing pressures (cmH₂O) were for PL 31 (4.6) and S 30 (5.2), $P = 0.4$. Minimum fresh gas flow into a circle system (ml min⁻¹) indicating leak for T was 373 (130), for PL was 485 (291) and S was 539 (344) with respective P values for T:PL <0.01, T:S <0.01 and PL:S = 0.2. The first three parameters demonstrated excellent supraglottic airway qualities with sealing quality approaching that of tracheal tubes. Systolic blood pressure change (%) following insertion was for T 24 (14), PL -1.8 (11), S 3 (18) with respective P values wood <0.01, wood <0.01 and 0.1. Combined early + late sore throats (%), which were mild, were T 59, PL 30, S 49 with P values of <0.01, 0.2, 0.04. PL caused the least sore throats. Time (mins) from end of surgery to leaving theatre was for T 8.1 (2.8), PL 4.7 (1.2), S 4.84 (1.2) with P values = <0.01, <0.01, 0.9 respectively, demonstrating that extubation delays are circumvented by using supraglottic airways.

Conclusions: (a) Theatre time saved when using a supraglottic airway exceeds 3 minutes per patient. (b) Supraglottic airways provided less cardiovascular stress than tracheal intubation and fewer sore throats. (c) Satisfactory ventilation conditions were provided without muscle relaxants with both supraglottic airways.

References:

- 1 Keller C et al. *Anesth. Analg.*; 2000; 91: 1017–20.
- 2 Miller DM, Light DL. *Anaesthesia*; 2003; 58: 136–42.

A-47

Preadmission anaesthesia consultations using novel telemedicine technology – a pilot study

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Background and Goals: Telemedicine has been utilised by medical and surgical specialties however there have been no reports in the literature evaluating telemedicine technology for preoperative anaesthesia consultations^{1,2}. This study was undertaken to determine whether preadmission anaesthesia consultations using telemedicine technology are feasible, cost effective and satisfactory to the patient and the anaesthetist.

Materials and Methods: A prospective pilot study was conducted on patients from distant areas of Ontario in Canada having preadmission anaesthesia consultations using novel telemedicine technology. The demographics and clinical details of patients were documented and the level of satisfaction of the patient, the consulting anaesthetist and the attending anaesthetist were measured. Patients estimated cost and time involved in telemedicine consultation as compared to a conventional preoperative anaesthesia consultation.

Results: Ten telemedicine anaesthesia consultations were performed. The time to complete the anaesthesia consultation was 31 ± 7 minutes. Patients having telemedicine anaesthesia consultations spent 2.4 ± 0.9 hours and \$27 Canadian ± 39 versus an estimation of 28.3 ± 23.4 hours and \$235 Canadian ± 146 for conventional preoperative anaesthesia consultations. The format of the telemedicine anaesthesia consultation was found to be satisfactory to the patient, the consulting and attending anaesthetists.

Conclusions: This pilot study indicates that preadmission anaesthesia consultations are feasible and cost effective for patients residing in remote regions. Patients and anaesthetists were satisfied with the format of the consultation.

References:

- 1 Currell R, Urquhart C, Wainwright P, Lewis R. Telemedicine versus face to face patient care: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* 2000; (2): CD002098.
- 2 Roine R, Ohinmaa A, Hailey D. Assessing telemedicine: a systematic review of the literature. *CMAJ* 2001; 165(6): 765.

A-48

Preoperative ECG alterations in cataracts patients

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Background and Goal of Study: In 2002 we decided to introduce a selective preoperative ECG protocol for cataract surgical patients based on "history and physical examination which would have indicated the need for an ECG even if surgery had not been planned" (1). Before abandoning the routine protocol, we conducted this study to analyze the ECG alterations associated with the concomitant diseases in these patients.

Materials and Methods: Five hundred and ten patients scheduled for cataract surgery under local anaesthesia were prospectively studied. At our preanaesthetic clinic an anaesthetist noted the associated diseases and each patient had a 12-lead ECG.

Results and Discussions: There were 185 (36.3%) men and 325 (63.7%) women, mean age 74.7 years old (range 44–101). ECG alterations are shown in the table (as %).

Disease	N	MI	CB	LBBB	AF	LVH
No (N = 100)	67	6	1	2	0	4
IHD (N = 57)	21	56	56	8.8	5.7	3.5
SH (N = 255)	38	14	7.5	8.7	6.4	4.2
DM 1 (N = 32)	22	25	16	16	9.4	6.3
DM 2 (N = 94)	43	9.6	2.1	9.6	12	4.3

N: normal. MI: myocardial infarction. CB: conduction block. LBBB: left block. AF: atrial fibrillation. LVH: left ventricular hypertrophy. IHD: ischaemic heart disease. SH: systemic hypertension. DM: diabetes mellitus.

Conclusions: Since January 2003, we have applied this selective protocol to around 3000 patients, and only 11% of ECG have been done. However, since ECG alterations and associated diseases are so common, all of our patients are evaluated at our preanaesthetic clinic. ECG, BP and SpO₂ are monitored during surgery and each patient receives intraoperative O₂ in the presence of an anaesthetist.

Reference:

- 1 The Royal College of Anaesthetists and The Royal College of Ophthalmologists. Local anaesthesia for intraocular surgery guidelines. 2001.

A-49

A nurse led preanaesthetic clinic with the participation of the general practitioner

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Background and Goal of Study: In 2001 we set up a preanaesthetic clinic for cataract surgical patients at our hospital, consisting of one office for the anaesthetist and another one for the nurse, equipped with a personal computer, a monitor with ECG, SpO₂ and NIBP, and one ECG machine. Laboratory tests and chest X-rays could be obtained immediately. We present our preanaesthetic clinic experience, emphasizing the role of both the specialized nurse and the patient's general practitioner (GP).

Materials and Methods: Five hundred patients were prospectively studied. All patients were asked to answer a medical questionnaire, which should be produced at our preanaesthetic clinic on the day of the preanaesthetic visit. Patients were advised to visit their GP for help. Unanswered questionnaires were completed by the nurse. Based on the information obtained from the questionnaire and following the guidelines of our anaesthetic department, the nurse would proceed accordingly: (a) Accept the patient for surgery, (b) consult the anaesthetist, (c) refer the patient to their GP for further evaluation and (d) take an ECG and/or ask for any other investigations. On the day of surgery all patients would be visited and premedicated by an anaesthetist.

Results and Discussions: There were 310 (62%) women and 190 men (38%), mean age 74.4 years old (range 52–96). Seventy-five (15%) questionnaires were completed by the GP, 110 (22%) were completed by the patients or relatives, and 315 (63%) had to be completed by the nurse. 394 (78%) patients were accepted for operation (one of these patients had to be cancelled the day of surgery on account of acenocumarol and another one for claustrophobia). The anaesthetist was consulted for 15 (3%) patients, 66 (13.2%) were taking acenocumarol (only 8 (1.2%) were referred to the haematologist), 65 (13%) needed an ECG, 3 (0.6%) a chest x-ray and 3 (0.6%) some laboratory tests. 12 (2.4%) were referred to the GP.

Conclusions: In our experience, a well organized and equipped preanaesthetic clinic for cataract patients can be led by a specialized nurse. Since January 2001 we have successfully evaluated around 6000 patients.

A-50

Postoperative residual curarisation after outpatient surgery

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Background and Goal: To assess the incidence of postoperative residual curarisation (PORC) in ambulatory surgical patients receiving an intubation bolus of a neuromuscular blocking drug (NMBD).

Materials and Methods: After EC approval, we prospectively studied 150 adults planned for ambulatory surgery (duration < 60 min). They were given a single bolus of NMBD at induction. Immediately after arrival in the recovery room, the train-of-four (TOF) ratio was measured using the TOF Watch® (Organon).

Results: Results are shown in Tables 1 & 2.

Table 1.

Parameter	Number of patients (n)	Number of patients (%)
TOF < 0.7	23/150	15
0.7 ≤ TOF < 0.9	35/150	23
TOF ≥ 0.9	92/150	61

Table 2.

NMBD used	Patients (n)	Patients (%)	Patients with TOF < 0.7 (n)	Patients with TOF < 0.7 (%)
Atracurium	44/150	29	10/44	23
Rocuronium	23/150	15	6/23	26
Mivacurium	74/150	49	6/74	8
Succinylcholine	5/150	3	0/5	0
Cisatracurium	4/150	3	1/4	25
<i>Basis of reversal/extubation</i>				
Routine reversal	38/150	25	10/38	26
Clinical tests	82/150	55	10/82	12
NMT monitoring*	30/150	20	3/30**	10

NMT = neuromuscular transmission; *Qualitative (visual/tactile) or quantitative assessment of the TOF ratio; **These patients only had qualitative TOF assessment.

Conclusions: We found a high incidence of PORC in this ambulatory surgical population; of the non-depolarising NMBDs, mivacurium seems to be an acceptable choice. Most patients were extubated on a clinical basis. Even in the minority of NMT-monitored patients, qualitative TOF assessment was associated with PORC.

A-51

Non-steroidal anti-inflammatory drugs in day surgery: an audit of prescribing practices

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Background and Goal of Study: NSAIDs have an established role as effective postoperative analgesics in day surgery and, in the absence of contraindications, are the drug of choice¹. They are still frequently administered too late to achieve effective analgesia by the end of surgery; therefore it may be advantageous to prescribe NSAIDs as oral premedication². We set out to ascertain the current prescribing practices for NSAIDs in our day surgery unit.

Materials and Methods: A prospective audit of the prescription and administration of NSAIDs to patients undergoing general anaesthesia in a dedicated day surgery unit. Data collected included demographics, type of surgery and NSAIDs prescribed, timing and route of administration. Data were analysed with descriptive statistics using Microsoft® Excel 2000.

Results and Discussions: 326 patients were included. Only 103 (31.6%) patients received NSAIDs in hospital. Excluding urology, as most of these procedures do not generally require postoperative analgesia, this increases to 53.4% (gynaecological, orthopedic and general surgery patients). A further 25 (7.7%) patients received NSAIDs as discharge analgesia only. Of those patients who received NSAIDs, 66% were administered during surgery. Only 3 patients received an NSAID as premedication. Ketorolac IV was most commonly prescribed (54.2%). Other NSAIDs used were Diclofenac (40.7%) and Ibuprofen (5.1%). 41 (12.6%) patients had a contraindication to NSAIDs (gastric = 22, asthma = 15, renal = 1, other = 3).

Conclusions: Overall NSAIDs have been under-utilised in these day surgery patients. NSAIDs were rarely prescribed as premedication. We plan to set-up a protocol-driven prescription of NSAIDs, which could be implemented on admission to the day surgery unit. This will allow all patients to receive them at the appropriate time.

References:

- 1 Rawal N. *Br. J. Anaes.* 2001; 87: 73–87.
- 2 Code WE, Yip WE, Rooney ME et al. *Can. J. Anaesth.* 1994; 41: 98–101.

Acknowledgements: The authors would like to thank the nursing staff of the Gartnavel General Hospital DSU for their assistance.

A-52**Postoperative symptoms 24 hours after laparoscopic cholecystectomy and patients satisfaction after 1 week**

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Background and Goal of Study: To evaluate two widely used anesthetic schemes regarding the postoperative symptoms and patients' satisfaction and acceptance 24 hours and 7 days after laparoscopic cholecystectomy.

Materials and Methods: 60 patients 30–82 years, ASA I–II were randomized to receive either total intravenous anesthesia with Remifentanyl and Propofol (TIVA group, $n = 30$) or Propofol for induction and Remifentanyl and Sevoflurane for maintenance of anesthesia (SF group, $n = 30$). Both groups received Tropisetron 5 mg IV and Ketoprofen 100 mg IM before the start and Pethidine 50 mg IM 30 min before the end of the operation. On the first postoperative day, patients were asked to complete a questionnaire about their experience of postoperative nausea, vomiting, wound pain, intraoperative awareness, faintness, weakness, drowsiness within 24 h after surgery and if they wanted to be given medication for pain. 7 days after surgery, patients were interviewed by telephone, using a standardized questionnaire to determine the postoperative symptoms and satisfaction.

Results and Discussions: Incisional pain, nausea/vomiting, drowsiness and weakness were found to be the more frequent symptoms 24 hours after surgery. A slightly better patients' acceptance and satisfaction was recorded in TIVA group due to less side effects within 24 h after operation. (5% observed nausea and 4% emesis in TIVA group compared with 10% and 6% respectively in SF group). 12 patients (40%) in SF group and 10 patients (33%) in TIVA group were given additional analgesics. No patient recalled any events during surgery. 23% of patients in SF group had drowsiness compared with 16% in TIVA group. 1 week after, all patients in both groups had returned to normal daily activities. Weakness was recorded at 10% in SF group and 6% in TIVA group.

Conclusion(s): 24 h after laparoscopic cholecystectomy, a better patients' acceptance and satisfaction is recorded in TIVA group due to less side effects, but no difference is found between the two groups after 1 week.

A-53**Comparison of propofol and dexmedetomidine in monitored anesthesia care of ear–nose–throat surgery**

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Background and Goal of Study: The aim of present study, was to compare dexmedetomidine and propofol during monitored anesthesia care of patients undergoing septoplasty and endoscopic sinus operations in terms of haemodynamic, analgesic, sedative and side effects.

Materials and Methods: Following ethic committee approval and written informed consent, 40 patients were randomly divided into two groups. All patients received standart premedication. In group I, sedation induction was done with propofol 0.8 mg kg^{-1} and then propofol infusion was started as $2 \text{ mg kg}^{-1} \text{ hr}^{-1}$, whereas in group II, induction was done with dexmedetomidine $1 \mu\text{g kg}^{-1} \text{ iv}$ (infused in 5 mins) and infusion was started as $0.4 \mu\text{g kg}^{-1} \text{ hr}^{-1}$. Infusion rates were adjusted according to sedation scale in both groups. All the patients received $1 \mu\text{g kg}^{-1}$ fentanyl after sedation induction and received $0.5\text{--}1 \mu\text{g kg}^{-1}$ fentanyl when visual rating scale was 4> or when patient required. Intraoperative mean blood pressure, heart rate, SpO_2 and visual rating scale were evaluated and recorded at 5., 10., 20., 30., 40., and 50.mins. At the end of operation consumption of study drugs were recorded and Aldrete scores were evaluated 3 times at 15 min interval. Mean blood pressure, heart rate, SpO_2 were recorded and pain was evaluated by visual analog scale (VAS) at postoperative 1., 2., 4., 6., 12. and 24.hrs. When VAS scores were 4> diclofenac 75 mg was given.

Results and Discussions: Aldrete scores in 15 min was lower in Group II ($p < 0.05$). Intraoperative VRS scores were indifferent, postoperative VAS values at 1., 2., 4. and 6.hrs were found to be significantly higher then Group II in Group I ($p < 0.05$). Intraoperative sedation scores were higher in all the measured times in Group II ($p < 0.05$). First analgesic requirement time was significantly prolonged in Group II ($p < 0.05$). Total diclofenac consumption was $123.8 \pm 83.5 \text{ mg}$ in Group I and it was $33 \pm 48.7 \text{ mg}$ in Group II and found to be significantly higher in Group I.

Conclusion(s): As a result, sedation caused by dexmedetomidine was more profound however analgesia was better in postoperative period, dexmedetomidine can be used in monitored anesthesia care and be an alternative to propofol.

A-54**The induction dose–effect of propofol in addition to low-dose rocuronium on tracheal intubation conditions for day-case tonsillectomy in children**

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Background and Goal of Study: Tonsillectomy in children is a short surgical procedure performed in general anesthesia on a day-case basis. Short-acting or low-dose intermediate acting muscle relaxants are recommended (1). We supposed that induction dose of propofol preceded by alfentanil in addition to low-dose rocuronium might improve adequate intubation conditions (AIC).

Materials and Methods: Ninety children (aged 5–11 yrs; ASA I or II) were included in a prospective, randomized, double-blinded clinical study. All children were premedicated with midazolam 0.5 mg kg^{-1} . In thirty children anaesthesia was induced with propofol in a dose of 2.0 (Group A), 2.5 (Group B) or 3.0 mg kg^{-1} (Group C) preceded by alfentanil (0.02 mg kg^{-1}). In all groups, low-dose rocuronium ($1.5 \times \text{ED}_{50}$; 0.45 mg kg^{-1}) was used. Maintenance was with propofol ($0.1 \text{ mg kg}^{-1} \text{ min}^{-1}$) and alfentanil ($0.0015 \text{ mg kg}^{-1} \text{ min}^{-1}$). The intubating conditions were estimated using a four-point scoring system by Helbo-Hansen et al. The AIC were accepted if score in three variables (easy of laryngoscopy, movement of vocal cords and coughing) was equal or less than 2, and inadequate (IIC) if it was greater than 2. Data were analyzed by Fisher's exact and Mann-Whitney test. $p < 0.05$ was regarded significant.

Results and Discussions: Groups were comparable in demographic data. Onset time of neuromuscular block did not differ between groups ($A = 3.2 \pm 0.4$, $B = 3.1 \pm 0.4$, $C = 3.1 \pm 0.4 \text{ min}$). Significant lower mean arterial pressure was recorded immediately after bolus dose of 3.0 mg kg^{-1} of propofol (80 ± 7 vs. $A = 92 \pm 6$ and $B = 90 \pm 9 \text{ mmHg}$) ($p < 0.05$). AIC were achieved significantly higher after 3.0 and 2.5 mg kg^{-1} of induction-dose of propofol (99% and 97%) to compare with 2.0 mg kg^{-1} (73%) ($p < 0.05$).

Conclusion(s): Induction dose of 2.5 mg kg^{-1} of propofol preceded by alfentanil in addition to low-dose rocuronium improved the AIC without significant changes in MAP. This method represents a recommended technique for short elective day-case tonsillectomy in children where neuromuscular block is required.

References:

- Moore EW, Pollard BJ, Elliott RE. *European J Anaesth* 2002;19:9–17.
- Viby-Mogensen J, Engbaek J, Eriksson LI et al. *Acta Anaesthesiol Scand* 1996;40:59–71.

A-55**The comparative effects of sevoflurane and propofol for electroconvulsive therapy**H.I. Toprak, E. Gedik, Z. Özpolat, E. Öztürk, B. Kaya, M.Ö. Ersoy
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Goal of Study: The aim of this study was to investigate the effects of sevoflurane and propofol used in electroconvulsive therapy (ECT) on hemodynamic variables, and duration of seizure activity and recovery profiles.

Material and Methods: Eleven unpremedicated patients, of mean age 27.1 years, were enrolled in this prospective open trial, receiving a total of 44 ECT treatments. Each patient was given the following two anesthetic regimens in random order: In group S, anesthesia was induced with 7% sevoflurane in 100% oxygen at 6 L/min fresh gas flow until the loss of eye-lash reflex and 1.5 mg/kg propofol in group P. Adequate muscle relaxation was achieved with suxamethonium, 1.0–1.2 mg/kg. Noninvasive mean arterial pressure (MAP) and heart rate (HR) values, duration of motor seizure activity, and recovery times were recorded.

Results: Data (mean \pm SD) are shown in the table:

	Group P (n = 22)	Group S (n = 22)
MAP		
Before treatment	94 \pm 13	93 \pm 7
1 min after anaesthesia	89 \pm 10	90 \pm 15
1 min after ECT	95 \pm 11	100 \pm 7 [#]
10 min after ECT	89 \pm 8	99 \pm 11 [#]
HR		
Before treatment	89 \pm 18	94 \pm 24
1 min after anaesthesia	90 \pm 13	89 \pm 14
1 min after ECT	81 \pm 20	92 \pm 20
10 min after ECT	87 \pm 13	93 \pm 20

(continued)

	Group P (n = 22)	Group S (n = 22)
Motor seizure (s)	28.9 ± 9*	42.0 ± 15
Spontaneous breathing (s)	227.36 ± 73	287.36 ± 73
Open eyes (s)	452.63 ± 169	448.86 ± 124
Obey commands (s)	800.68 ± 187	781.82 ± 112

*P < 0.05 vs group S. *P < 0.05 vs MAP 0.

Conclusion: Induction with 7% sevoflurane allows prolonged duration of motor seizures in ECT. We concluded that inhaled induction of anaesthesia with sevoflurane is a reasonable alternative for patients undergoing ECT.

A-56

Pharmacokinetics and pharmacodynamics of AQUAVAN® bolus injection: a population PK/PD model®

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Background and Goal of Study: AQUAVAN® (AQ) (GPI 15715, Guilford Pharm., Baltimore, MD) is a water-soluble prodrug of propofol. Data from Phase I, open label, single bolus, dose escalation study is analyzed to develop a pharmacokinetic (PK) and pharmacodynamic (PK/PD) model of AQ and propofol (P) derived from AQ over a wide range of doses.

Materials and Methods: After IRB approval, 36 ASA I volunteers were randomized into 6 cohorts (male/female: 3/3) and given a bolus dose of AQ (5, 10, 15, 20, 25, 30 mg/kg). Arterial plasma samples were collected (1 to 480 min) and analyzed for both AQ and P. BIS (BISTM-XP, Aspect MS, Natick, MA) measured the hypnotic effect. The simultaneous population PK compartmental (comp.) model was developed using NONMEM software. Influence of weight (WT, range 54–84 kg) and gender on exposure was examined; a population PK/PD model of BIS was also established. The models were evaluated using simulations and bootstrap analysis.

Results and Discussions: A nonlinear 6-comp. model describes PK of AQ and P (3 comp. each). AQ elimination is characterized by nonlinear metabolism to P. The metabolic rate increases with AQ concentration (conc.). Liberating P faster than expected (85% and 96% of P plasma Cmax is achieved by 3 and 5 min, respectively). Distribution of P is saturable. P conc. decline to 50% Cmax by 25 min. P exposure is greater than dose-proportional (with power $\gamma = 1.34$ and 1.51 , for AUC and Cmax respectively). P Cmax is less than weight-proportional; dosing proportionally to $WT^{0.75}$ would provide weight-independent exposure. BIS change from baseline is described by the Hill model of P conc. in the effect comp. ($EC_{50} = 2.1 \mu\text{g/mL}$, $E_{\text{max}} = 81.3$, $\gamma = 1.67$). The effect comp. rate constant (Keo) is proportional to P plasma conc., making equilibration time to be dose and time dependent. Neither weight nor gender affects the PK/PD relationship.

Conclusion(s): The PK/PD profile of AQ is characterized by a rapid initial rate of metabolism that slows with falling AQ conc. This provides rapid onset of action and gradual offset. The model suggested less than weight-proportional dosing, and confirmed absence of gender effect.

A-57

Is topical anaesthesia and sedation with remifentanyl a substitute for retrobulbar anaesthesia in glaucoma surgery?

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Background and Goal of Study: There is little information about topical anaesthesia with sedation in glaucoma surgery (1–3). The aim of this study was to compare local anaesthesia and retrobulbar anaesthesia, both with sedation (remifentanyl) in ambulatory glaucoma surgery.

Materials and Methods: We studied 20 patients, ASA II–IV, divided in two groups: Group I (n = 10): topical anaesthesia (TA) with drops of oxybuprocaine 0.4% and lidocaine 2% (with a haemostatic sponge). Group II (n = 10): retrobulbar anaesthesia (RA) with mepivacaine 2%. Both groups were sedated with a perfusion of remifentanyl ($0.05\text{--}0.1 \mu\text{g Kg}^{-1} \text{min}^{-1}$) to maintain a grade II–III Ramsay scale. A bolus of remifentanyl ($0.3 \mu\text{g Kg}^{-1}$) was added if the patient complained of pain. We compared: (a) Arterial pressure, heart rate, oxygen saturation and BIS in these times: pre-anaesthesia, during surgery and in recovery room, (b) Pain measured with visual analogic scale (VAS) during administration of TA, RA and after surgery, (c) Length of surgery, (d) recovery time before discharge and (e) needs for more analgesia. Mann-Whitney U-test was used for statistical analysis.

Results and Discussions: There were no significant differences in demographic and haemodynamic data, oxygen saturation, BIS, length of surgery and recovery time. There were significant differences in VAS in group II during injection ($P < 0.001$) and in group I during the immediate postoperative period ($P = 0.009$) although this did not interfere with patient's comfort. No patient required extra bolus of remifentanyl during surgery.

Conclusions: (1) With retrobulbar anaesthesia, analgesia requirements are lower during the immediate postoperative period. (2) Topical anaesthesia is a good alternative for glaucoma surgery, especially in high risk patients who could be included in outpatients programs. (3) The use of remifentanyl is a good alternative in topical anaesthesia, as it provides good analgesia and the patient can collaborate with the surgeon and be comfortable at the same time.

References:

- 1 Julvez LE. *Arch Soc Esp Oftalmol* 2003; 78: 251–256.
- 2 Zabriskie N. *J Glaucoma* 2002; 11: 306–314.
- 3 Rebolleda G. *J Cataract Refract Surg* 2001; 27: 1214–1220.

A-58

Comparison of sevoflurane and desflurane for abdominal surgery of short duration concerning recovery times in operating and recovery room

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Background and Goal of Study: In this study we compared the recovery times and times to achieve discharge criteria from the recovery room after anaesthesia with sevoflurane or desflurane in patients undergoing abdominal surgery of maximum 60 min duration.

Materials and Methods: 84 patients, 21–79 years, ASA physical status I–III, were randomly assigned in two groups. Both groups received antiemetic prophylaxis with Tropisetron 5 mg. Induction of anaesthesia and tracheal intubation was achieved in both groups with propofol 2 mg/kg, cis-atracurium 0,15 mg/kg and fentanyl 4 $\mu\text{g/kg}$. Maintenance of anaesthesia was obtained either with sevoflurane at 1–1.5% (SF group, n = 42) or with desflurane at 3–4.5% (DS group, n = 42). All patients received 66% N₂O in O₂ at standardized fresh gas flow. Ventilation was controlled to maintain normocapnia. Recovery times (eye opening T₁, extubation T₂, orientation T₃, name recall T₄, birthday recall T₅) were recorded immediately after skin closure and cessation of anaesthetic agents. Statistical analysis included typical deviation of the times in the two groups, using SPSS.

Results and Discussions: Desflurane achieved significantly shorter times than sevoflurane concerning eye opening (5,20 min for DS vs 8,30 for SF), extubation (6 min for DS vs 9,30 min for SF), orientation (6,20 min for DS vs 10,15 min for SF), name recall (7,5 min for DS vs 11,40 min for SF) and birthday recall (7,6 min for DS vs 12,20 min for SF). In the recovery room times to full awakens with patient's orientation at place, time, persons were approximately similar (13,10 min for DS vs 13,50 min for SF). Time for discharge from the recovery room was also similar in the two groups.

Conclusion(s): In abdominal surgery of short duration, desflurane seems to be superior to sevoflurane concerning the shorter recovery times in the operating theater, but is not beneficial concerning the eligibility for discharge from the recovery room.

Reference:

- Song D et al. Fast-track eligibility after ambulatory anaesthesia: a comparison of desflurane, sevoflurane and propofol. *Anesth Analg* 1998 86:267–273.

A-59

Intraarticular sufentanil does not improve postoperative pain control after arthroscopic anterior cruciate ligament reconstruction procedure in outpatients

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Background and Goal of Study: Arthroscopic anterior cruciate ligament reconstruction (AACLRL) is a painful procedure requiring a tight postoperative pain control. In a prospective, randomized, blinded study we compared the effects of two intraarticular (IA) solutions, on postoperative pain in outpatients submitted to AACLRL.

Materials and Methods: We studied 120 patients, randomly divided into 2 groups. At the end of the operation, patients belonging to group S, received 0.5% ropivacaine 20 ml, sufentanil 5 μg and clonidine 1 $\mu\text{g kg}^{-1}$ into the knee joint. Patients in group C received the same solution but the

sufentanil. Anaesthesia consisted of weight related doses of propofol, remifentanyl and sufentanil. To rate postoperative pain we used a visual analog scale (VAS). Assessments were performed 1, 2, 3 hours, the same evening and the day after the IA injections.

Results and Discussion: Demographic data are shown in tab. 1. The VAS pain scores were similar in both groups (fig. 1). All patients were discharged on the day of surgery. One patient was readmitted for bleeding and two others for wound infection. No patient was readmitted for pain. Nearly all patients had an excellent control of their postoperative pain.

Conclusions: IA ropivacaine and clonidine provided a good pain control after AACLR. The addition of IA sufentanil did not improve pain control.

Table 1. Patient characteristics and operative data.

	Group S	Group C
Age (yr)	30.5 [15-53]	30.1 [15-50]
Sex (F : M)	12 : 48	15 : 45
Surgery duration (min)	55.4 [20-120]	52 [25-120]
Discharge time (min)	232 [100-370]	223 [90-410]

Data are presented as mean ± SD and/or [range].

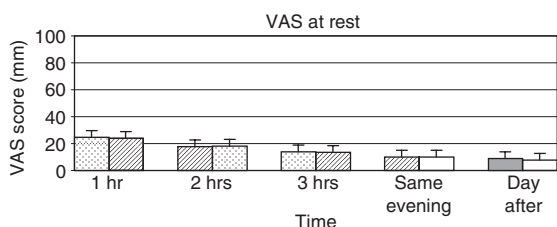


Figure 1.

A-60

The effect of fentanyl and remifentanyl on different recovery scores with sevoflurane and desflurane after ambulatory anaesthesia

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Background and Goal of Study: To compare sevoflurane and desflurane with opioids in operation room (OR-Phase-1) and postanesthesia care unit (PACU-Phase-2) by using Fast-Tract-Criteria (FTC) and Aldrete Criteria (AC) for ambulatory anaesthesia.

Materials and Methods: With approval of Local Ethics Committee, 80 ASA I-II patients, ages between 18-60 were randomized into one of four groups (n = 20) following standard anaesthesia induction: Group-I: 1-3% sevoflurane + 2 µg/kg/h fentanyl, Group-II: 1-3% sevoflurane + 0.25 µg/kg/h remifentanyl, Group-III: 2-5% desflurane + 2 µg/kg/h fentanyl, Group-IV: 2-5% desflurane + 0.25 µg/kg/h remifentanyl in 60% N₂O. Extubation times were recorded. FTC and AC were evaluated in OR at 5th and 10th min. following extubation and in PACU at 5th, 15th and 25th min. P < 0.05 was considered significant.

Results and Discussions:

Table 1. FTC and AC scores in OR and PACU.

	Group I	Group II	Group III	Group IV
Ext. (min)	5 (1-10)	5 (2-13)	4 (1-11)	5 (2-7)
Phase I				
5th FTC	10 (8-11)	10 (6-12)	11 (7-14)	12 (5-14)
AC	7 (4-10)	8 (5-10)	8 (4-10)	9 (5-10)
10th FTC	11 (11-14)	12 (12-14)	12 (9-14)	12 (9-14)
AC	9 (8-10)	9 (8-10)	9 (5-10)	10 (9-10)*
Phase II				
5th FTC	9 (5-10)	9 (4-10)	9 (7-10)	12 (9-14)*
AC	9 (7-10)	9 (8-10)	10 (8-10)	10 (9-10)*
15th FTC	13 (9-14)	13 (12-13)	13 (11-14)	12 (10-14)
AC	9 (6-10)**	10 (8-10)	10 (10-10)	10 (10-10)
25th FTC	13 (10-14)	13 (12-14)	13 (12-14)	13 (12-14)
AC	10 (7-10)	10 (9-10)	10 (10-10)	10 (10-10)

*P < 0.05 (Group I vs Group IV); **P < 0.01 (Group I, II, III vs Group IV); ***P < 0.05 (Group I vs Group II, III, IV).

Conclusion(s): Desflurane and remifentanyl combination seems to be suitable for ambulatory anaesthesia.

Reference:

1 Song D et al J Clin Anesth 1999;11(5):364-7.

A-61

Ambulatory anesthesia for placement of intragastric balloon in obese patients: TCI-midazolam vs TCI-alfentanil

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Background and Goal of Study: BIB placement is an endoscopic procedure for weight loss, performed under sedation or either general anesthesia. Desaturation and upper airways obstruction are the limiting factors of deep sedation. The aim of this study is to evaluate incidence of episodes of desaturation (defined as SpO₂ < 90%) and recovery times of two sedation strategies: midazolam + diprivan TCI vs alfentanil + diprivan TCI in morbid obese patients undergoing endoscopically placement or removal of Inamed Health Balloon.

Materials and Methods: 30 pts were randomized in 2 groups similar about age (36 ± 1.41), weight (mean BMI Kg/h² 36.27 ± 1.78), ASA (I-III). In group A n = 15 was administered alfentanil 5 mcg Kg and in group M n = 15 midazolam 0,03 mg Kg. Induction for both was slowly obtained with TCI [c]_{site effect} 2,2 ± 1.41 mcg/ml, maintenance at the range of 1.8-2.7 mcg/ml, giving O₂ 5 lt/min. SpO₂, ECG, BIS were continuously recorded. Times of procedures and recovery were assessed as the time elapsing from the end of infusions and eye opening (awakening time) and the time necessary to recall the date of birth (recovery time), and time to discharge from operating room.

Results and Discussions: Total dose of propofol was 266 ± 44 mg(A)/215 ± 58 mg(M), alfentanil 637,5 ± 281 mcg midazolam 3.6 ± 0.9 mg. Any desaturation episode was recorded in both group; mean BIS at induction/maint. 60 ± 8/76 ± 14(A), 55 ± 7,8/68.8 ± 22.7(M). Awakening times were: 1,8 ± 1.24 min(A), 2,45 ± 1.41 min(M), p = ns; recovery times were 2.1 ± 1.41min(A), 3.0 ± 1.6(M) p = ns; discharge times were 12.1 ± 0.85 min(A), 12 ± 0,52(M) p = ns.

Conclusions: No statistically significant differences of total dose of drugs used, times of procedures, recovery times were noted. SpO₂ was always greater than 93%. All patients maintained reflex of coughing and spontaneous breathing. Short half-life opioids or benzodiazepines determine an additive action with propofol that consents to maximize benefits and minimize side effects.

Reference:

Totte E "Weight reduction by means of intragastric device: experience with the bio-enterics intragastric balloon". Ob. Surg. 2001 Aug;11(4):519-23.

A-62

Conscious sedation with remifentanyl in CARTO (mapping system)

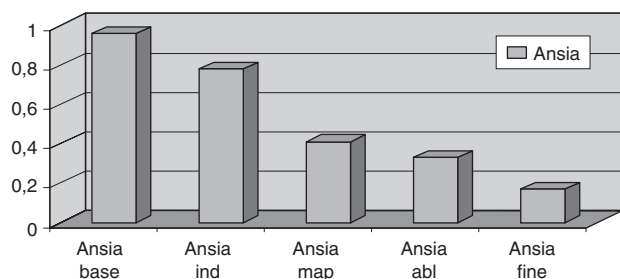
S. Magrin, M. De Luca, G. Fracasso, E. Casaletti, O. Sottocorno, M. Putzu, P. Bergonzi, R. Fiori, B. Salamoussas, A. Zangrillo

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Background and Goal of Study: The goal of sedation and analgesia is to provide comfort to the patient while keeping airway reflex intact. Remifentanyl is the relatively new, ultra short-acting, potent µ-opioid agonist. Employing a remifentanyl infusion for sedation maintains a degree of analgesia without excessive somnolence, and assures wakefulness at the desired time. The CARTO system is a new, non fluoroscopic method for mapping designed associating a specific intracardiac electrocardiogram with the endocardial location from which it has been recorded. In this study, our aim was to determine if remifentanyl give a good comfort during CARTO procedure.

Materials and Methods: We used two different dosage regimens, in different moment of procedure. 54 patients received continuous infusion of remifentanyl 0.025 microg × kg⁻¹ × min⁻¹ in continuous perfusion, followed by of 0.05 microg × kg⁻¹ × min⁻¹ during ablation. These dosage regimens ensured patient comfort and sedation. Cardio respiratory parameters, the degree of pain, discomfort and anxiety were monitored and recorded. The quality of the analgesia was assessed with Ramsay scale.

Results and Discussions: There was no statistical difference among the group in terms of demographic variables. Hemodynamic stability was maintained with both remifentanyl doses. P anxiety < 0.05.



Conclusion(s): Administration of remifentanyl for mapping system CARTO provides adequate analgesia, satisfactory hemodynamic stability and maintained adequate respiration. The low dose of remifentanyl resulted in fewer side effects, slightly greater sedation and less anxiety, during all time of procedure.

References:

- Circulation. 2003 Oct 28;108(17):2099–106.
N Engl J Med. 2003 Nov 6;349(19):1803–11.

A-63

Prophylactic antiemetics for laparoscopic cholecystectomy: droperidol plus metoclopramide versus droperidol and metoclopramide

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Background and Goal of Study: Postoperative nausea and vomiting (PONV) is a common complication of laparoscopic cholecystectomy¹. This study evaluates the antiemetic effect of metoclopramide plus droperidol with each drug alone or placebo in the prevention of PONV after laparoscopic cholecystectomy.

Materials and Methods: A 140 patient's ASA physical status I–II were included in prospective, double blind, placebo-controlled, randomised study. The same standard general anaesthetic technique and postoperative analgesia were used in all patients. Patients were allocated to one of four groups to receive study drug: Group 1 (placebo), Group 2 (metoclopramide 10 mg after induction in anaesthesia and placebo 12 h after surgery), Group 3 (droperidol 1.25 mg after induction in anaesthesia and droperidol 1.25 mg 12 h later), and Group 4 (droperidol 1.25 mg plus metoclopramide 10 mg after induction and 12 h later droperidol 1.25 mg). The patients were observed for 24 hours for incidence of PONV, pain, need for rescue analgesic and adverse events. Data were analysed using t-test and chi-square analyses, with $p < 0.05$ considered statistically significant.

Results and Discussions: The groups were similar with respect to age, weight, and duration of surgery. The incidence of PONV was 54% with placebo, 42% with metoclopramide, 14% with two doses of droperidol alone and 11% with combination of metoclopramide plus droperidol. Patients receiving combination of metoclopramide plus droperidol had significantly less PONV than those receiving metoclopramide ($p < 0.05$) and placebo ($p < 0.001$). Those receiving two-dose droperidol alone also had significantly less incidence PONV compared with metoclopramide ($p < 0.05$) and placebo ($p < 0.001$). Sedation was significantly greater with patients who received droperidol 12 h after surgery.

Conclusion(s): We concluded that combination of metoclopramide plus droperidol and two-dose droperidol alone significantly decreased the incidence of PONV after laparoscopic cholecystectomy. Metoclopramide was ineffective.

Reference:

- 1 Nagueib M, el Bakry AK, Khoshim MHB, et al. *Can J Anaesth* 1996;43:226–31.

A-64

Antiemetic prophylaxis with an oral administration of tropisetron by patients with altered body habitus and a history of PONV

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Background and Goal of Study: The aim of this study was to compare the effectiveness of a different preoperatively administration of the selective

5-HT₃-receptor-antagonist tropisetron by patients with altered body habitus and a history of PONV (postoperative Nausea and Vomiting) after previous anaesthesia.

Materials and Methods: 1,275 adult patients with different body habitus and a history of PONV after previous anaesthesia scheduled for elective surgery under general anaesthesia were included in this prospective follow-up study. Patients were divided into three groups with different antiemetic prophylaxis. Group I ($n = 492$ patients) was left as a control group without any prophylaxis, group II ($n = 371$ patients) received tropisetron 2 mg i.v. after induction of anaesthesia, group III ($n = 412$ patients) was administered tropisetron 5 mg p.o. sixty minutes before induction of anaesthesia. For statistic evaluation the Chi-Square-test and as post hoc test the Fisher's exact test was used ($p < 0.05$).

Results and Discussions: The high incidence of PONV (50.6%) in patients without any prophylaxis and normal weight (BMI 20–25 kg/m²) was significantly reduced in patients receiving tropisetron i.v. (46.4%) or tropisetron p.o. (35.7%). Similar results were shown by the obese patients (BMI > 25 kg/m²): 54.3% (control group) versus 39.1% tropisetron i.v. versus 39.0% (tropisetron p.o.).

Conclusions: The oral administration of tropisetron is a highly potent antiemetic prophylaxis and should be used by high-risk patients for postoperative nausea and vomiting. The body habitus is no important determinate risk factor for PONV and without any effect in the choice of the antiemetic prophylaxis. Further studies should determine the reasons of the effectiveness of the oral application in contrast to the intravenously.

References:

- 1 Cohen MM et al., *Anesth. Anag.* 1994;78:7–16.
2 Lerman J, *Br. J. Anaesth.* 1992;69:24S–32S.

Acknowledgements: NOVARTIS Pharma GmbH.

A-65

Intravenous fluid therapy decreases postoperative nausea and vomiting in high risk patients

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Background and Goal of Study: The potential for intravenous rehydration to reduce postoperative nausea and vomiting (PONV) following ambulatory surgery remains unclear, with conflicting results reported [1,2]. We wished to determine whether aggressive intravenous rehydration would decrease the incidence of PONV in patients with an increased predicted risk [3].

Materials and Methods: Eighty ASA grade I–III patients presenting for gynaecologic laparoscopy were randomized to receive high (3 mL·kg⁻¹ per hour fasting) or low (2 mL·kg⁻¹) dose infusions of Hartmann's solution over 30 min preoperatively. A standardized balanced anaesthetic was used. The incidence and severity of PONV and pain were assessed at 0.5, 1 and 4 hours after surgery, and on days 1–3 postoperatively.

Results and Discussions: PONV incidence [17.1% vs. 64.9%, $P < 0.001$], severity [mean ± SEM, 1.8 ± 0.3 vs. 0.9 ± 0.2 at 24 hours, $P < 0.05$] and anti-emetic requirement [21.9% vs. 51.4%, $P = 0.01$], were lower in the high-infusion group at all time points. The high infusion group also has decreased postoperative pain scores [1.8 ± 0.2 vs. 0.7 ± 0.1 at 24 hours, $P < 0.01$] and required less supplemental morphine [5.3 ± 1.2 mg vs. 1.6 ± 0.4, $P < 0.01$].

Conclusion: Correction of intravascular volume deficits reduces PONV in high risk ambulatory patients.

References:

- 1 McCaul et al, *Can J Anesth* 2003; 50(5): 440–4.
2 Yogendran S et al, *Anesth Analg* 1995; 80(4): 682–6.
3 Apfel CC et al, *Anesthesiology* 1999; 91(3): 693–700.

A-66

The role of dexamethasone on postoperative nausea and vomiting after gynaecological surgery: a double-blind placebo controlled comparative study with ondansetron and metoclopramide

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Background and Goal of Study: To investigate the prophylactic value of dexamethasone as an alternative therapy to usage of ondansetron or metoclopramide to prevent postoperative nausea and vomiting (PONV) after gynaecologic surgery.

Materials and Methods: This double-blind, prospective, placebo controlled clinical study consisted of 80 patients, ASA I–II, aged 17–64 years old. The general anesthesia and postoperative pain management were standardized. The participants were randomized into four groups. Before induction of anaesthesia, the patients in the Group D received dexamethasone in a dose of 8 mg, those in the Group O received 4 mg ondansetron, those in the Group M received 10 mg metoclopramide, and those in the Group P received 2 ml of 0.9% saline intravenously. VAS and SES (Severe Emesis Score) was used to evaluate pain and PONV, additional analgesic and antiemetic requirement were recorded at the 1st, 15th, 30th, 45th, 60th minutes and 2nd, 6th, 12th and 24th hours. One-way ANOVA, Chi-square test, T-test, Kruskal-Wallis and Dunn tests were used for statistical analysis and $p < 0.05$ was used as the cut-off level for statistical significance.

Results and Discussions: There was no statistical significance between VAS and additional analgesic requirement ($p > 0.05$). There was statistically significant difference in SES between four groups at the 1st and 15th minutes ($p < 0.0001$ for both). The differences in the incidence of antiemetic requirement were statistically significant when comparing three drugs to placebo but not when comparing drugs to each other. The additional antiemetic requirement was found to be higher in the Group P than it was in the Groups D, O, M (65%, 30%, 10%, 25%, respectively) ($p = 0.016$), but it was not different between Groups D, O, M.

Conclusion(s): Prophylactic administration of dexamethasone significantly reduces the incidence of PONV after total abdominal hysterectomy, but the effectiveness of the drug was not different from the effectiveness of ondansetron and metoclopramide.

Monitoring: Equipment and Computers

A-68

DBS, 100 Hz Tetanus or Acceleromyography: which one performs best as a punctual test to detect residual paralysis at the end of surgery?

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Background and Goals: Residual paralysis (RP) remains frequent (1). To detect RP reliably with acceleromyography (AMG), calibration before injection of the myorelaxant is recommended (2). In practice, AMG is often used as punctual test at the end of surgery and thus, calibration is not possible. In this setting the performance of AMG has not been investigated. This study assessed the performance of AMG used as a punctual test to detect RP and compared it with double burst stimulation (DBS) and 100 Hz tetanus.

Materials and Methods: After approval and consent 25 ASA I–III adult patients were studied. Anaesthesia was induced and maintained with propofol and sufentanil. Neuromuscular (NM) transmission was evaluated using mechanomyography (MMG) of the adductor pollicis, supramaximal stimulation (2 Hz) was applied every 15 s to the ulnar nerve; after signal stabilization, 0.15 mg/kg cisatracurium was given, patients were intubated and time course of NM block was monitored. To assess NM recovery at the end of surgery a first physician evaluated fade after a single DBS and then quantified AMG TOF-ratio (current set at 60 mA, one TOF stimulation). Thereafter a second physician, not aware of the results of the first, assessed fade after 100 Hz 5 s tetanus. At the moment of evaluation they were not aware of the MMG value measured at the opposite arm. The positive predictive value (PPV), negative predictive value (NPV), sensitivity (Sen) and specificity (Spe) of the DBS, 100 Hz tetanus and AMG TOF were calculated.

Results: Data (95% CI) are shown in the table

	AMG	DBS	Tetanus
PPV	1.0 (1.0–1.0)	1.0 (1.0–1.0)	0.8 (0.6–1.0)
NPV	0.5 (0.3–0.8)	0.4 (0.1–0.6)	0.4 (0.1–0.8)
Sen	0.7 (0.5–0.9)	0.3 (0.1–0.5)	0.7 (0.5–0.9)
Spe	1.0 (1.0–1.0)	1.0 (1.0–1.0)	0.6 (0.2–0.9)

Conclusions: This study confirms the poor performances of DBS. After calibration, AMG may allow to detect RP with a probability $> 95\%$ (2), however, using it as a punctual test at the end of surgery does not allow to detect RP reliably.

References:

- 1 Debaene B. et al. *Anesthesiology* 2003; 98: 1042–8.
- 2 Capron F. et al. *Anesthesiology* in press.

A-69

Measurement of pulmonary capillary blood flow by partial CO₂ rebreathing during one-lung ventilation

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Background and Goal of Study: Oxygen transport is usually impaired during one-lung ventilation (OLV) due to reduced effective pulmonary capillary blood flow (PCBF). The PCBF can be monitored noninvasively by partial

CO₂ rebreathing maneuvers (1), but this technique has not been evaluated under OLV.

Materials and Methods: Following approval of the local ethics committee, and with written informed consent, 11 patients who underwent open, surgical procedures of the lungs were included in this study. PCBF was measured noninvasively by partial CO₂ rebreathing (PCBF_{reb}) and invasively as thermolilution cardiac output minus intrapulmonary shunt. Measurements were obtained in supine position under ventilation of both lungs (TLV), when a volume challenge with 500 ml HES 6% was performed. Following that, patients were put in side position and measurements were repeated under TLV. Then, OLV was initiated and measurements were performed without and with application of 100% oxygen as CPAP (5 cmH₂O) to the nondependent lung.

Results and Discussions: Bias and precision calculations showed close agreement between methods (0.1 ± 0.7 l/min). PCBF_{reb} increased from 3.2 ± 0.8 l/min to 3.6 ± 0.9 l/min ($p < 0.05$) as a result of the volume challenge. Side position did not influence PCBF_{reb} significantly (3.6 ± 0.8 l/min, $p = 0.86$), but OLV led to a reduction of PCBF_{reb} to 2.9 ± 0.8 l/min ($p < 0.05$). The use of CPAP in the nondependent lung resulted in the reversal of the hypoxic pulmonary vasoconstrictory effect (HPV), leading to a further reduction of PCBF_{reb} in the ventilated lung (2.6 ± 0.6 l/min, $p < 0.05$).

Conclusion(s): The partial CO₂ rebreathing technique is sensitive to the major sources of variation of PCBF during surgical procedures of the lungs, namely intravascular volume variation, one-lung ventilation and reversal of the HPV effect.

Reference:

- 1 Gama de Abreu et al., Partial Carbon Dioxide Rebreathing: A Reliable Technique for Noninvasive Measurement of Nonshunted Pulmonary Capillary Blood Flow. *Crit Care Med* (25): 675–683, 1997.

A-70

Evaluation of intubation with Glidescope® or McIntosh laryngoscope by experienced anaesthetists in simulated easy and difficult airways

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Background and Goal of Study: The new video-equipped laryngoscope, Glidescope® (GS), is developed for difficult airway management. We compared this device with McIntosh laryngoscope (ML) in intubation of simulated grade 1 and grade 3 larynx by experienced anaesthetists.

Materials and Methods: In this double crossover study, 20 anaesthetists were randomized to use either the GS or ML first, and then further randomized to intubate grade 1 or grade 3 larynx first. They were allowed 3 attempts to intubate in a maximum time of 360 sec in each of the 4 scenario on the Human Patient Simulator.

Results: In the grade 1 scenario, success and ease of intubations were similar with both devices. Time taken was shorter with ML (mean 12.7 sec, SD 5.9 sec vs. 19.0 sec, SD 9.7 sec, $p = 0.006$). Most of the anaesthetists chose ML (17/20) with 3 undecided. In the grade 3 scenario, there were more successful intubations with GS (20/20 vs. 18/20, $p = 0.5$). Time taken for was shorter for GS (mean 23.5 sec, SD 12.7 sec vs. 70.5 sec, SD 101.2 sec, $p = 0.001$). The anaesthetists graded intubation easier with the GS (Median easy vs intermediate, $p = 0.025$). And more would choose the GS for the grade 3 scenario (12/20 vs. 6/20).

Discussion: This study showed that in simulated grade 3 larynx, experienced anaesthetists had a high success rate of intubation with both GS and ML, but more would choose the GS which enables good visualization of the larynx. GS was associated with shorter intubation time. Most anaesthetists preferred the ML in grade 1 scenario due to their experience and familiarity with it.

Conclusion: In simulated grade 1 larynx, there was no advantage with GS, and intubating time was longer. In simulated grade 3 larynx, success rate and intubation time were better with the GS. We suggest further study of the GS in real patients with difficult airways.

A-71

Comparison of cutaneous heat loss under dry and moist conditions

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Background and Goal of Study: Anesthetic-induced inhibition of normal thermoregulatory control, combined with cold exposure, makes most surgical patients hypothermic. Even mild hypothermia causes severe complications that adversely influence patient outcome. To maintain perioperative core normothermia any method is suitable, but passive insulation such as surgical draping material is among the most commonly used approaches. Ordinary surgical drapes reduce cutaneous heat loss by 30%, which is a clinically important amount. This measurement, though, included only radiative, conductive, and convective loss; evaporative loss was not measured. Normally, accuracy is little sacrificed by ignoring evaporation since insensible evaporative heat loss is only about 10% of the metabolic rate in adults. However, evaporative heat loss can be substantial in infants or when skin is moistened by sweat or other fluids.

Materials and Methods: We used a new surgical drape (Tiburon, Cardinal Health, Inc.), which is impervious to moisture that presumably reduces evaporative heat loss. We thus compared skin temperature and cutaneous heat loss with and without cover under dry and moist conditions. Cutaneous heat loss was calculated from 15 area-weighted thermal flux transducers on 8 volunteers. Skin-surface temperatures were recorded from thermocouples incorporated into thermal flux transducers. Transducers were either kept dry or moistened to simulate wet skin. A 20-minute-long uncovered control period was followed by 40 minutes during which volunteers were covered from the neck down. Data were recorded continuously and averaged over 10-minute-long epochs.

Results and Discussions: Under dry conditions, baseline heat loss was 82 ± 14 watts and decreased 30% with the surgical drape ($P < 0.001$). Under moist conditions, baseline heat loss was 231 ± 45 watts and decreased 29% with the drape covering ($P < 0.001$). Moist skin therefore increased heat loss 282% ($P < 0.001$), that is a nearly three-fold increase in heat loss.

Conclusion(s): Moist skin increases heat loss by almost three-fold, even under an impervious surgical drape. Preventing skin wetting under surgical drapes will reduce intraoperative heat loss.

A-72

Fuzzy logic closed loop system for propofol and remifentanyl administration using bispectral index and haemodynamics

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Background and Goal of Study: Previous studies have reported the use of a closed loop system to improve propofol administration. They were based on binary logic model and one variable control. We reported a multiparametric closed loop system for propofol (P) and remifentanyl (R) administration based on a fuzzy logic model.

Materials and Methods: After institutional approval and informed consent, 14 patients scheduled for general surgery were enrolled. General anaesthesia combined P (Schnider model) and R (Minto model) administered at target effect site concentration (Ce). Minimum concentrations of R and P were defined by anesthesiologist. All patients were intubated. Closed loop for Ce P was based on absolute value and variations of bispectral index (BIS™), burst suppression ratio (BSR), and mean arterial pressure (MAP). Controlled parameters for R were heart rate (HR), HR variations and MAP. A 52 rules matrix was necessary for the system to operate. Primary targets were a BIS value of 50 and HR, MAP ranged

between $\pm 30\%$ of initial values, with low alarms. Controlled variables could be changed as necessary on the computer using a Windows™ interface. HR, MAP, BIS, BSR, P Ce and R Ce were recorded every 10 sec. System bias and precision for BIS were calculated. Results are expressed in mean \pm SD.

Results and Discussions: Loss of consciousness was obtained in 163 ± 60 sec. Mean regulation time was 157 ± 100 min. Perioperative P Ce and R Ce were 2.4 ± 0.7 mcg/ml and 3.0 ng/ml respectively. Two patients had one hypotension episode requiring ephedrine administration after induction. Bias was -1% and precision 10% for BIS. Emergence time was 9 ± 3 min. Manual interventions consisted in modification of BIS target in 4 patients. No explicit awareness was detected.

Conclusions: Fuzzy logic closed loop system for propofol and remifentanyl co-administration provided a well control of depth of anaesthesia. Further studies are needed to improve this model according to patient inter and intravariability.

References:

- 1 Mylne SE, et al *Br J Anesth* 2003; 90:623–9.
- 2 Struys M, et al *Anesthesiology* 2001; 95:6–17.

A-73

The advantages of end-tidal CO₂ monitoring for improved patient care during total intravenous anesthesia

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Background and Goal of Study: The aim of this study was to show how patient care could be improved by capnography monitoring during total intravenous anesthesia (TIVA) for short surgical procedures where the patients are vulnerable to hypoventilation and apnea. Patient outcome, anesthetic drug titration and spontaneous respiration were compared with and without capnography monitoring.

Materials and Methods: Patients (N = 222) undergoing ovum retrieval by vaginal ultrasound guidance (ASA physical statuses I–II) were randomly divided into two Groups, A = 104 and B = 118. Both groups were monitored for SpO₂, NIBP and ECG. Group A was also monitored for EtCO₂ using an oral/nasal CO₂/O₂ cannula (Smart CapnoLine™ O₂). Group B (without EtCO₂ monitoring) had oxygen supplied by a standard O₂ cannula. Both groups received supplementary oxygen 2–3 l/min. Before anesthesia, all patients received 1 mg Midazolam, 1 µg/kg fentanyl and then were anesthetized with 2 mg/kg Propofol IV. During the procedure, bolus injections of 20–50 mg Propofol were administered as indicated by patient's movement or other signs of light anesthesia. Anesthetic management using EtCO₂ data was left to the anesthesiologist's discretion.

Results and Discussions: At end of procedure, Group A, 4.2% of patients were "not awake" and Group B, 18.3% were "not awake." Oxygen desaturation <90%: Group A, 3.4% episodes of desaturation, Group B, 7.7%. With capnography monitoring, titration efficiency, defined by µg/kg/min, improved by more than 7%.

Conclusion(s): Capnography monitoring during TIVA results in fewer oxygen desaturations and provides for improved emergence. Although no specific capnography-based titration protocol was followed, using capnography during TIVA resulted in better Propofol dosing during anesthesia.

A-74

Gastric intramucosal pH monitoring during descending aortic repair with Femoro-Femoral bypass

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Background and Goal of Study: Distal aortic perfusion by Femoro-Femoral bypass (FF bypass) is well-known adjunct for the aid of organ preservation during descending aortic surgery (1). However, the changes in acid-base status of the gastrointestinal mucosa during FF bypass have not been evaluated. The purpose of this study was to examine the incidence of gastrointestinal acidotic episodes during FF bypass for the repair of descending aortic aneurysms, using gastric tonometry.

Materials and Methods: A prospective study was carried out in six patients (five men and one woman; age 64 ± 7 yrs) who underwent descending aortic surgery for aortic aneurysm. All patients received distal aortic perfusion by FF bypass. Gastric intramucosal pH (pHi) and PaCO₂-PgCO₂ gap (PCO₂ gap) were measured by air automated gastric tonometry. Systemic

hemodynamical changes, including mean arterial pressure, cardiac output and arterial blood gas were also measured.

Results and Discussions: Data were presented as mean \pm SD and analyzed by using one-way analysis of variance followed by Scheffe's test.

	Before FF	FF 30 min	Before end of FF	10 min after FF	30 min after FF	End of ope gap
PCO ₂	3.4 \pm 2.1	14.2 \pm 5.5*	8.0 \pm 1.4*	2.3 \pm 1.5	6.7 \pm 8.1	5.8 \pm 2.8
pHi	7.35 \pm 0.05	7.30 \pm 0.10	7.37 \pm 0.07	7.27 \pm 0.14*	7.21 \pm 0.10*	7.31 \pm 0.03
BE	0.0 \pm 2.5	-2.4 \pm 3.3	-2.0 \pm 3.0	-4.0 \pm 1.8*	-5.2 \pm 2.8*	-2.7 \pm 1.3

PCO₂ gap; mmHg, BE; base excess, *P < 0.05.

Conclusion(s): Enlargement of PCO₂ gap might be related to the insufficient visceral perfusion during FF bypass. The subsequent low pHi after the FF bypass might be associated with the progression of metabolic acidosis. Accordingly, gastric tonometry may be useful modality that enabled minimal invasive monitoring of visceral perfusion during distal aortic surgery with FF bypass.

Reference:

1 Safi J. et al. *J Vasc Surg* 1998; 27: 145–152.

A-76

Evaluation of the A-line monitor in awake volunteers

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Background and Goal of Study: The A-Line[®] Auditory Index (AAI) is depressed by many anesthetics in a dose-dependent fashion and may help the anesthesiologist to titrate anesthetics (1). However, in pilot studies we saw some unexpected low AAI in awake patients. We therefore evaluated the performance of the monitor systematically on awake volunteers.

Materials and Methods: Following institutional review board approval and written informed consent 10 volunteers (5 females, ASA status I, mean age 28 (22–51) yr) were asked to lie comfortable on a couch but stay alert. Alertness was controlled 20 min after recording-start in 5 min periods by asking the subject with a silent voice to move a limb. Electrode impedance was kept < 5 k Ω . We made three recordings of 41 \pm 1 min duration from each subject (A-line AEP monitor, Version 1.4, Danmeter). The AAI were stored on the monitor with a rate of 1s⁻¹ and were transferred after the measurements for offline analysis to a PC.

Results and Discussions: Overall recording time was 74166 min. We recorded 6338 episodes of at least 10 sec duration with an AAI < 30. The total time of these episodes was 2531 min.

Conclusions: The A-Line[®] monitor may show unreasonable low AAI in awake subjects.

Reference:

1 Litvan H, Jensen EW, Revuelta M et al. *Acta Anaesthesiol Scand* 2002;46:245–251.

A-77

Assessment of a new nasally placed trans-oesophageal Doppler probe in awake volunteers

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Background and Goal of Study: Trans-oesophageal Doppler is a validated method of assessing cardiac output and fluid status (1,2). It is non-invasive and provides estimates of fluid status within a short period of time. Current probes are only suitable for use in sedated or anaesthetized patients. Extending the use of TOD into the pre- and post-operative period may allow improved peri-operative care of the higher risk surgical patient. We investigated the ease of use of a new probe specifically designed for nasal insertion in the awake subject.

Materials and Methods: We studied 10 healthy volunteers. The nose and pharynx were anaesthetized with lidocaine spray. The probe was lubricated with gel and inserted nasally. The optimum signal was ascertained and the time from start of insertion to optimum signal was recorded. The subject kept the probe in for at least 60 minutes and was free to move around the department. After this time the optimum signal was obtained again and the time to achieve this recorded. Visual analogue scores (VAS) (0–100 mm) for tolerability of insertion and manipulation were recorded by the subject after probe removal.

Results and Discussions:

Time to first signal (min)	Time to second signal (min)	VAS insertion (mm)	VAS manipulation (mm)
7 (3–8)	1 (1–3)	10.5 (11–54)	17 (7–54)

Data are given as median (interquartile range).

Cardiac output (bias 0.2 l min⁻¹) and corrected flow time (bias 8ms) were higher on the second reading but all values were within 10% of the initial value. One subject had a small amount of blood on the tip of the probe on removal. There were no other complications.

Conclusion(s): The new design of trans-oesophageal Doppler probe allows rapid assessment of cardiac output in the awake patient and is well tolerated in healthy volunteers.

References:

1 Sinclair S, James S, Singer M. *Br Med J* 1997; 315: 909–12.

2 Atlas G, Mort T. *Chest* 2001; 119: 319.

Acknowledgements: The probes were supplied by Deltex Medical (Chichester, UK).

A-78

Laryngoscopy and intubation is facilitated with Truview[®] blade when compared to Macintosh

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Background and Goal of Study: The optical system of the new Truview[®] blade (TV) (Truphatek, Israel), offers the possible advantage of improved laryngeal view (1), while using less force (in a manikin study) (2). The aim of the study was to compare the force applied, time to intubation and signs of airway trauma for TV and Macintosh (M) blades in humans.

Materials and Methods: After obtaining human experiments' committee approval and informed consent, prospective and randomized comparison was done in 60 ASA I–II, 18–80 years old, with normal airways (Mallampati I–II), elective surgical patients undergoing general anesthesia and intubation. The best laryngeal view obtained (BLV), force used, time to best laryngeal view and intubation, anesthesiologist satisfaction (on a scale of 1–10) and signs of trauma (immediately, in the PACU, and 24 hours later) were recorded for TV and M blades. Two tails student T-test was used to determine the significance of the difference in the mean value for each parameter measured. P < 0.05 was considered significant.

Results and Discussions: 31 males and 29 females underwent laryngoscopy and intubation with TV (31) or M (29) blades by a single consultant (ARH). The average age, weight, and height, were 39 \pm 15 years, 74.3 \pm 15.6 kg and 169 \pm 9.6 cm accordingly.

	Macintosh	Truview [®]	P value
BLV	1.7 \pm 0.7	1.1 \pm 0.3	<0.0001
Time to BLV	7.8 \pm 4.7 sec	4.8 \pm 2.5 sec	<0.02
Time to intubation	13.7 \pm 10.2 sec	8.5 \pm 3.2 sec	<0.02
Force	7.6 \pm 1.8 kg	7.0 \pm 1.3 kg	NS
Ease of intubation	8.3 \pm 2	9.7 \pm 0.7	<0.001
Satisfaction	8.1 \pm 2	9.9 \pm 0.5	<0.001
Trauma signs	2/29 patients	0/31 patients	

Conclusion(s): The Truview[®] blade caused less trauma, significantly improved visualization and anesthesiologist satisfaction and shortened the intubation time when compared to the Macintosh blade.

References:

1 Gaitini LA, et al. *Abst. ESA*;2003:A-163.

2 Lieberman N, et al. *Abst. ASA meeting*;2003:A-565.

A-79

Evaluation of a modified thermo-wrap for the Allon warming system in patients undergoing elective off-pump coronary artery bypass grafting

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Background: The Allon warming system has proven to be efficient in maintaining normothermia during off-pump coronary artery bypass grafting (OPCABG)¹. However, the wrap used with this system is expensive,

complications (i.e. burns) have been described² and handling is time consuming. The aim of this investigation was to evaluate the efficacy and the handling of a simplified and less expensive wrap.

Methods: With institutional approval and informed consent 40 consecutive patients undergoing elective OPCABG were randomly assigned to either the original (group A) or the modified wrap (group B). Active warming was started after induction of anaesthesia (setting the Allon system to 36.9°C body core temperature [BCT]). BCT was recorded every 30 min during surgery, maximal intraoperative BCT decrease/increase was calculated and reddening of the skin was assessed by visual analogue scale (VAS) at the end of the procedure. After the clinical evaluation 15 staff members involved in the handling of the Allon system were interviewed; answers were recorded using a Likert scale. Statistical analysis was done using student's t-test. $P < 0.05$ was considered significant; data are presented as mean \pm SD.

Results: 20 patients ASA III in each group (age: 68 ± 10 years, body mass index 28 ± 5) were studied. Duration of OPCABG was comparable (A: 257 ± 59 min, B: 269 ± 53 min; $p = 0.89$). There was no significant difference of BCT at the beginning and end of the intervention (BCT_{start}: A = $36.2 \pm 0.4^\circ\text{C}$, B = $36.1 \pm 0.2^\circ\text{C}$; $p = 0.43$ and BCT_{end}: A = $36.7 \pm 0.4^\circ\text{C}$; B = $36.8 \pm 0.3^\circ\text{C}$; $p = 0.17$). Intra-operative BCT changes were significantly different for A compared to B (BCT decrease/increase: A = $-0.7 \pm 0.4/+1.2 \pm 0.3^\circ\text{C}$, B = $-0.4 \pm 0.3/+1.0 \pm 0.3^\circ\text{C}$; $p < 0.005$). Skin changes were comparable for both groups (VAS: A = 6 ± 1 , B = 6 ± 1 ; $p = 0.78$). An improved positioning and a reduced time requirement for B compared to A was found by the interviewed staff in 73% and 80% respectively ($p < 0.005$).

Conclusion: In this series of patients undergoing OPCABG, modification of the Allon wrap showed improved intraoperative thermoregulatory capacity and simplified handling.

References:

- 1 *Anesthesiology* 2003; A-608.
- 2 *Anesthesiology* 2003; 98: 1509–10.

A-80

Nerve stimulators for peripheral nerve blocks: are they all the same?

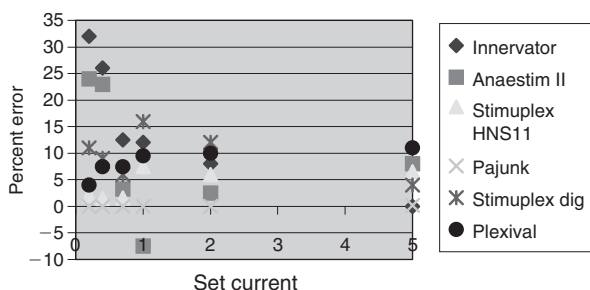
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Background and Goal of Study: Reliable current delivery is important in the safe and effective use of peripheral nerve stimulators (PNS) for nerve location (1). The aim of this study was to compare the accuracy of constant current stimulators used in clinical practice in the UK.

Materials and Methods: 6 PNS (Braun Stimuplex Dig, Stimuplex HNS 11, Vygon Plexival, AnaestimII, Pajunk Multistim LA, Fisher Paykel Innervator) fitted with fresh batteries were set to deliver preselected currents between 0.2 and 5.0 mA into a series of resistance loads between 1 and 20 kOhm. The output of the PNS was determined using a factory calibrated oscilloscope and actual current delivered calculated using Ohm's Law. All resistors were of 2% tolerance. The measurement sequence was repeated 3 times. Results calculated as % error (median and range) and Friedman's test (to assess differences in ranked % error at the preset currents).

Results and Discussions: All performed well at the manufacturer recommended levels (1 mA into 1 or 2 kOhm load). At low currents delivered at 1 kOhm (see Figure) the median error (%) increased from 4.7 (0 to +12.5%) at 0.7 mA to 7.5 (0 to +32%) at 0.2 mA. At higher load resistance (>5 kOhms) only Stimuplex HNS 11 and Pajunk stimulators were able to deliver a target current to $\pm 15\%$ accuracy ($p < 0.01$ vs Innervator, Anaestim; $p < 0.05$ vs Dig). The maximum voltage output tested as a function of the load ranged from 8.8 to 75 volts.



Conclusion(s): PNS used for regional anaesthesia vary in accuracy of current output particularly at the extremes of current and impedance. Users need to be aware of this to ensure successful blocks and prevent complications.

Reference:

- 1 Hadzic et al *Anesthesiology* 2003;98:969–74.

A-81

Comparison of noninvasive cardiac output using compression volumetrical oscillometry and thermodilution cardiac output

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Background and Goal of Study: A safe hemodynamical monitoring is an important part of anesthesia and intensive care (1). So, we compared the accuracy of cardiac output (CO) measurements using a method of noninvasive compression volumetrical oscillometry and thermodilution.

Materials and Methods: We performed a prospective clinical trial in the general intensive care unit. Surgical patients with pulmonary artery floating catheter and invasive blood pressure cannula entered the study. Simultaneously we registered the thermodilution CO, volumetrical CO, invasive and volumetrical blood pressure. For statistical analysis we used the Spearman's correlation test, and Bland-Altman method.

Results and Discussions: We obtained the total of 45 sets of measurements. The mean thermodilution CO value was 7.68 L/min (4.1–13.5; SD 2.39), mean volumetrical CO value was 6.27 L/min (3.1–9.13; SD 1.77). The mean difference between methods was 20.2% (–46 to 108; SD 46). There has been revealed a significant direct correlation ($r = -0.6$; $p < 0.05$). The Bland-Altman plot showed a bias of 1.004 L/min and SD difference of ± 3.57 L/min. A linear regression gives the following equation: volumetrical CO = $9.83 - 0.44 \times$ thermodilution CO. We found a significant correlation between the invasive and noninvasive blood pressure (systolic blood pressure, $r = 0.7$, $p < 0.05$; diastolic blood pressure, $r = 0.5$, $p < 0.05$; mean blood pressure, $r = 0.9$, $p < 0.05$).

Conclusion(s): We conclude that the compression volumetrical oscillometry is a safe and efficient method for the measurement of cardiac output and blood pressure and it can be successfully used in clinical practice.

Reference:

- 1 Allsager C.M., Swanevelde J. Br. J. Anaesth – CEPD Rev. – 2003. – Vol. 3, 1. – pp. 15–19.

A-83

Intrathoracic blood volume, pulmonary capillary wedge pressure and extravascular lung water monitoring during liver transplantation

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Background and Goal of Study: Large intraoperative volume shifts are frequent in orthotopic liver transplantation (OLT) and may contribute to the accumulation of extravascular lung water (EVLW) and pulmonary edema formation (1). In lung transplantation, intrathoracic blood volume (ITBV) has been previously compared with pulmonary capillary wedge pressure (PCWP) as a cardiac preload index (2). This study was to determine the ITBV and PCWP changes during OLT and its relationship with EVLW.

Material and Methods: We studied 28 adult patients undergoing OLT (21 M/7 W; age 56 ± 11 yrs). Mean pulmonary artery pressure (MPAP) and PCWP were monitored through a pulmonary artery catheter while ITBV and EVLW indexes (ITBVI and EVLWI) were determined using the PiCCO System. Recordings were made at five stages: after the induction of anesthesia (T1), before suprahepatic clamping (T2), at the end of the anhepatic phase (T3), 30 minutes after reperfusion (T4) and at the end of the surgery (T5). Changes in the variables were calculated as follows: $\Delta 1 = T2 - T1$, $\Delta 2 = T3 - T2$, $\Delta 3 = T4 - T3$ and $\Delta 4 = T5 - T4$. Multivariate repeated measures model was applied between changes of EVLWI and changes in both preload variables (PCWP and ITBVI).

Results: Hemodynamic and volumetric data (mean \pm SD) are shown in the table. Both PCWP and ITBVI changes correlated poorly with EVLWI changes.

	T1	T2	T3	T4	T5
PCWP mmHg	12.6 ± 3	11.9 ± 5	11.8 ± 3	$13.3 \pm 5^*$	$16.6 \pm 5^*$
ITBVI mL/m ²	827 ± 205	864 ± 229	818 ± 212	900 ± 207	885 ± 222
EVLWI mL/kg	6.6 ± 1.5	6.8 ± 1.7	6.9 ± 1.8	7.3 ± 1.6	7.7 ± 2.2

* $P < 0.05$

Conclusions: In patients undergoing OLT, a conventional index of preload as PCWP, but not ITBVI, increased during surgery. No correlation was found between EVLWI changes and changes in PCWP and ITBVI.

References:

- 1 Yost CS. *Chest* 2001; 119:219–223.
- 2 Della Rocca G. *Anesth Analg* 2002; 95:835–843.

A-84

Automatic control of rocuronium-induced neuromuscular block

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Background and Goal of Study: During balanced anaesthesia the degree of neuromuscular block (NMB) must be sufficient to provide adequate surgical conditions but not as excessive as to make it difficult to antagonize at the end of surgery. An appropriate technique for long-lasting operations is continuous relaxant infusion but manual control of pump speed can be time-consuming. The aim of the study was to test the safety and control precision of our own closed-loop computer-controlled system for automatic muscle relaxant administration.

Materials and Methods: After local ethics committee approval and informed consent, 120 patients (ASA I–III) undergoing neurosurgical intervention (expected duration > 120 min) under standardized general anaesthesia (midazolam, thiopentone, sufentanil, 60% nitrous oxide in oxygen, 0.8 MAC isoflurane, rocuronium infusion) were randomized into a group with closed-loop (CLC) and manual (MC) control of NMB. The degree of block (TOF-ratio, T_1) was determined using NMT Datex-Ohmeda S5™ monitor interfaced to a PC for data collection. In the CLC group the computer was programmed to ensure a stable level (target $T_1 = 10\%$ of baseline) of NMB by controlling the rocuronium infusion pump. The efficacy of regulation was assessed by rocuronium consumption (ROC) and root mean square deviation (RMSD) as an index of T_1 variation around the preset NMB level [1].

Results: No user intervention was necessary during anaesthesia in CLC group. Data are given as mean \pm SD.

	RMSD (%)	ROC (mg/kg/hr)
MC group (n = 60)	6.3 \pm 2.94	0.43 \pm 0.29
CLC group (n = 60)	2.6 \pm 0.86*	0.38 \pm 0.22

*p < 0.01 vs MC.

Conclusion: Throughout long surgical procedures the closed-loop system is better at maintaining a stable level of NMB than manual control. As no human intervention is needed the clinical workload is reduced and the quality of NMB control increases.

Reference:

- 1 Ross JJ et al. *Br J Anaesth* 1997; 78: 412–415.

Acknowledgements: Supported by the Czech Ministry of Health Internal Grant Agency – project ND7665-3/2003.

A-85

Fuzzy logic closed loop system for norepinephrine withdrawal in septic shock using mean arterial pressure

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Background and Goal of Study: Previous studies have reported the use of fuzzy models in several medical domains (1,2). We reported a closed loop system based on fuzzy logic for norepinephrine withdrawal.

Materials and Methods: After institutional approval a 54 years old patient with septic shock, with a controlled haemodynamic state under norepinephrine infusion was included. The fuzzy logic closed loop system regulated norepinephrine dosage. Median of 7 minutes consecutive mean arterial pressure (MAP) was defined as the primary target. Primary target was set at 75 mmHg. 20% dosage increases must be validated by intensivist. Withdrawal was defined by an infusion at a posology of 0.1 mg·h⁻¹ without haemodynamic instability for more than 4 hours. Infusion posology is shown on the figure.

Results:

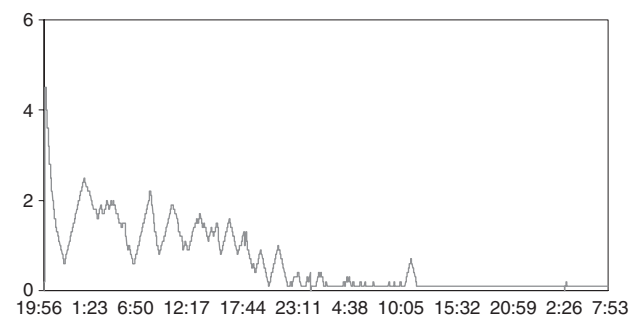


Figure. Time course of norepinephrine infusion (mg·h⁻¹).

Time of withdrawal was 32.6 hours. Norepinephrine total dosage was 0.022 mg·h⁻¹·kg⁻¹.

Conclusion: Closed loop system for norepinephrine withdrawal could change our constant infusion schemes practice. This model could optimize catecholamines delivery (posology, dosage time) in function of pre-defined arterial pressure objectives. Comparative study is needed to evaluate the real benefit of this approach.

References:

- 1 Allen R, et al *Artif Intell Med* 2001;21:185–91.
- 2 Schaublin J, et al *Br J Anaesth* 1996;77:636–41.

A-87

Placement of CVCs: still only with ultrasound (US)?

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Background and Goal of Study: The goal of this analysis of the literature was to find out if and when the directly (D) or indirectly (ID) carried-out doppler- (DSP) or ultrasound-supported (USP) placement of CVCs shows statistically significant clinical advantages in comparison to the conventional landmark technique (LM).

Materials and Methods: We and the Central Library of Medicine each carried out a literature search in the Medline, Embase, CDSR, and CCTR databases. Altogether, 45 prospective randomized studies (PRS) (n = 4902 patients), 30 prospective studies (n = 477) and 3 retrospective studies (n = 363), as well as 25 case reports (n = 1127) were found. With help of the C.C. Rev. Man. 4.2.2., we evaluated the PRS; all other sources though were also included in our closing reflections.

Results and Discussions: In comparison to the LM-technique, the DUSP significantly reduces the number of puncture attempts, as well as the failure and complication rates, for the predominant portion of investigated vessels and subgroups (children, patients with risk factors, in-/experienced doctors (I/E D), etc.) with a nearly equal time requirement. For the remaining procedures (IDUSP, ID/DDSP), the reduction is notably less convincing.

Conclusion(s): The DUSP significantly improves patient safety. It should therefore be used, primarily for punctures with expected difficulties and from IDs, secondarily for all other situations already after a few failed attempts. And even the IDUSP, as well as the ID and DDSP, are in all cases preferable to the LM technique.

A-88

Continuous and intermittent lithium dilution cardiac output measurements

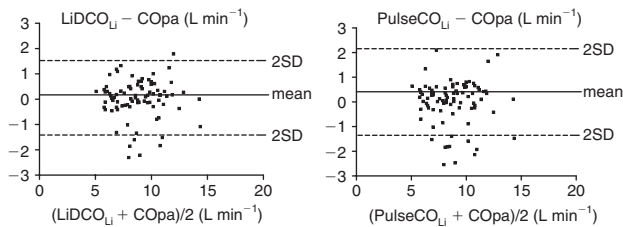
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Background and Goal of Study: Recently a new device, that measures intermittent cardiac output by lithium dilution technique (CO_{Li}) and continuous cardiac output (PulseCO_{Li}) from the arterial pressure waveform, has been introduced in clinical practice (LiDCO, Ltd, Cambridge, UK). The aim of this study was to assess the level of agreement of CO_{Li} and PulseCO_{Li} to the current clinical standard, the intermittent pulmonary thermodilution technique (COPa) obtained with a pulmonary artery catheter (Intelicath, Edwards Laboratories, Irvine, CA USA).

Materials and Methods: Measurements were made in 12 liver transplanted patients. Data were collected after intensive care unit (ICU) admission (T0) and every 8 hours until the 48th postoperative hour. Statistical analysis used the method described by Bland and Altman.

Results and Discussions: Mean bias between CO_{Li} and COPa was 0.23 litre min⁻¹ (2SD = 1.54 litre min⁻¹). Mean bias between PulseCO_{Li} and COPa was 0.49 litre min⁻¹ (2SD = 1.77 L min⁻¹).



Conclusions: Intermittent and continuous CO obtained from lithium dilution indicator technique provided comparable measurement also in the postoperative time in liver transplanted patients even if larger population studies are needed to confirm these data.

References:

- 1 Linton RAF, et al. *Critical Care Medicine* 1997; 25: 1796–1800.
- 2 Jonas MM, et al. *Curr Opin Care* 2002; 8(3): 257–61.

A-90

Efficacy of the A-line™ AEP monitor as a tool for predicting successful intubation during sevoflurane anesthesia

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Background and Aim of Study: It is essential for the clinical anesthetist to know if patients are sufficiently anesthetized to tolerate a noxious stimulus about to be given during airway manipulation. Due to the lack of an accurate objective method available for determining the level of general anesthesia, under- or overdosing of anesthetics may occur. Auditory evoked potentials (AEP) is one of several physiological parameters under investigation. The method has been improved by rapid extraction and conversion of the AEP curve into an index (A-Line ARX Index™ = AAI). We aimed to determine the clinically required depth of anesthesia, measured by the A-line™ AEP monitor, for 90% probability of acceptable intubation conditions.

Materials and Methods: We studied 101 patients anesthetized by mask with increasing concentration of sevoflurane in oxygen and 70% nitrous oxide. Before induction, fentanyl (1.5 microgram kg⁻¹) was given intravenously. The monitor was programmed to give an alarm at AAI between 10 and 30 according to randomisation. When the alarm sounded, the end-expiratory sevoflurane concentration was recorded and the intubation conducted. Intubation conditions were assessed by an observer blinded to the AAI.

Results and Discussions: At AAI 10 we found acceptable intubation conditions in 91% (CI 72–99%). The table shows further details:

AAI	Acceptable	Not Acceptable	Success %	CI
10	21	2	91	72–99
15	18	4	82	60–95
20	17	9	65	44–83
25	11	7	61	36–83
30	6	6	50	21–79

Conclusion: Under the conditions of the present study, a depth of anesthesia according to an AAI of 10 is sufficient to ensure a 90% probability of acceptable intubation conditions.

A-91

Noninvasive cardiac monitoring by aortic blood flow determination in patients undergoing hyperthermic intraperitoneal intraoperative chemotherapy (HIIC)

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Background and Goal of Study: Extensive surgical cytoreduction combined with hyperthermic intraperitoneal intraoperative chemotherapy (HIIC) has recently emerged as a new treatment modality, which might improve survival. A major problem encountered during the HIIC is the patient's peripheral vasodilatation causing a decreased urine output and then hypotension and tachycardia. The aim of this preliminary study was to evaluate the haemodynamic changes during surgery and HIIC using an echo-Doppler device (EDD) (Hemosonic 100) capable to visualise the haemodynamic profile which include aortic blood flow (ABF), left ventricular ejection time (LVET), stroke volume and systemic vascular resistances (SVR).

Materials and Methods: The standard monitoring included ECG, capnometry, invasive measurement of blood pressure and pulseoxymetry. Twenty

adult patients undergoing HIIC under general anaesthesia were successively included in evaluating the feasibility of Hemosonic 100. Anaesthesia was maintained with sevoflurane and remifentanyl as continuous infusion. Haemodynamic measurements were obtained throughout surgery and HIIC procedure.

Results and Discussion: EDD was able to efficaciously detect the haemodynamic changes occurred in all patients. Stroke volume significantly decreased at the beginning of the HIIC procedure owing to the increased intra-abdominal pressure; concomitantly, peripheral vascular resistances increased. During HIIC hypotension occurred associated with increase in ABF and reduction in SVR.

Conclusions: HIIC is administered after a major abdominal procedure that may be accompanied by massive fluid shifts and blood loss. Therefore, the possibility of using a "real time" monitoring equipment is important for promptly restoring homeostasis. These preliminary results suggest that the ABF determination constitutes a reliable noninvasive tool for estimating CO and tracking its changes in patients undergoing HIIC.

A-92

Effect of digital block on spaO₂ lag time and height of plethysmographic wave of pulse oximeter in presence of shock simulation

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Background and Goals: Pulse oximetry is impaired by hypotension and peripheral vasoconstriction (1). Digital block may cause increase in tissue perfusion and hence improving the parameters of pulse oximetry (2). The purpose of this study was to investigate the effect of digital block on spaO₂, lag time and height of plethysmographic wave (PW) of pulse oximeter, in presence of shock simulation in upper extremity.

Materials and Methods: After approval of the proposal by ethics committee and obtaining the informed consent, 34 patients under general anesthesia and elective surgery were selected. In each patient, one hand randomly underwent simulated shock by cooling (<35°C), elevation of hand (40 cm) and inflation of arm cuff (30 mmHg). Lag time, height of PW (in mm) and spaO₂ had been measured in middle and small fingers of this hand and compared to that of middle finger of another hand. Shocked middle finger was blocked by lidocaine 2% and above parameters were measured in 15th and 20th minutes after digital block and compared to small shocked finger and middle finger of non-shocked hand. Statistical analysis was performed with ANOVA.

Results: Mean height of PW in shocked and blocked, shocked non-blocked and control fingers are shown in table (Mean ± SD). There were no significant differences between three fingers in lag time and spaO₂.

Finger	Height of PW (mm)		
	Before block	15th min	20th min
Shocked and blocked	11.5 ± 4.2	16.2 ± 6.2*	21 ± 5.92*
Shocked and non-blocked	10.8 ± 4.3	11.4 ± 4.3	11.8 ± 4.3
Control	11.3 ± 4.4	10.7 ± 4.3	11.2 ± 3.9

*P < 0.05 vs shocked and non-blocked finger; *P < 0.05 vs control finger.

Conclusions: This study showed that digital block may improve height of plethysmographic wave in shocked condition.

References:

- 1 Kamat V. *Indian J Anaesth* 2002; 46: 261–268.
- 2 Bourke DL, Grayson RF. *Anesth Analg* 1991; 73: 815–817.

A-93

The agreement of peripheral and central venous pressure measurements: effect of catheter placed in neurosurgical patients

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Background and Goal of Study: Previous studies suggest a correlation of central venous pressure (CVP) with peripheral venous pressure (PVP) in different clinical setups. The effect of measurement site on PVP and its agreement with CVP in patients under general anesthesia is investigated in this study.

Materials and Methods: Thirty ASA I–II patients undergoing elective craniotomy were included in the study. CVP and PVP were monitored throughout the study. Patients were randomly assigned into Group A (n = 15) and Group D (n = 15), for antecubital and hand dorsum catheterization sites respectively. A total of 1925 simultaneous measurements were recorded at

5-minute intervals. Bland Altman assessment for agreement was used for CVP and PVP in two groups.

Results and Discussions: PVP measurements were within range of ± 2 mmHg of CVP values in 92.5% of the measurements. Considering all measurements mean bias was -0.072 mmHg (CI 95%, -0.134 to -0.010). Group A measurements showed a bias (CVP – PVP) of 0.173 ± 3.557 mmHg, while the bias was -0.122 ± 4.322 mmHg (mean \pm SD_{corrected} for repeated measurements) in Group D. All of the measurements were within mean \pm 2 SD of bias, which means that PVP and CVP are interchangeable in our clinical setting.

Conclusion: Peripheral venous pressure measurement may be a noninvasive alternative for estimating central venous pressure. Measuring PVP from hand dorsum does not interfere with the agreement of CVP and PVP.

References:

- 1 Bland JM, Altman DG. *Lancet* 1986; **1**: 307–10.
- 2 Charalambous C et al. *Anaesth Intensive Care* 2003; **31**: 34–9.
- 3 Amar D et al. *J Cardiothorac Vasc Anesth* 2001; **15**: 40–3.

A-95

Determination of optimum cuff volume of the PAXpress airway device

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Goal of Study: To define optimum cuff volume of PAXpress™ (PAX) [1] in order to achieve best ventilatory performance.

Materials and Methods: After IRB approval, 118 ASA 1–2 consenting adult anaesthetized paralyzed patients (M/F: 43/75), were included. Patients with anticipated difficult airway or at risk of regurgitation were excluded. The PAX was inserted with the patient's head in neutral position. PAX depth from upper incisors was recorded. All patients underwent three stages of standardized manual positive pressure ventilation at different cuff volumes (40, 50 and 60 ml). Inspiratory leak pressure (I_Pleak), maximum tidal volume (V_Tmax) and intracuff pressure difference ([in vivo]-[atmospheric] cuff pressure) (IPD), were recorded at each stage.

Results and Discussion: Table shows patients' allocation to one of the three stages of cuff inflation studied, according to best ventilatory performance (highest values of I_Pleak and V_Tmax) achieved.

	Stage A 40 ml	Stage B 50 ml	Stage C 60 ml	
n	28 (24%)	36 (31%)	54 (45%)	P-value
V _T max (ml/kg)	19.3 \pm 6.6 (7–27)	20.6 \pm 5.2 (10–32)	20.2 \pm 5.4 (10–31)	NSS*
I _P leak (cmH ₂ O)	33.6 \pm 6.2 (20–45)	33.2 \pm 5.4 (20–45)	34.4 \pm 6.0 (22–47)	NSS*
IPD (cmH ₂ O)	53.3 \pm 16.2 (16–72)	54.9 \pm 18.4 (17–90)	57.8 \pm 21.5 (21–109)	NSS*
M/F	16/12	9/27	18/36	0.02 [‡]
Weight (kg)	75.0 \pm 11.5 (49–96)	74.8 \pm 14.2 (51–105)	75.8 \pm 10.4 (53–106)	NSS*
Height (cm)	170.6 \pm 9.3 (152–186)	165.8 \pm 8.1 (150–182)	164.9 \pm 7.3 (149–182)	0.01*
PAXdepth (cm)	11.6 \pm 0.8 (11–13)	11.1 \pm 0.7 (10–12)	10.9 \pm 0.9 (10–12)	0.002*

[‡]Chi-square; *ANOVA.

Conclusions: Optimum cuff volume seems to correlate with PAX depth and patient's height and gender. Male, tall patients and deeper PAX placement relate with lower cuff volumes. However, the clinical significance of our findings can be questioned.

Reference:

- 1 Dimitriou V et al. *Can J Anesth* 2003; **50**: 495–500.

A-96

Stimulation-induced vasoconstriction measured with pulse plethysmography for measuring hemodynamic responsiveness

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Background and Goal of Study: Vasoconstriction induced by noxious stimulation recorded by pulse plethysmography (PPG) is suppressed by

alfentanil (1). We hypothesized that PPG variation induced by noxious stimulation would discriminate patients with hemodynamic response to intubation from non-responders.

Materials and Methods: 86 ASA I or II patients anesthetized with propofol TCI, remifentanil and vecuronium were randomly assigned to different BIS levels and effect site remifentanil concentrations (ng/ml). When the selected levels were achieved an electrical stimulus was applied to the ulnar nerve. Linear and non-linear (Poincaré analysis) parameters of PPG variability (2) of the 60 Sec post-stimulation were computed from the digitized pulse oximeter signal and normalized to the 60 Sec pre-stimulation values. The response to tracheal intubation defined as max. heart rate (max HR) > 90 bpm or systolic BP increase (delta SAP) > 20 mmHg was recorded. BIS, remifentanil effect site conc. and PPG variability were compared between responders and non-responders.

Results and Discussions: Data are mean (SEM). PPG data normalized to pre-stimulation values (arbitrary units).

	Responders	Non-Responders	P
BIS	46.4 (1.9)	41.0 (1.3)	0.015
Remifent. ng/ml	1.83 (0.13)	2.89 (0.19)	<0.001
Delta SAP mmHg	31 (2.4)	9.9 (0.7)	<0.001
Max. HR min ⁻¹	87.2 (11.6)	70.2 (1.3)	<0.001
Min. PPG amplitude	0.51 (0.02)	0.55 (0.09)	0.25
PPG SD	3.99 (0.42)	3.16 (0.30)	0.062
PPG SD1	1.51 (0.12)	1.29 (0.06)	0.176
PPG SD2	4.51 (0.49)	3.42 (0.34)	0.042

Conclusion: Stimulation induced vasoconstriction measured with PPG variability differs with hemodynamic responsiveness in surgical anesthesia.

References:

- 1 Luginbuhl M, Reichlin F, Sigurdsson GH, et al. *Br J Anaesth* 2002; **89**: 389–397.
- 2 Tulppo MP, Makikallio TH, Takala TE, et al. *Am J Physiol* 1996; **271**: H244–H252.

A-97

Faster treatment for myocardial ischemia using a graphic cardiovascular display

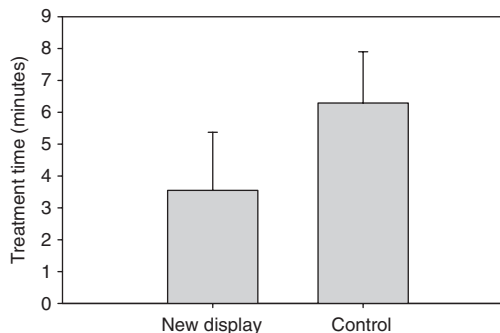
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Background and Goal of Study: A usability study to validate the effectiveness of a graphic cardiovascular display in a simulated MI scenario. A previous evaluation of the display indicated better performance for anesthesiologists using the new display with PA catheter information¹. The current study expands these findings in the absence of PA catheter information.

Materials and Methods: A simulated ischemia scenario was presented to eight clinicians using the new display and eight clinicians without the display. Both groups had traditional patient monitors and were balanced for expertise. The scenario was simulated with a patient simulator (METI) in the absence of PA catheter information.

Results and Discussions: The figure below shows performance differences for users in the new display condition, $t(12) = 2.31$, $p < .05$.



Conclusion(s): The results replicate previous findings in the absence of PA catheter information. Clinicians using the new display show better management of MI scenarios.

Reference:

- 1 Agutter et al. *Anesth Analg* 2003 Nov; **97**(5):1403–13.

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A-98

Effects of propofol and fentanyl anesthesia on heart rate variability using two analytical methods

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Background and Goal: We studied heart rate variability (HRV) using two methods in order to elucidate how propofol and fentanyl anesthesia affect heart rate (HR) and mean blood pressure (MBP) through the autonomic nervous system (ANS).

Materials and Methods: We studied 60 patients [20 without fentanyl (F0), 20 with 2 ng/ml fentanyl concentration (F2), and 20 with 4 ng/ml fentanyl concentration (F4)] before and after receiving 3 µg/ml propofol concentration. The MemCalc/Makin (Suwa Trust, Tokyo, Japan) (1) provides the percentage of the entropy (the randomness of 4 R-R intervals) and numbers for low frequency (LF) and high frequency (HF) by the maximum entropy method. The Anemon-I (Medical Control SA, Geneva, Switzerland) (2) provides Current (the ANS reactivity index) and Trend (the trend of the ANS reactivity index) through fractal analysis of ECG.

Results: Data (Mean ± SD) are shown in the table:

	F0	F2	F4
HR (bpm)			
Before	67.0 ± 12.4	61.8 ± 9.5	59.2 ± 7.4
After	65.9 ± 11.6	58.5 ± 9.6	56.3 ± 7.6*
MBP (mmHg)			
Before	87.0 ± 13.7	86.0 ± 13.1	85.0 ± 14.1
After	79.5 ± 12.8	74.6 ± 13.3	68.0 ± 14.5#
Entropy (%)			
Before	42.0 ± 10.1	40.2 ± 10.0	34.7 ± 6.5
After	27.1 ± 8.4#	30.9 ± 9.8#	32.0 ± 10.6
HF			
Before	400 ± 346	326 ± 258	245 ± 138
After	122 ± 188#	147 ± 108	203 ± 251
LF/HF			
Before	2.7 ± 1.5	2.4 ± 1.2	2.2 ± 1.2
After	7.0 ± 5.6#	5.1 ± 5.1	4.2 ± 3.6
Current			
Before	73.4 ± 16.2	68.2 ± 16.9	64.1 ± 16.8
After	65.1 ± 17.1	62.4 ± 16.4	59.4 ± 16.1

*P < 0.05 vs. F0; #P < 0.05 vs. Before.

Conclusions: Fentanyl was shown to tend to suppress parasympathetic activity and sympathetic activity. Propofol decreased parasympathetic activity, but increases sympathetic activity because of the baroreflex mechanism.

References:

- 1 Kanaya N. *Anesthesiology* 2003; 98: 34–40.
- 2 Chinzei M. *J Anesth* 1998; 12(Suppl): 531.

A-99

Inspired and end-tidal sevoflurane concentrations during anaesthesia with FGF of 2.0 L/min, 1.0 L/min and 0.5 L/min

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Background and Goal of Study: The main disadvantage of all low-flow techniques is that the inspired (In) and end-tidal (Et) concentrations of anaesthetic drug are not directly related to the vaporizer setting, especially when high solubility drugs are used (1). Goal of study was to evaluate the effect of fresh gas flows (FGF) of 2.0, 1.0 and 0.5 L/min on In and Et sevoflurane concentrations during 60 min of anaesthesia with vaporizer setting fixed at 2%.

Materials and Methods: A total of 60 ASA I–II patients were randomly assigned to three groups (20 in each of the group). Patients received FGF of 2.0, 1.0 or 0.5 L/min with sevoflurane vaporizer setting fixed at 2%. In and Et sevoflurane concentrations were monitored and Et/In, In/vaporizer setting value (In/2%) and Et/vaporizer setting value (Et/2%) ratios were estimated during 60 min of low-flow anaesthesia. Data were analysed by Wilcoxon test (significance level P < 0.05).

Results and Discussions: After 60 min of anaesthesia, In and Et sevoflurane concentrations were 1.79% vs. 1.55% (P < 0.001) in 2.0 L/min group, 1.50% vs. 1.30% (P < 0.001) in 1.0 L/min group and 1.12% vs. 0.94% (P < 0.001) in 0.5 L/min group. Et/In ratios were 0.86, 0.87 and 0.84 in 2.0, 1.0 and 0.5 L/min groups, respectively (not significant difference). Ratios In/2% and Et/2% after 60 min of sevoflurane anaesthesia with FGF of 2.0, 1.0 and 0.5 L/min are shown in the table. Data are mean ± SD.

	2.0 L/min (n = 20)	1.0 L/min (n = 20)	0.5 L/min (n = 20)
FGF (%)			
In/2	0.89 ± 0.04	0.75 ± 0.05*	0.56 ± 0.07**
Et/2	0.78 ± 0.05	0.65 ± 0.06*	0.47 ± 0.06**

*P < 0.001, 1.0 vs. 2.0 L/min; **P < 0.001, 0.5 vs. 1.0 L/min.

Conclusions: After 60 min of sevoflurane anaesthesia with fixed vaporizer setting at 2%, there is significant difference between In and Et sevoflurane concentrations, but not also for Et/In ratio when FGF of 2.0, 1.0 and 0.5 L/min are used. With FGF of 1.0 L/min, Et concentrations of sevoflurane was 0.65 of the vaporizer setting, but with FGF of 2.0 L/min and 0.5 L/min, Et values were increased by 0.13 and decreased by 0.18, respectively.

Reference:

- 1 Johansson A, Lundberg D, Luttrupp HH. *J Clin Anesth* 2002;14:267–270.

A-100

Does the best timing of tracheal intubation based on neuromuscular monitoring decrease laryngeal injury?

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Background and Goal of Study: Vocal cord sequelae (VCS) and postoperative hoarseness (PH) after general anaesthesia are a significant source of morbidity for patients (1). Several risk factors for laryngeal injury have been identified in the past, e.g. the quality of tracheal intubation (TI, 2). However, whether the best timing of intubation for individual patients (based on neuromuscular monitoring, NMM) affects their incidence is unclear.

Materials and Methods: After Ethics Committee approval and informed consent, 70 patients (Pat) were randomised in 2 groups (n = 35 for each) to receive propofol (2.5–3 mg/kg), fentanyl (2–3 µg/kg) and atracurium 0.5 mg/kg for induction of anaesthesia. TI was performed after 2 min for all Pat of the Standard (Stand) group or at maximum block (NMM group). Intubating conditions (IntCond) were evaluated (3), PH was assessed in the PACU (PA) and at 24, 48 and 72 h after surgery and the vocal cords were examined by stroboscopy before and 24 and 72 h after surgery. Statistics: χ^2 test and ANOVA.

Results and Discussions: Excellent IntCond were significantly increased in the NMM group compared to the Stand group (p < 0.05), however incidence of PH and VCS was comparable between the groups (Table). Most VCS were bilateral (86%) and edema (70%). Onset time was significantly increased in the NMM group compared to the Stand group: 4 min vs. 2 min, respectively; P < 0.001.

	Postoperative hoarseness			Vocal cord sequelae		
	Stand n = 31	NMM n = 30	P	Stand n = 31	NMM n = 30	P
PA	8	7	0.94	n.a.	n.a.	–
24 h	6	6	0.79	6	11	0.22
48 h	3	2	1.00	n.a.	n.a.	–
72 h	1	1	1.00	2	1	1.00
>72 h	0	0	–	0	0	–
Pat	8	7	0.94	6	11	0.22

n.a. = not assessed. Values are numbers.

Conclusions: PH (24%) and VCS (28%) were frequent, however NMM did not decrease the incidence of intubation-associated laryngeal morbidity. An induction regimen with propofol/fentanyl/atracurium allowed TI in all Pat after 2 min (Stand group).

References:

- 1 *Anesthesiology* 1999;91:1703–11.
- 2 *Anesthesiology* 2003;98:1049–56.
- 3 *Acta Anaesthesiol Scand* 1996;40:59–74.

A-101

Automated real-time capture of anaesthetic drug administration data using a computer, some standard peripheral devices and a simple robotic syringe-handling device

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Background and Goal of Study: Compared to the traditional anaesthetic record, automatic anaesthetic data capture promises increased accuracy (1) and precision for recording and auditing clinical work. It should eliminate

form-filling, allowing the anaesthetist to concentrate on the care of the patient. Current systems are too cumbersome to allow drug data entry in real time during anaesthetic induction.

Materials and Methods: A system has been developed that allows automated real-time capture of drug administration data during anaesthesia. A personal computer is connected to the required peripherals. Drugs are identified using barcodes on sticky labels placed on syringes. Doses administered are automatically calculated from change in weight of syringes and knowledge of drug concentration. A robotic device returns each syringe to the storage tray after weighing. The data is printed as it is generated and is also stored electronically for later retrieval. Drug administration data (drug name, dose, time of administration) was captured in real time during anaesthetic induction in 10 patients. Note was made of instances of two failure events, namely incorrect recording of drug name or (b) the system failing to release any syringe for re-use.

Results and Discussions: No example of any of the two failure events was seen.

Conclusion(s): The system usefully records (in real time) drug name and dose and does not hamper the anaesthetist in operation.

Reference:

- Merry AF, Webster CS, Weller J, Henderson S et al. Evaluation in an anaesthetic simulator of a prototype of a new drug administration system designed to reduce error. *Anaesthesia* 2002; 57: 256-263.

A-102

Heads up display monitoring improves monitor vigilance during simulated critical incident scenarios

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Background and Goal of Study: Anaesthetists are frequently distracted from monitor observation whilst performing tasks at critical stages of anaesthesia¹. We utilized a new heads up display monitor (NOMAD, Microvision, Bothall, WA, USA) to determine if, whilst wearing the display, anaesthetists responded more quickly to adverse events during simulated critical incidents.

Materials and Methods: We studied 10 anaesthesia residents in our medical simulator. 5 residents were randomized to wearing the display, 5 acted as controls. During a standardized simulated scenario the anaesthetist performed a fiberoptic tracheal intubation. During this task their response times to the audible oxygen saturation alarm, and to visually displayed severe ST segment depression information was recorded. Total time to complete the scenario, and total monitor observation time was also recorded.

Results and Discussions: Mean times with standard deviation.

Task	Subjects (n = 5) Time (seconds)	Controls (n = 5) Time (seconds)
Total scenario	378? 86.7*	627? 113.1
Monitor observation	19.4? 8.8*	77.6? 16.1
Audible task	35.6? 9.8	38.2? 9.8
Visual task	44.6? 14.3*	142.4? 47.6

* P < 0.05.

Residents wearing the heads up display completed the scenario in less time; spent less time observing the integrated display monitor and responded quicker to visually displayed adverse events than the control group. There was no difference in response to audible monitor alarms.

Conclusion(s): The heads up display enhances monitor vigilance during periods of necessary distraction in simulated anaesthetic scenarios.

Reference:

- Loeb RG. *Anesthesiology*. 1994 Mar;80(2):527-33.

Acknowledgements: Microvision, Bothall, WA, USA.

A-103

Changes of interstitial fluid volume in superficial tissues induced by hypergravity (+2 Gz) and nil-by-mouth period detected by a miniature ultrasound device

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Background and Goal of Study: During spaceflight interstitial fluid shifts towards the skin of the head are generally observed (1), on the other hand a fluid load can induce a swelling of superficial tissues (2). The aim of our study was to evaluate the changes of the skin thickness (TT) induced by a

12 h nil-by-mouth period and by a +2 Gz hypergravity measured at forehead and tibia.

Materials and Methods: Sixteen male volunteers were subjected to 30 min of +2 Gz acceleration twice with differential fluid load before hypergravity exposure. Procedure A: fluid load of 250 ml/h and procedure B: nil-by-mouth period for 12 h. Before (t0), after 10 min (t10), and after 30 min (t30) of hypergravity the TT was measured at the forehead (TT-f) and at the tibia (TT-t) by a miniature 10 MHz A-mode ultrasound device. The body weight and the hematocrit (hct) were estimated at t0 and t30. To evaluate for statistical significance (p < 0.05), parametric tests were applied.

Results and Discussions: The nil-by-mouth period induced a weight loss of 1.13 ± 0.92 kg (mean \pm SD; p < 0.05) and an increase of hct ($0.97 \pm 1.51\%$; p < 0.05). TT-t but not TT-f decreased significantly (p < 0.05). By hypergravity exposure TT-f declined in procedure A and B at t10 and t30 (p < 0.05 respectively) whereas TT-t was not influenced.

Conclusion(s): Changes of interstitial fluid load of superficial tissues can be traced by A-mode ultrasonography. The effect of fluid loss can preferably be detected at the tibia whereas the hypergravity induced changes can be observed at the forehead. This knowledge could help to study the redistribution of interstitial fluid during micro- or hypergravity.

References:

- Kirsch et al. *Clin Investig* 1993;71(9):687-9.
- Eichler et al. *J Appl Physiol* 2000;89:359-63.

A-104

Haemodynamic changes measurement during laparoscopic cholecystectomy using transesophageal Doppler (ODM II)

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Background and Goals: Aim of this study was to investigate haemodynamic changes induced by pneumoperitoneum and positioning (reverse Trendelenburg) of patients undergoing laparoscopic cholecystectomy, using transesophageal Doppler ultrasonography (ODM II).

Material and Methods: Thirty four patients (11 male, 23 female), aged 31-71 years old, ASA I-II, undergoing elective laparoscopic cholecystectomy were studied. The following parameters were recorded: mean arterial pressure (MAP), heart rate (HR), central venous pressure (CVP), stroke volume (SV), cardiac output (CO) and end-tidal CO₂ concentration (ETCO₂)¹. Measurements took place (i) after induction of anaesthesia (A), (ii) after gas insufflation (B), (iii) 15 min (C), (iv) 30 min (D) later, and (v) after desufflation². For the statistical analysis of the results paired t-test was used (P < 0.05 was considered significant).

Results: Induction of pneumoperitoneum caused significant decrease in SV and CO, while HR, MAP and CVP increased. ETCO₂ increased gradually with time after CO₂ insufflation. No further changes caused by patient's positioning (reverse Trendelenburg) were observed. All of the previous effects normalized after desufflation. No complications due to ODM catheter placement were observed.

Conclusion: Laparoscopic cholecystectomy is accompanied by significant haemodynamic changes which can be easily detected by non invasive ODM II application.

References:

- Galizia G, Prizio G, Lieto E, et al. *Surg Endosc* 2001; 15: 477-483.
- Donati A, Munch C, Marini B, et al. *Minerva Anestesiol* 2002; 68: 549-554.

A-106

Airway management device (AMD) versus laryngeal mask airway (LMA) in gynecologic surgery

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Background and Goal of Study: Airway management devices (AMD) is a supraglottic device, the presumed advantages include the possibility of blind intubation with minimal opening of the rima oris, occlusion of esophagus and introduction of the tube for aspiration of gastric liquid regurgitation. Scope of our study was to compare AMD with laryngeal mask airway (LMA) in patients undergoing elective gynecologic surgery in general anaesthesia.

Materials and Methods: After we obtained informed consent, 40 patients age 38 (\pm 7 yrs), weight 67 (\pm 6 kg), ASA I-II, Mallampati class I-II, they have been divided in 2 groups GA and GL they had general anaesthesia with TIVA. In the GA group intubation has been carried out with AMD, in the GL group

with LMA. We evaluated: time necessary for intubation, eventual necessity of airway manipulation for its realization, ventilation parameters (SpO₂, EtCO₂), presence of complications after extubation (pharyngodynia, presence of blood in the terminal cuff). The success of intubation was evaluated objectively and with medical equipment (SpO₂ < 95%).

Results and Discussions: Intubation with AMD was faster than LMA ($p = 0.01$). The insertion of the AMD was easy and non traumatic, in 16 cases only 4 patients needed a second attempt. On the other side the intubation with LMA in 3 cases demanded a second attempt and 3 cases also the third attempt. During maintenance of anesthesia, the effectiveness of intraoperative ventilation resulted better with AMD, with only 2 cases of SpO₂ < 93%; while in the GL group we had 6 cases of SpO₂ < 93%. After extubation 1 single case of presence of blood in GA group and 5 in the GL group, 0 cases of pharyngodynia in GA group and 5 in the GL group.

Conclusion(s): Successful attempts of insertion, and less complications with AMD is more likely than that of the LMA.

Reference:

- 1 Cook, TM; An evaluation of the Airway Management Device; *Anaesthesia*. 2001 Jul;56(7):660-4.

A-107

Detection of venous air-embolisms (AE): will there soon be a new gold-standard?

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Background and Goal of Study: AE arise frequently during, among others, abdominal as well as neurosurgical operations in the sitting position. In order to reduce the morbidity and mortality of such events through early detection and swift therapy, we developed a CVC with an integrated multi-application 8 MHz doppler probe (DO-SVC), to which a device for documentation and quantification of the AE is connected. In-vitro and animal experimental tests verified the high sensitivity of the measurement method (1,2).

Materials and Methods: After approval by the local ethics commission, we are currently validating our procedure on 10 patients, who were operated upon in the sitting position and we are comparing it with the usually employed procedure (TEE as the gold standard, precordial doppler).

Results and Discussions: The detection sensitivity of the DO-SVK is just as high as that of the TEE and significantly higher as those of the usual procedures. In regards to the clinical predictability and cost-effectiveness, the DO-SVK is superior to all other procedures.

Conclusion(s): The DO-SVK enables one to safely and dependably register the smallest amounts of air. With our procedure, clinical monitoring could be simplified and improved, and less practicable (TEE) and sensitive (precordial doppler) monitoring methods could be replaced.

Reference:

- 1 Volk O, Brass P, Schregel W, et al. *Der Anästhesist* 2002;51:716-20.

A-108

Decision rules and prediction models in preoperative risk assessment; the anesthesiologist replaced by the computer?

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Background and Goal of Study: Preoperative risk assessment is an important and time consuming task for the anesthesiologist. At present, much is known about the preexisting conditions that lead to untoward outcomes and data are now often collected in patient management systems. However, simple collection of data is not enough; real progress is made when data are continuously converted into new knowledge and then applied in clinical practice using active decision support. This will allow a further refinement in the evaluation of patients, reduce risks and improve patient management. For this purpose, the use of intelligent software in the preoperative setting can be of great value.

Materials and Methods: This ongoing study is based on a newly developed digital questionnaire, complemented with a basic physical examination. The 45 questions seek to identify and score conditions that are known from the literature to be risk factors. The questionnaire is integrated in our anesthesia information system (Draeger). The active decision support is realized by using Omega software (KiQ). This software allows the online application of prediction models (derived from historical data from our hospital) and decision rules. Both are based on patient variables (collected through the questionnaire and examination), type of surgery, expert opinion and literature sources. The decision logic can easily be adjusted, i.e. no computer expert

is needed. For every patient, an overview of risks (including clear warning signs) and relevant protocols is available in the entire OR environment.

Results and Discussions: Most patients can answer the questions by themselves within 5–15 minutes. The software appears dependable in risk assessment (ASA, organspecific or anesthetic risk, etc) and decision support (advices for further testing, consultation and care planning, protocols, etc) when weighted against an expert opinion. Models for PONV, pain and duration of operation are already available.

Conclusion(s): The use of decision rules and prediction models in preoperative risk assessment seems promising. It can be of great value for ongoing better patient management, while (partly) relieving the anesthesiologist of a labour-intensive task.

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Influence of directions of guide-wire end on aberrant locations of subclavian venous catheters

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Background and Goals: A malpositioned central venous catheter can result in faulty central venous pressure or lead to serious complications such as thrombosis, vascular erosions and perforations of the veins (1, 2). We hypothesized that the bended direction of guide-wire tip may be influenced by the directions of guide-wire end or bevel of needle in subclavian venous catheterization.

Materials and Methods: We studied 80 patients undergoing neurosurgery, orthopedic surgery, and abdominal surgery. By the direction of guide-wire and bevel of the needle, the patients were randomly allocated into 4 groups, which consisted of group 1 (heart direction in both the bevel of needle and guide-wire; age 48 ± 15 yrs), group 2 (heart direction in the bevel of needle and head direction of guide-wire; age 65 ± 11 yrs), group 3 (neutral upward bevel direction and heart direction of guide-wire; age 60 ± 11 yrs), group 4 (neutral upward bevel direction and head direction of guide-wire; age 49 ± 12 yrs).

Results: Overall incidence of misplacement of subclavian vein catheter was 18.8%. The frequency of catheter malposition was 5% for group 1, 10% for group 2, 20% for group 3, and 45% for group 4 respectively ($P = 0.012$). Aberrant location was mostly associated with ipsilateral right internal jugular vein (80%).

Conclusion(s): The direction of guide-wire end during infraclavicular subclavian catheterization has a clinically important effect on the likelihood of misplacement of catheter.

References:

- 1 Conces DJ et al. *Arch Surg* 1984; 119: 293-5.
- 2 Ellis LM et al. *Ann Surg* 1989; 209: 475-8.

A-110

Cidex, savlon and hydrogen peroxide: which of them is more effective in disinfection of ventilator tubes

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Background and Goals: The most common nosocomial infection in intensive care units is pneumonia caused by endotracheal intubation and mechanical ventilation (1). The best procedure for prevention of this complication is use of suitable and proper techniques for equipment sterilization (2). The goal of this study was determination and comparison of disinfection effect of cidex (C), savlon (S) and hydrogen peroxide (HP) on breathing tubes of ventilators.

Material and Methods: After institutional approval, this experimental trial study was done on three groups of ventilators breathing tubes. The number of tubes in each group was 20. These three groups of breathing tubes were disinfected with C, S and HP respectively. Samples were obtained from tubes for microbial culture on blood agar before and after disinfection. The results of microbial culturing were compared between three groups. Statistical analysis was performed with ANOVA and T pair.

Results: Data (Mean \pm SD) are shown in the table:

Disinfectant material	Colony count		
	Before disinfection	After disinfection	Efficacy (%)
Cidex	183.2 \pm 73.1	0	100
Savlon	171 \pm 75.4	8.6 \pm 3.2	98.08
Hydrogen peroxide	220.8 \pm 72.9	0	100

Conclusions: All of the tested chemical materials had the same results in disinfection. Considering hydrogen peroxide has less adverse effects on human

and environment and it is less expensive than cidex, we recommend the use of this material for disinfection of mechanical ventilator breathing tubes.

References:

- Richardson CJ, Rodriguez JL. *Am J Surgery* 2000; 179:8–11.
- Das I, Fraise AP. *J Hosp Infect* 1997; 37:263–72.

A-111

The effect of propofol and sevoflurane based anaesthesia on oto-acoustic emission in pediatric patients

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Background and Goal of Study: Oto-acoustic emissions (OAE) as a sensitive indicator of cochlear status and a screening test for hearing ability. Anesthetic agents have been shown to alter OAE amplitudes in animal studies. A single human study with propofol and isoflurane revealed significant decrease in OAE amplitudes. The aim of this study was to determine and compare the effect of sevoflurane and propofol based anaesthesia on transient oto-acoustic emission (TEOAE) and distortion product oto-acoustic emission (DPOAE) amplitudes.

Materials and Methods: After the approval of local ethics committee, 29 patients without ear pathology, aged between 7 days to 16 years, were randomly allocated into two groups according to the anesthetic technique. Group P (n = 14) received propofol-based anaesthesia, while Group S (n = 15) received sevoflurane anaesthesia. TEOAE, DPOAE and tympanometry tests were performed preoperatively, intraoperatively (15th minute) and postoperatively (30th minute) in all groups. Friedman test, Mann Whitney U and t test were used for statistical analysis.

Results and Discussions: There were no statistically significant intergroup or in-group differences in hemodynamic parameters. No significant differences were observed between the groups in TEOAE and DPOAE amplitudes. Both anesthetic agents induced a decrease in TEOAE and DPOAE amplitudes compared to preoperative values. In Group P, TEOAE amplitudes showed a significant decrease in 1.25 kHz, 1.75 kHz and 2.5 kHz in post-operative period while DPOAE amplitudes decreased significantly in both postoperative (0.75 kHz, 1 kHz, 1.5 kHz, 2 kHz and 3 kHz) and intraoperative (1 kHz) periods (p < 0.05). In Group S, TEOAE amplitudes decreased in intraoperative and postoperative periods at 2.5 kHz (p < 0.05). In Group S, DPOAE amplitudes decreased in intraoperative (1.5 kHz) and postoperative period (1.5 kHz and 2 kHz) (p < 0.05).

Conclusion: Sevoflurane and propofol anaesthesia effects cochlear function. However this effect does not influence hearing ability of the patients in the postoperative period.

Reference:

Hatzopoulos S et al. *Hearing Research*. 2002; 170: 12–21.

A-112

Comparison of convective warm air and cotton blanket on core rewarming in moderate hypothermic patients

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Background and Goals: Moderate hypothermia is often the single factor for delaying return to spontaneous ventilation and tracheal extubation in recovery after cardiac surgery with hypothermia. The goal of our study was to compare forced warm air versus cotton blanket during immediate post-operative in the rate of core rewarming after cardiac surgery.

Materials and Methods: After the approval by the review board and obtaining informed consent 30 hypothermic patients were randomized into 2 groups to receive either forced warm air (n = 15) or cotton-blanket (n = 15) for rewarming, immediately admission in Post-Surgical Reanimation. Core (oesophageal) and skin temperatures were recorded every hour during a period of 4 hours. Statistical analysis was performed with Anova test for repeated measures.

Results and Discussions: Central rewarming (37°C) took between 3rd and 4th hour in all patients. We did not find difference on core temperatures during rewarming between groups. Core temperatures are presented as mean (°C) (standard deviation).

Groups	Admission	1st	2nd	3rd	4th
Cotton	34.5	35.1	35.9	36.6	37.3
Blanket	(0.4)	(0.8)	(0.9)	(1.0)	(0.8)
Forced	34.4	35.4	36.1	37.0	37.5
Warm Air	(0.5)	(0.5)	(0.4)	(0.4)	(0.6)
Anova	NS	NS	NS	NS	NS

Conclusions: There were no differences between core temperatures after rewarming with forced air warming and cotton blanket in hypothermic patients after cardiac surgery.

A-113

An innovative drug delivery system designed for very low flow rates: experimental and clinical evaluation

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Background and Goal of Study: In order to meet the requirements of drug and fluid administration at very low dosing rates even in the sub- μ l-range a portable drug delivery system (MEDOS) was developed. Utilizing a prototype configuration this novel device was tested *in vitro* for dosing accuracy, safety, and ease of use and additionally evaluated during postoperative pain therapy.

Materials and Methods: The drug reservoir (10 ml) conventionally pressurized by a spring actuator is connected to a disposable fluid connector incorporating an innovative silicon micro-channel thereby providing for a linear correlation of reservoir pressure and flow and precisely predictable flow rates. Capillary flow rates of water were first studied by gravimetric measurements and, additionally, the viscosity of various drugs was determined experimentally. After IRB approval and informed consent MEDOS was then examined in 39 adult patients after abdominal surgery.

Results and Discussions: Viscosity measurements of various drugs yielded a strong non-linear dependence on temperature, differing from water by 4 to 15% between 20 and 50°C. Gravimetric measurements of the capillary flow rate resulted in $1.12 \pm 0.04 \mu\text{l}/\text{min}$ (1 * SD). As for the clinical trial we noted a mean infusion rate of $1.56 \pm 0.59 \mu\text{l}/\text{min}$ (1 * SD) for MEDOS comprising an overall measuring time of 1054.4 h. Visual examination of the 65 micro-restrictions used returned 32 suspect of malfunction, however, microscopical control confirmed only 20 (31%) as damaged.

Conclusion(s): Its miniaturization potential and superior device-to-device reproducibility provide for a high *in vitro* accuracy of MEDOS at very low flow rates, however, the *in vivo* drug delivery differed from the predicted flow rate by 50% approximately. Inappropriate preparation of the drug delivery system, unintentional manipulation of the fluid connector by the patient, viscosity changes due to temperature variations, and the highly difficult assessment of the delivered drug amount by determining the weight of the MEDOS device before and after therapeutic use variably contribute to the aforementioned *in vivo* dosing error.

References:

- Park KM et al. *Pain* 63 (1995) 163–172.
- Koppert W et al. *Anesthesiology* 95 (2001) 395–402.

Acknowledgements: The study was funded by the Bavarian Research Foundation.

A-114

Relation between elektroencephalogram monitoring by SFx and propofol concentration during anesthesia

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Background and Goal of Study: Target plasma concentrations of propofol is defined for hypnosis 2 to 6 $\mu\text{g}/\text{ml}$. Complex EEG analytic methods, such as SFx (neuromonitor PSM2000-Medisyst) has been used to assess the effects of intravenous anesthetics. The current study investigated the effect of using SFx monitoring on propofol concentration.

Material and Method: After IRB approval the patients, who underwent laparoscopic cholecystectomy, were prospectively randomized into one of the following two groups. In Group I with SFx (n = 18) anesthesia was induced with a bolus of propofol (2 mg/kg) and continuous infusion of remifentanyl (0.25 $\mu\text{g}/\text{kg}/\text{min}$). Anesthesia was maintained by continuous infusion of propofol and remifentanyl to keep SFx < 80. In group II (n = 18) without SFx anesthesia was maintained according to the clinical parameters. Blood samples for measurement of propofol concentrations were taken from forearm veins at the following intervals: 1, 3, 5, 10, 15, 30 min., and later each 30 min. until the end of anaesthesia. Propofol was assayed using liquid chromatography. Data were analyzed using Student t-tests and are presented as mean \pm SD.

Results and Discussion: In Group I mean concentration of propofol during induction was $3.35 \pm 1.61 \mu\text{g}/\text{ml}$, while maintenance concentrations of propofol were in the range from $1.79 \pm 0.49 \mu\text{g}/\text{ml}$ to $2.38 \pm 0.89 \mu\text{g}/\text{ml}$. In Group II mean concentration of propofol during induction was $5.26 \pm 2.15 \mu\text{g}/\text{ml}$, while maintenance concentrations of propofol were in the range from $2.40 \pm 0.95 \mu\text{g}/\text{ml}$ to $4.69 \pm 1.04 \mu\text{g}/\text{ml}$.

Conclusions: Monitoring of depth of anesthesia by SFx allows to achieve the lowest concentrations of propofol for maintaining of anesthesia.

References:

- 1 Dimpfel W., Hofmann H.C., Schober F., et al. Eur J Med Res, 1998, 3, 453–460.
- 2 Ziem N., Schönberg G., Patschke D. Abstractband DAK 2002, 114Z.

A-115

Palmar skin conductance compared to a developed stress score and to noxious and awakesness stimuli on patients in anaesthesia to study the sensitivity and specificity of skin conductance

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Background and Goal of the Study: Skin Conductance (SC) as a measure of emotional state or arousal may be a tool for monitoring physiological stress during surgery and general anaesthesia. When an outgoing sympathetic nervous burst occurs to the skin, the palmar and plantar sweat glands are filled up, and the SC increases before the sweat is removed and the SC decreases. This creates a SC fluctuation. The purpose of this study was to measure number of SC fluctuations (NSCF) during laparoscopic cholecystectomy with propofol and remifentanil anaesthesia and to find the sensitivity and specificity of the NSCF compared to a simple perioperative clinical stress score. Moreover, different patterns of SC responses were studied and compared with BIS to find out if the SC monitoring could differentiate between inadequate hypnotic or analgesic medication as causative for the observed signs of physiological stress.

Material and Methods: 14 patients in ASA group 1 and 2 were studied during 7 stressful or non-stressful registration periods. Further registrations were done every 10 minutes, or if the systolic arterial pressure was more than 130 mmHg, or if the patient moved, or if the NSCF/sec. were more than 0.05 perioperative. During each registration period the NSCF/sec was compared to the clinical stress score (systolic blood pressure > 130 mmHg, cough, tears, EMG in the forehead over 50 and movements).

Results and Discussions: In 12 registration periods both the NSCF and the clinical stress score showed stress. In 28 registration periods the NSCF reacted to stress and the stress score did not react. In 2 situations the NSCF did not react to stress and the clinical stress score did react. In 186 registration periods neither the NSCF nor the stress score showed stress. The sensitivity of the NSCF to the clinical stress score was 86% and the specificity was 86%. Moreover, in all situations when NSCF/sec was more than 0.05 and BIS more than 50; the mean SC level increased. This was different from situations where NSCF/sec was more than 0.05 and BIS < 50, then the mean SC level did not increase ($p < 0.001$).

Conclusion: NSCF/sec may be more sensitive than the clinical stress score during surgical stimulation. Moreover, the combined use of mean SC level and NSCF may be used to differentiate between situations of stress due to inadequate hypnotic effect versus inadequate analgesic effect.

A-116

SNAP index failed to monitor the analgesic potency of remifentanil during propofol anaesthesia

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Background and Goal of Study: Hypnosis and analgesia are two important components of “depth of anaesthesia”. The aim of the present study is to investigate the possibility to monitor increasing concentration of remifentanil during propofol anaesthesia with a very new monitor-system, the SNAP™ and with the Bispectral Index™ (BIS™, 1).

Materials and Methods: Following IRB approval we investigated 19 female patients during minor gynaecologic surgery. Target controlled infusion (TCI) of propofol was increased in a step-by-step mode (0.5 µg/kg) every 1 min until the patients became unresponsive. 5 min after the patient lost response remifentanil 0.4 µg/kg/min was started. 1, 2, 3, 4 and 5 min after start of remifentanil SNAP™ Index, BIS™, spectral edge frequency, mean arterial blood pressure and heart rate were recorded. Changes after start of remifentanil were analysed with Friedman's and post hoc with Wilcoxon's test.

Results and Discussions: Start of remifentanil infusion resulted in statistically significant changes for BIS™, spectral edge frequency, mean arterial blood pressure and heart rate ($p < 0.05$). For SNAP™ Index no statistically significant effect were found ($p > 0.05$).

Conclusion(s): Index was not able to reflect the analgesic potency of remifentanil during propofol infusion.

Reference:

- 1 Rampil I. Anesthesiology 1998; 89: 980–1000.

A-117

Operating room nitrous oxide trace concentrations: a clinical study in ambulatory surgery

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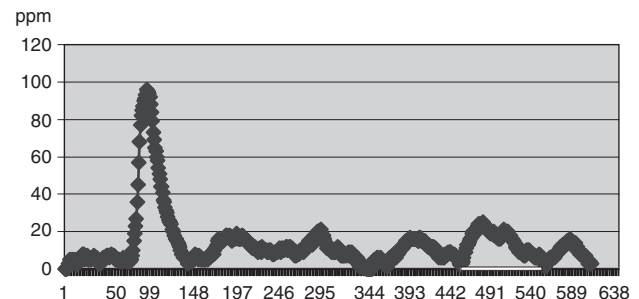
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Background and Goals: Occupational health and environmental authorities use time-weighted averages (TWA) during an 8 hour period as guidelines for chronic exposure to trace concentrations of anaesthetic gases. The present blinded study uses a novel, simple trace concentration nitrous oxide monitor to investigate N_2O_{TWA} in ambulatory surgery theatres (limits vary 25–100 ppm).

Materials and Methods: Two Gasfinder™ (infrared real-time nitrous oxide gas diffusion dosimeters, Medair AB, Delsbo SWEDEN) were placed above anaesthetic machines in randomly selected ambulatory surgery theatres with blinded personnel. Anaesthesia: Induction with propofol & fentanyl. No inhaled anaesthetics before laryngeal mask placement. Fresh gas flow of 3 L/min (1:2 O_2 in N_2O) and sevoflurane 2%. Laryngeal mask was removed only when patient had recovered with discomfort from the mask.

Results: Twenty-one sessions were monitored. The TWA and maximum daily values recorded are shown in the table. Six out of the 21 recordings had at least one peak value above 100 ppm. The figure (x-axis values are minutes) shows a typical recording with delayed gas scavenging activation.

ppm (n = 21)	TWA	Daily peak
Mean	11	157
Minimum	0.1	14
Maximum	81	2 000



Conclusion: This study demonstrates the value of an on-line trace gas dosimeter in everyday practice to assure adequate operating room environment.

A-118

Effect of nitrous oxide on spectral entropy of the EEG during sevoflurane anaesthesia: preliminary results

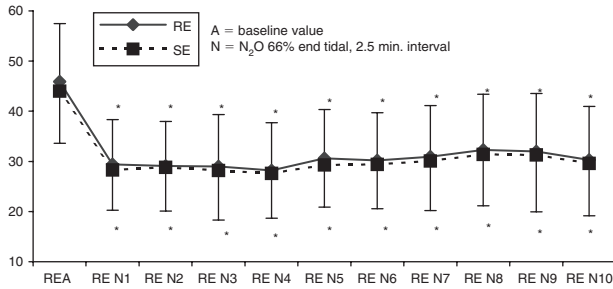
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Background and Goal of Study: Spectral entropy (E) of the EEG is a new technique proposed to monitor the depth of anaesthesia. This study investigated the effect of N_2O on E during sevoflurane anaesthesia.

Patients and Methods: After IEC approval, 10 adult consenting patients, ASA status I or II, aged 28–71 years, and undergoing routine lumbar disc surgery were enrolled in the study. They were premedicated with alprazolam 0.5 mg and atropine 0.5 mg given orally 1 h before surgery. Anaesthesia was induced with propofol, sufentanil and rocuronium, and maintained with sevoflurane 2% end tidal (ET) in air/ O_2 . Under stable anaesthetic and surgical conditions, N_2O was then administered to achieve a 66% ET concentration while keeping a constant 2% ET sevoflurane concentration. Mean arterial pressure (MAP), heart rate (HR), response (RE) and state (SE) entropy were recorded every 2.5 min during 10 minutes before N_2O administration (baseline) and during 25 minutes at 66% ET N_2O . Data (mean \pm SD) were analysed using oneway ANOVA's. $P < 0.05$ was considered statistically significant.

Results: N₂O at 66% ET provoked a significant and persistent decrease in RE and SE compared to baseline values, without affecting the RE–SE gradient. No difference was observed in MAP during the study period. HR was significantly lower than baseline at 15, 17.5 and 20 min after N₂O administration. **Conclusions:** N₂O provokes a significant decrease in RE and SE under stable sevoflurane anaesthesia. This change suggests an increase in hypnotic depth directly caused by N₂O or secondary due to a better analgesia. Further investigations must be performed to eliminate a possible order effect.



A-119
The burst suppression ratio as an EEG-derived parameter for ischaemia detection in carotid surgery

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Background and Goal of the Study: Reliable detection of cerebral ischaemia is a main aim of neuromonitoring during carotid surgery. Until now many problems with the interpretation of the electroencephalogram (EEG) or evoked potentials (EP) like oversensitivity of EEG or delayed onset of significant EP-changes remain still unsolved. The goal of this study was to validate an EEG-derived marker of cerebral ischaemia: the burst suppression ratio (BSR). **Material and Methods:** In a prospective clinical trial 191 patients undergoing carotid endarterectomy were monitored: group 1 with pEEG® (Dräger, Germany; n = 94, two-channel-EEG) and group 2 with EPOCH 2000™ (AXON Systems, USA; n = 97, four-channel-EEG). BSR was defined as percentage of zero-line-EEG (flattening less than 5µV amplitude of the raw EEG) over a period of 60 seconds. With the EPOCH 2000™ the EP's above the post central region after Median nerve stimulation were monitored simultaneously. BSR and EP were recorded from induction to reversal of anaesthesia. Feasibility of BSR-monitoring was determined by the onset of a new neurological deficit, successful temporary shunt placement and technical problems. **Results and Discussion:** BSR-onset was detected due to the following events: clamping ischaemia, hypotension, clonidine-administration or immediately after induction of anaesthesia (Table). Sometimes BSR persisted during the whole operation period (most of these patients had a previous stroke in their history). EEG recording was disturbed in three cases because of technical problems and EP recording was disturbed in five cases because of a previous stroke with hemiparetic syndrome. The EPOCH 2000™ was superior to the pEEG® (no technical problems, fewer patients with persisting BSR after induction of anaesthesia and combined EEG/EP-monitoring). In the second group the use of a temporary shunt dropped from 16 to 4.1% without an increase of neurological problems. Sensitivity of BSR was 100% in both series; specificity was 94.6 and 97.8%. BSR onset was faster than EP-changes.

Device	n	BSR due to/immediately after (% of patients)			
		Induction	Hypotens.	Clamping	Clonidine
pEEG	94	17	8,5	17	16
EPOCH	97	22,7	4,1	4,1	6,2

Conclusion: The BSR could be a reliable and fast reacting EEG-derived parameter for cerebral ischaemia detection.

A-120
Analysis of bispectral index, state and response entropy values upon emergence from anesthesia in patients anaesthetized with propofol or sevoflurane

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Background and Goal of the Study: The analysis of frontal EEG with the bispectral index (BIS XP®, Aspect Medical) or spectral entropy

(Datex-Ohmeda) monitors is used to titrate the effects of anaesthetic drugs. We investigated the BIS, state (SE) and response (RE) entropy values associated with eye opening (EO) upon verbal command during emergence from anaesthesia.

Material and Methods: For 21 ASA class I–II patients, scheduled for digestive surgery, anaesthesia was induced and maintained with propofol (Prop; n = 12) or sevoflurane (Sevo; n = 9) and remifentanyl (Remi). Predicted effect site concentrations for Prop (Marsh model) and Remil (Minto model) were calculated with Rugloop II® software; end-tidal (ET) sevo concentrations were measured with the Datex-Ohmeda AS5 monitor. BIS, SE (frequency range: 0.8–32 Hz) and RE (0.8–47 Hz with frontal EMG signal) values were synchronised electronically. Upon emergence from anaesthesia patients were asked every 15 seconds to open their eyes. Values are median (range). one way analysis of variance on ranks followed by pairwise multiple comparisons (Dunn's method). Correlations among two variables were analysed with the Spearman rank correlation test. A p value < 0.05 was considered as significant.

Results and Discussion: For the propofol and sevoflurane groups respectively patients had 54 (29–72) and 48 (25–59) yrs; 71 (47–100) and 76 (51–84) kg; 179 (162–179) and 173 (158–195) cm.

Prop Ce or ET sevo	Remi Ce (ng/ml)	BIS values	BIS EMG values	SE values	RE values
1.7 (0.8–5.3) µg/ml	1.1 (0.2–2.6)	73 (46–85)*	43 (34–58)	80 (62–90)**	95 (76–98)
0.3 (0–0.4)%	0.5 (0.1–0.9)	82 (59–94)*	54 (41–65)	88 (72–91)**	98 (94–100)

* p < 0.05 versus RE (Kruskal-Wallis test with Dunn's test); ** p < 0.05 versus RE.

Conclusion: EO occurred at significantly higher values for RE as compared with BIS and SE values. These results suggest that RE values could be a reliable predictor of emergence from anaesthesia.

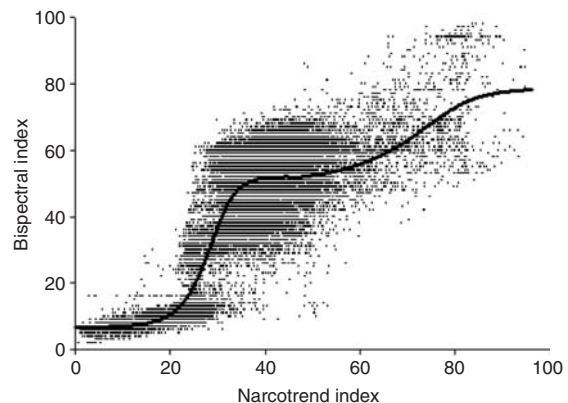
A-123
Comparability of Narcotrend index and bispectral index during propofol anaesthesia

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Background: The dimensionless Narcotrend™ (NCT) index (MonitorTechnik, Germany, version 4.0) from 100 (awake) to 0 is a new index based on EEG pattern recognition. Translation of guidelines for the titration of bispectral index™ (BIS-XP, USA) to the NCT index depends on their comparability.

Methods: In 18 adult patients undergoing radical prostatectomy an epidural catheter was placed in the lumbar space and electrodes for BIS and NCT were applied. Epidural anaesthesia was initiated with 15 ml bupivacaine 0.5%. General anaesthesia was induced and maintained with propofol, and 45 minutes after induction, propofol concentration was increased to substantial burst suppression and then decreased. This was done twice in each patient, and BIS and Narcotrend values were recorded in intervals of 5 s. Values are mean (SD).

Results: We collected 38,629 artifact-free data pairs of BIS and NCT values. Decreasing BIS values co-occurred with decreasing NCT values. A sigmoidal model (NCT index = 52.8 + 26.8/(1 + e^((BIS - 78.3)/4.8))^0.4 R = 0.52) described the correlation between BIS and NCT index in a BIS range between 100 and 50. For BIS values lower than 50 a second sigmoidal model with a correlation of R = 0.83 was applied (NCT index = 6.6 + 45.3/(1 + e^((BIS - 29.8)/2.4))^0.6). The relationship between burst suppression ratio (BSR) and NCT index was best described by the following sigmoidal model: NCT index = 265/(1 + e^((BSR - 108)/-49)); R = 0.73.



Conclusion: We found a sufficient correlation between BIS and NCT index, but deviations from the line of identity in some ranges require attention. Therefore, a simple 1:1 transfer from BIS to NCT values is not adequate. Our results might serve as a blueprint for a rational "translation" of BIS into NCT values.

A-124

Remifentanyl dose-response effect on EEG parameters and heart rate variability

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Background and Goal of Study: Remifentanyl (R) effect on bispectral index™ (BIS) is still controversial [1,2]. Aim of the study was to evaluate modifications of EEG parameters and heart rate variability (HRV) during increase of R effect concentration (Ce) during propofol anaesthesia.

Materials and Methods: After institutional approval and informed consent, 14 patients (ASA I,II) scheduled for elective surgery were included in this study. Anaesthesia was induced with propofol at a Ce of 4 mcg/mL (Schnider model), R at a Ce of 4 ng/mL (Minto model). Atracurium 0.5 mg/kg was injected. After skin incision, propofol was lowered to 2 mcg/mL, and R to 1 ng/mL. Every 5 sec, heart rate (HR), SVI, BIS (Aspect A2000 XP version), approximate entropy (ApEn) of EEG and EMG were calculated and stored for further analysis. Sympatho-vagal index (SVI) is defined as ratio of low-frequency (LF; 0.04 to 0.15 Hz) and high-frequency component (HF = 0.15 to 0.4 Hz) of RR intervals power spectrum densities. After reaching the steady state, R dose-response curves were measured. R Ce raised from 1 to 2, 4, 8, 16 ng/mL every 5 minutes while propofol remained stable at 2 mcg/mL. Statistical analysis consisted in anova. Data are shown as mean ± SD. $P < 0.05$ is considered significant.

Results and Discussions:

Table 1. Haemodynamic, SVI and EEG parameters at different R Ce.

	Remifentanyl effect site concentration (ng/mL)				
	1	2	4	8	16
HR (bpm)	70 ± 11	69 ± 10	64 ± 11	59 ± 10* [#]	56 ± 9* [#]
PAM (mmHg)	90 ± 15	80 ± 12	74 ± 11*	67 ± 13* [#]	62 ± 15* [#]
BIS	60 ± 10	56 ± 9	51 ± 9*	47 ± 9* [#]	42 ± 6* [#]
ApEn	.46 ± .16	.47 ± .14	.44 ± .17	.40 ± .15* [#]	.38 ± .15* [#]
SVI	1.3 ± .7	1.5 ± .6	1.2 ± .4	1.0 ± .4	.7 ± .3 [#]

* $P < 0.05$ vs 1 ng/mL; [#] $P < 0.05$ vs 2 ng/mL; [§] $P < 0.05$ vs 4 ng/mL.

The increase of R Ce induced a dose dependant decrease in EEG parameters, particularly at Ce of 8 and 16 ng/mL. HRV was also diminished. Hypotension required ephedrine in two patients. EMG remained stable during all the procedure.

Conclusion: At a propofol Ce of 2 mcg/mL, R induces EEG, haemodynamic and HRV changes that could serve to monitor his effect.

References:

- 1 Amarin P, et al. Eur J Anaesth 2003;S30:A152.
- 2 Barvais L, et al. Br J Anaesth 2003;91:347-52.

A-125

Narcotrend and bispectral index monitoring during emergence from isoflurane anaesthesia

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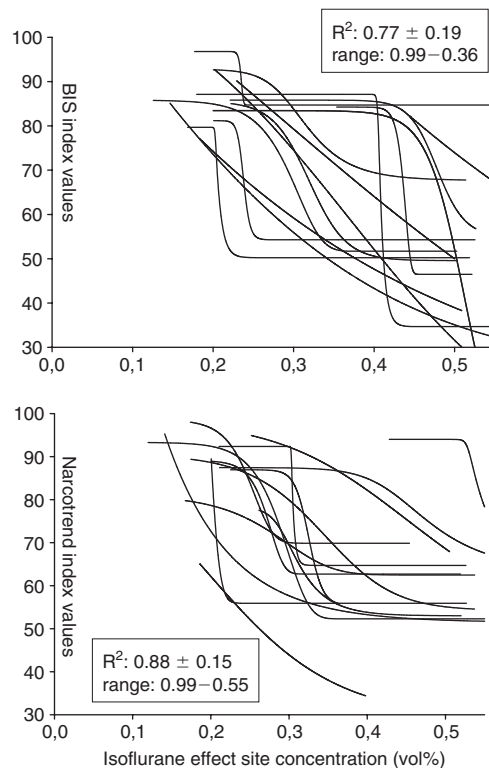
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Background: The dimensionless Narcotrend™ (NCT) index (MonitorTechnik, Germany, version 4.0) from 100 (awake) to 0 is a new index based on EEG pattern recognition. This study was designed to compare NCT and BIS (Aspect, USA, version XP) values during emergence from an isoflurane anaesthetic.

Methods: With IRB approval and written informed consent 15 adult male patients scheduled for radical prostatectomy were investigated. An epidural catheter was placed in the lumbar space and electrodes for BIS and NCT monitoring were applied to the patient's head. Induction of anaesthesia consisted of 2 mg kg⁻¹ propofol and remifentanyl which was stopped after

intubation. For the further course of anaesthesia patients received 15 ml bupivacaine 0.5% epidurally, and isoflurane in O₂/air was given for hypnosis. BIS and NCT values as well as end-tidal isoflurane concentrations were recorded in intervals of 5 s during emergence from anaesthesia; correlation analysis was performed. Isoflurane effects site concentrations were calculated with a k_{e0} value of 0.16 for BIS and of 0.18 for Narcotrend [Anesthesiology 2003 99: A338].

Results and Conclusion: Fifteen patients (64 ± 5 yrs, 81 ± 9 kg, ASA II) were enrolled. During emergence from anaesthesia the correlation between isoflurane effect compartment concentrations and Narcotrend index ($R^2 = 0.88 \pm 0.15$) was as least as good as BIS (0.77 ± 0.19).



A-126

Datex-Ohmeda Entropy Module and Bispectral Index during propofol/remifentanyl anaesthesia

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Background and Goal of Study: Different analytical concepts were introduced to quantify the changes of the electroencephalogram (EEG). The Datex-Ohmeda Entropy™ Module was the first commercial monitor based on the spectral entropy. The Datex-Ohmeda Entropy™ Module generates two indices, the State Entropy (SE) and the Response Entropy (RE). The aim of the present study was to compare the accuracy of SE and RE with the Bispectral Index™ (BIS™) to distinguish different states of propofol/remifentanyl anaesthesia.

Materials and Methods: Following IRB approval and written informed consent we investigate 20 female patients during minor gynaecologic surgery. The ability of the SE, RE, BIS™, mean arterial blood pressure and heart rate to distinguish between the steps of anaesthesia: *awake vs. loss of response*, *awake vs. anaesthesia*, *anaesthesia vs. first reaction* and *anaesthesia vs. extubation* were analysed with the prediction probability (1). Moreover, we calculated the prediction probability to differentiate between two interesting nuances of anaesthetic states: *loss of response vs. first reaction*.

Results and Discussions: Only BIS™ showed a high prediction probability for all investigated steps of anaesthesia ($P_K > 0.9$). SE and RE showed a high prediction probability ($P_K > 0.9$) for the steps *awake vs. loss of response*, *awake vs. anaesthesia*, *anaesthesia vs. extubation* and a lower prediction probability ($P_K > 0.8$) for the step *anaesthesia vs. first reaction*. SE, RE and BIS™ failed to differentiate the nuances of anaesthesia ($P_K < 0.7$). SE, RE and BIS™ were

superior to mean arterial blood pressure and heart rate to distinguish between the investigated steps of anaesthesia with propofol and remifentanyl.

Conclusion(s): Datex-Ohmeda Entropy™ Module and BIS™ provided useful additional information for the anaesthesiologist.

Reference:

- 1 Smith WD, Dutton RC, Smith NT. *Anesthesiology* 1996; 84: 38–51.

A-127

The impact of the post-auricular response on the AAI

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Background and Goal of Study: The A-Line® ARX index (AAI) is calculated from the 20- to 80-ms window of the AEP. The 20-ms start of the window was chosen by the inventor not to include artefacts of the post-auricular reflex (PAR) (1). The aim of the study was to determine if the AAI might be affected by the PAR in spite of this chosen window, because the PAR is a muscle action potential (2) and may therefore be reduced by muscle relaxants.

Materials and Methods: Following institutional review board approval and written informed consent 10 healthy volunteers were asked to lie comfortable, but alert on a couch. Alertness was controlled 20 min after recording-start in 5 min periods by asking the subject with a silent voice to move a limb. We made three recordings of 41 ± 1 min duration from each subject (A-line AEP monitor, Version 1.4, Danmeter). We averaged 725 blocks of 1024 sweeps from 30 measurements. The size of the PAR of each block was automatically determined with a self-written program in Matlab® (Natick, MA, USA).

Results and Discussions: The correlation between the size of the PAR and AAI of the according period was 0.69 in all ($n = 30$) recordings. However, in 11 measurements we could find a correlation ≥ 0.75 (range 77–99).

Conclusions: The PAR might affect the size of the AAI. This may explain incomplete sensitivity and specificity of the AAI in paralyzed patients (3).

References:

- 1 Litvan H, Jensen EW, Galan J et al. *Anesthesiology* 2002;351–8.
- 2 O'Beirne GA, Patuzzi RB. *Hear Res* 1999;138(1–2):115–32.
- 3 Ge SJ, Zhuang XL, Wang YT, et al. *Acta Anaesthesiol Scand* 2003;47(4):466–71.

A-128

Comparative effects of a bolus of ketamine on Bispectral Index and Spectral Entropy of the EEG during sevoflurane anaesthesia

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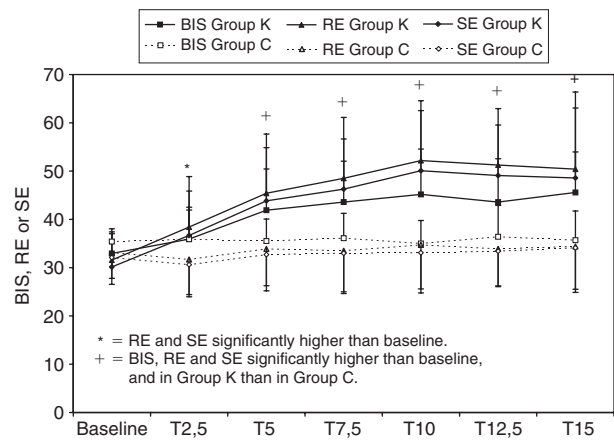
University Dpt of Anaesthesia and ICM, CHR de la Citadelle, Liege, Belgium

Background and Goal of Study: Bispectral Index (BIS) and Spectral Entropy (E) are proposed to monitor the depth of anaesthesia. This study compared the effect of ketamine on BIS and E during sevoflurane anaesthesia.

Methods: After IEC approval, 23 consenting women undergoing gynaecological surgery were enrolled in this double blind study. Anaesthesia was induced with propofol, sufentanil and rocuronium, and maintained with 1 MAC sevoflurane in air/O₂. Patients were randomly assigned to receive either ketamine 0.5 mg/kg (GK) or normal saline (NS) (GC) under stable surgical conditions. Blood pressure, heart rate, BIS, response (RE) and state (SE) entropy were recorded from 10 min. before ketamine or NS administration (baseline) and every 2.5 min thereafter (T2.5, T5, T7.5 T10, T12.5 and T15). Data (mean \pm SD) were analysed using twoway mixed-design ANOVA's. Maximum relative increases of BIS, RE or SE (% of baseline) were compared using Bonferroni corrected Wilcoxon. $P < 0.05$ was considered statistically significant.

Results: Demographic data and ASA status were similar in both groups. Ketamine compared to NS provoked a significant increase in BIS, RE and SE from T2.5 (RE and SE) or T5 (BIS), and thereafter. BIS, RE and SE were also significantly higher in GK than in GC from T5 to T15. The maximum relative increase of RE ($42.2 \pm 10.4\%$) and SE ($41.6 \pm 10.9\%$) was significantly higher than that of BIS ($29.4 \pm 10.4\%$). Haemodynamic parameters did not change and were similar in both groups.

Conclusions: Under sevoflurane anaesthesia, ketamine causes a significant increase in RE and SE, proportionally greater than the increase in BIS. Ketamine may confound BIS, RE and SE as indices of the depth of anaesthesia.



A-129

Comparing the suppression ratio (SR) of the BIS-XP monitor with the suppression ratio of the electroencephalogram (RS/EEG) in severe head injured patients treated by barbiturate

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Background and Goal of Study: Severe head injured patients (SHI) with high intracranial pressure are treated by barbiturates in order to obtain a burst suppressed electro-encephalography (EEG). The BIS-XP® (Aspect Medical Systems) monitor gives real time data from the EEG: the BIS and the SR (suppression ratio). The aim of this study was to assess the relationship between the SR and the percentage of suppression time on the EEG (SR/EEG) in SHI patients treated by barbiturates.

Materials and Methods: Consecutive SHI patients treated by barbiturates in our intensive care unit have been prospectively included from May to October 2003. Digitalized EEG were recorded once a day for one hour and read by a neurologist. Every five minutes, one minute of data was used to record the percentage of electrical silences (SR/EEG). At the same time, SR were recorded on the BIS-XP® monitor. The relationship between these 2 values were studied with a correlation test and a graphical representation according to Bland and Altman method.

Results and Discussions: 12 patients have been studied: 31 EEG (1 to 4 examinations per patient; 575 values kept for analysis). There was a strong correlation between SR and SR/EEG: correlation coefficient of 0.97; $p < 0.0001$.

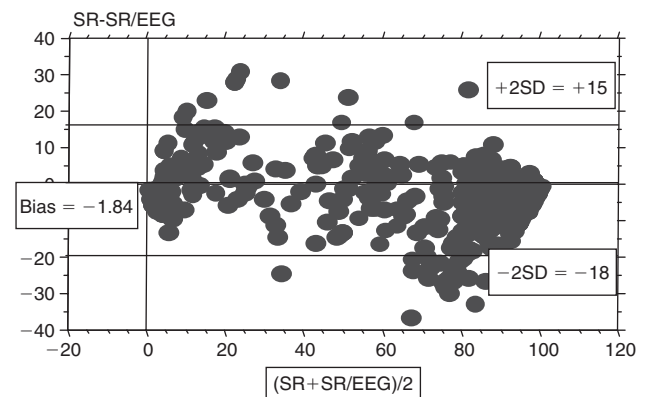


Figure 1. Difference against mean for SR data (average bias = -1.84 ; standard deviation $SD = 8.47$).

Conclusion: BIS-XP® has been tested in normal patients under anaesthesia; this study shows that for SHI, the SR of BIS-XP® monitor is a good estimate for SR/EEG despite limits in agreement of 17%. A study of EEG is being carried out to analyse patients whose biases were very large.

A-130

Combined use of Bispectral Index and A-Line Autoregressive Index for assessing adequacy of analgesia in patients undergoing lumbar arthrodesis

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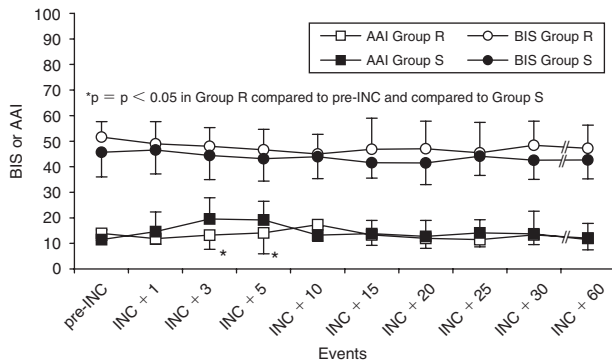
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Background and Goal of Study: Assessment of analgesia is still a matter of concern. We evaluated the use of Bispectral Index™ (BIS) and A-Line™ Autoregressive Index (AAI) during lumbar arthrodesis surgery.

Patients and Methods: After IEC approval, an epidural catheter was inserted (L1–L2 level) in 20 consenting patients randomly allocated to receive either 15 ml 0.2% ropivacaine + 75 µg clonidine (GR, n = 10) or 15 ml NS (GS, n = 10). Anaesthesia was then induced with propofol, remifentanil infusion and cis-atracurium. Remifentanil was stopped 2 min after tracheal intubation. Maintenance was achieved with sevoflurane vaporised in air/O₂ to keep the BIS around 50. Mean blood pressure (MBP), BIS, and AAI were recorded continuously. End tidal concentration of sevoflurane (Etsevo) was recorded every 5 min. Analysis was performed on averaged values during the following periods: before incision (pre-INC: from 11 min after stopping remifentanil to incision), 1, 3, 5 and every 5 min to 60 min after incision (INC + 1, ..., INC + 60: 2 min period averaging). Student t tests, χ^2 tests and twoway ANOVA's were used. $p < 0.05$ was considered significant.

Results: Demographic data and length of surgery were similar in both groups. No difference was observed in BIS within or between groups throughout the study. AAI significantly increased in GS at INC + 3 and INC + 5 compared to pre-INC, and was also significantly higher in GS than in GR at those times. MBP was significantly higher in GS than in GR throughout the study. Etsevo concentration tended to be higher in GS than in GR.

Conclusions: During BIS-guided anaesthesia, AAI increased at the onset of surgical painful stimulation in patients who did not receive epidural analgesia. Those results suggest that AAI could reflect the analgesic state.



A-131

Effect of intravenous magnesium sulphate administration on bispectral index during propofol–remifentanil anaesthesia: preliminary results

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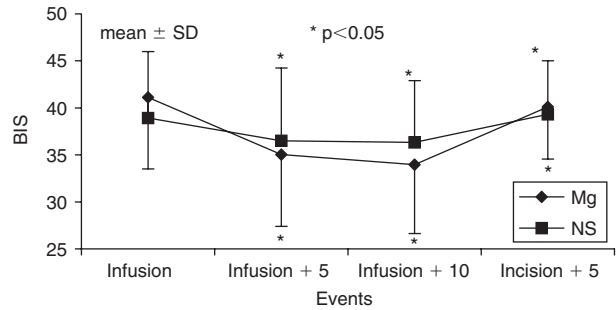
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Background and Goal of Study: Magnesium sulphate (MgS) has been shown to reduce propofol requirements during surgery, leading to higher observed BIS values¹. We investigated the effect of MgS on BIS under general anaesthesia at a constant blood propofol concentration.

Patients and Methods: After IEC approval, 22 consenting surgical patients were studied. Anaesthesia was induced and maintained with propofol (TCI) to achieve a 3 µg/ml blood concentration, and remifentanil infused at a rate of 0.25 µg/kg/min. Intubation was facilitated with rocuronium. Patients were ventilated with N₂O and O₂ (FiO₂ = 0.4) and randomly divided into two groups of 11 patients each, to receive either 5 g of MgS in 250 ml normal saline (NS) (Mg group) or the same volume of NS (Control group) over 15 min before skin incision. Arterial hypotension was treated with boluses of 5 mg ephedrine. BIS values were recorded every min and averaged over 5 min periods from the beginning of MgS or NS infusion till 5 min after skin incision. Data were analysed using two-way mixed design ANOVA. $P < 0.05$ was considered statistically significant. An α value of 0.005 (Bonferroni correction) and a relevant difference in mean BIS value of 10 were chosen for power calculations.

Results: Demographic data were similar in both groups. BIS decreased significantly from the beginning of infusion to skin incision and increased

significantly thereafter in both groups. No difference in BIS was observed between the two groups. The power of this study was 0.73.



Discussion: MgS by itself does not seem to affect BIS at constant blood propofol concentration and remifentanil infusion rate. A deep level of anaesthesia could account for this absence of effect. Thirty-two patients would be necessary to increase the study power to more than 0.9.

Reference:

- 1 Choi JC et al. Anesthesiology 2002, 97: 1137–41.

A-132

The EEG-based SNAP index: as useful as the BIS index in monitoring depth of anaesthesia?

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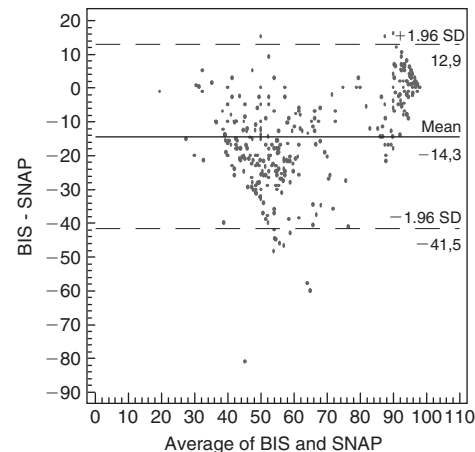
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Background: The Bispectral index correlates with the depth of anaesthesia and the range 40–60 with the adequate level for surgery¹. The SNAP™ monitor additionally analyzes ultra-high EEG frequencies, theoretically improving responsiveness during induction and emergence. We studied the behaviour and capability of the SNAP index to monitor the depth of anaesthesia by comparison with the BIS index.

Methods: 70 adult patients ASA I–III allocated to two groups regarding the maintenance technique (TIVA versus halogen agent). Electrodes were placed on the right (BIS) and left (SNAP) temporofrontal area. Induction consisted of propofol, fentanyl and rocuronium followed by propofol or sevoflurane–N₂O for maintenance. Values were recorded before induction, after intubation, after the surgical incision and at the following 10, 30 and 50 minutes, emergence and extubation. The R of Pearson compared data pairs and the Bland-Altman test mean values.

Results: Data (mean ± SD) and statistics are shown below.

	BIS	SNAP
Baseline	95'4 ± 3	91'0 ± 5
Postintb	35'5 ± 9	58'9 ± 15
Postincis	40'7 ± 8	60'1 ± 13
10 min	40'3 ± 6	60'1 ± 9
30 min	43'8 ± 11	61'8 ± 11
50 min	45'5 ± 9	63'6 ± 10
Awaken	82'0 ± 13	89'3 ± 11
Extubat	91'2 ± 6	94'8 ± 3



The Pearson correlation for both maintenance techniques was 0.82 ($p < 0.05$). The calculated linear correlation was: $\text{SNAP} = 36.4 \pm 0.61 \text{ BIS}$. **Conclusions:** The SNAP index correlates with changes in the hypnotic component of anaesthesia during both TIVA and sevoflurane- N_2O anaesthesia when compared with the BIS index, with the range 58–70 equivalent to the BIS range 40–60.

Reference:

- 1 Struys M et al. *Anaesthesia* 1998; 53:4–12.

A-133**Spectral Entropy and bispectral index as measures of the EEG effects of sevoflurane**

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Background and Goal of Study: Recently entropy algorithms have been proposed as EEG measures of anesthetic drug effect [1]. Datex-Ohmeda introduced an entropy module, a new EEG monitor designed for measuring depth of anaesthesia. Based on a time-frequency balanced spectral entropy the monitor calculates a State Entropy (SE) computed over the frequency range from 0.8 to 32 Hz reflecting the EEG-dominant part of the spectrum. In addition a Response Entropy (RE) is computed over the frequency range of 0.8 to 47 Hz, including both the EEG and EMG-dominant part of the spectrum. We investigated the dose response relationship of state entropy and response entropy during sevoflurane anaesthesia in comparison with bispectral index (BIS).

Materials and Methods: 16 Patients (ASA I–II) were studied without surgical stimulus. Frontal electrodes for the BIS and Entropy monitor were positioned as recommended by the manufacturers. Anaesthesia was induced by sevoflurane inhalation with a tight fitting facemask. Data were automatically recorded every 5 sec. Sevoflurane concentrations were increased systematically until substantial burst suppression occurred and subsequently decreased and increased twice until the measurement was stopped and patients were intubated for surgery. The performance of state entropy, response entropy and bispectral index to predict the sevoflurane effect compartment concentration, obtained from the sevoflurane end tidal concentrations using a k_{e0} of 0.29 [2], were compared.

Results and Discussions: State entropy, response entropy and bispectral index decreased continuously over the observed concentration range of sevoflurane. The performance of the entropy parameters (prediction probability [3] $PK = 0.83 \pm 0.06$ for SE and 0.82 ± 0.07 for RE) as indicators for sevoflurane effect site concentrations was similar to BIS ($PK = 0.80 \pm 0.06$).

Conclusion: State entropy and response entropy appear to be useful EEG measures of sevoflurane drug effect.

References:

- 1 Bruhn J., Ropke H., Hoefft A., *Anesthesiology*, 2000; 92(3):715–26.
- 2 Rehberg B., Bouillon T., Zinslerling J. et al, *Anesthesiology*, 1999; 91(2):397–405.
- 3 Smith W.D., Dutton R.C., Smith N., *Anesthesiology*, 1996; 84(1):38–51.

A-134**Is there cortical electrical activity after cardiac arrest? Apparent contradictory results between BIS and ENTROPY**

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Background and Goal of Study: EEG is considered the gold standard for the diagnosis of brain death. The Bispectral Index, derived from the EEG signal (BIS™), has also been proposed for this purpose¹. ENTROPY™ is a non invasive technique based on the analysis of the EEG signal. The State Entropy (SE) is computed over the frequency range from 0.8 Hz to 32 Hz. It includes the EEG-dominant part of the spectrum, and therefore primarily reflects the cortical state of the patient. The Response Entropy (RE) is computed over a frequency range from 0.8 Hz to 47 Hz, and includes both the EEG-dominant and EMG-dominant part of the spectrum. Both BIS™ and ENTROPY™ reflect cortical electric activity. Our aim has been to assess the utility of ENTROPY™ for the diagnosis of brain death after cardiac arrest.

Materials and Methods: An ENTROPY™ and a BIS™ sensor were placed on the forehead of five consecutive dying patients admitted to our ICU. The SE, RE and the burst suppression ratio (BSR) from the ENTROPY™, as well as the BIS number and the suppression rate, were collected every 10 minutes after cardiac arrest was documented until the SE, RE and the BIS number were 0.

Results and Discussion: While the BIS number decreased to 0 immediately after cardiac arrest, the SE and the RE required a mean time of 61 min (range

40–95). Similarly, the suppression rate observed in the BIS monitor rose rapidly to 100, but the BSR only reached this value in three patients at the end of the study. This finding may be related to the presence of remaining electroencephalographic activity after clinical diagnosis of brain-stem death². This activity is detected by the ENTROPY™ but not by the BIS™, as this algorithm was developed to maximize the clinical and electroencephalographic correlation.

Conclusions: BIS can be used for the assessment of death after cardiac arrest, but does not exclude the presence of residual electric activity.

References:

- 1 Vivien B, Paqueron X, Le Cosquer P, et al. *Intensive Care Med* 2002;28:419–25.
- 2 Grigg MM, Kelly MA, Celesia GG, et al. *Arch Neurol* 1987;44:948–54.

A-135**Narcotrend may not differentiate between conscious and unconscious surgical patients**

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Background and Goal of Study: Narcotrend index is a dimensionless number between 0 and 100 which is calculated from the EEG and marketed as a monitor of depth of sedation and hypnosis during anaesthesia. We calculated prediction probability of Narcotrend to separate consciousness from unconsciousness in surgical patients.

Materials and Methods: EEG data of 40 patients were analysed offline. Patients had been randomly assigned to receive: (1) sevoflurane (SEVO)/remifentanyl (REMI), ($\leq 0.1 \mu\text{g kg}^{-1} \text{min}^{-1}$), (2) SEVO/REMI ($\geq 0.2 \mu\text{g kg}^{-1} \text{min}^{-1}$), (3) propofol (PRO)/REMI ($\leq 0.1 \mu\text{g kg}^{-1} \text{min}^{-1}$), (4) PRO/REMI ($\geq 0.2 \mu\text{g kg}^{-1} \text{min}^{-1}$). Patients were asked every 30 sec. to squeeze the investigator's hand. REMI and SEVO or PRO were given until loss of response to command (LOC1). Tunstall's isolated forearm technique [1] was used during succinylcholine administration and tracheal intubation. PRO or SEVO were stopped until return response to command (ROC1). PRO or SEVO were restarted to induce LOC2. After surgery, drugs were discontinued and ROC2 occurred. Narcotrend values at LOC1, ROC1, LOC2 and ROC2 were compared with each other and groups 1–4 were compared (GLM repeated measurement analysis). Prediction probability (P_k) [2] was calculated from values at the last command before and at LOC and ROC.

Results and Discussions: One data set from ROC1 and LOC2 was missing due to data file corruption. At 105 of 316 time points, Narcotrend did not calculate an index, and the closest calculated value (time delay between 3 and 563 sec.) was analysed. This reduced the number of missing values to 15. We did not find significant differences between LOC and ROC, but in group 1, values were significantly higher than in group 3. P_k was 0.501 (SE: 0.033).

Conclusion(s): (1) Narcotrend differentiated between consciousness and unconsciousness not better than a random process; (2) Narcotrend was not independent from the drug regimen.

References:

- 1 Tunstall ME *BMJ* 1977; 1: 1321.
- 2 Smith WD, Dutton RC, Smith NT *Anesthesiology* 1996; 84: 38–51.

Acknowledgements: The authors thank the Technische Universität München (KKF 8768170) and B. Braun AG, Melsungen, Germany for financial support.

A-136**Influence of electromyographic activity (EMG) on currently used monitors of hypnotic depth. Sudden drop in Bispectral- (BIS XP), Alaris AEP- (AAI) and Narcotrend Index (NTI) after Succinylcholin**

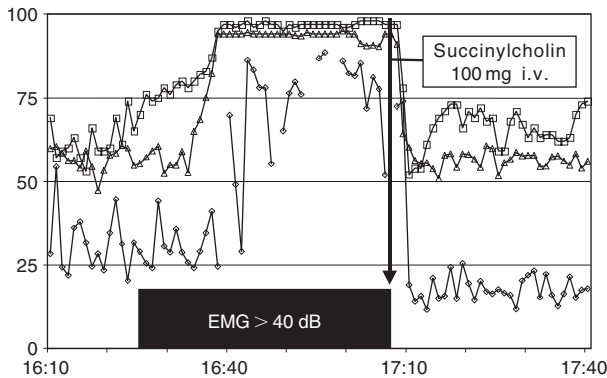
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Background: The importance of integrating high frequency EEG waves ($>30 \text{ Hz}$, "gamma frequency band") when monitoring cerebral activity to determine the hypnotic state of sedated or anesthetized patients has recently been pointed out¹. In the ICU, thermoregulatory muscular activity not clinically visible may lead to high EMG especially in hypothermic post-operative patients^{2,3}. EMG may hardly be distinguished from true EEG activity leading to falsely high hypnotic depth indices¹.

Methods: After approval of IRB and informed consent, 11 patients (mean \pm SD: 59 \pm 12 yrs, 74 \pm 14 kg, sex: f/m = 5/6) after major operations were sedated with Desflurane (Suprane®, Baxter Germany, Erlangen) and

ventilated in our ICU. Patients were monitored with BIS XP (Aspect Medical Systems, Leiden, Netherlands), Alaris AEP Monitor (Alaris Medical Systems, Gießen, Germany), and Narcotrend (MonitorTechnik, Bad Bramsted, Germany).



Results: Patients were monitored with BIS/AAI/NTI during 99/93/91% of total sedation time (46.4 h). Indices were displayed during 98/90/71%. A high EMG > 40 dB was displayed by the BIS monitor during 23% of sedation time, coinciding with falsely high BIS (□), AAI (△) and NTI (◇) as depicted in the figure: After 43 min of high EMG in a patient unresponsive to painful stimuli, succinylcholin was injected and all indices dropped down to realistic values.

Conclusions: In the intensive care setting hypnotic depth monitors should display EMG activity. If this is elevated, high indices should be interpreted with caution.

References:

- 1 Sleigh J W et al. *Brit J Anaesth* 86:50–8.
- 2 Meiser A et al. *Brit J Anaesth* 90:273–80.
- 3 Riess M L et al. *Eur J Anaesthesiol* 19:1–18.

A-137

Comparative evaluation of Narcotrend, BIS and classical EEG parameters during induction, maintenance and emergence of a propofol/remifentanyl anaesthesia

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Background and Goal of Study: New monitor systems were developed to measure the depth of anaesthesia. The aim of the present study is to compare the abilities of the new Narcotrend™ (1) with the Bispectral Index™ (BIS™, 2) electroencephalographic system during a standardized anaesthetic regime with propofol and remifentanyl.

Materials and Methods: Following IRB approval we investigated 26 patients undergoing laminectomy. Investigated states of anaesthesia were: awake, loss of response, steady state anaesthesia, first reaction and extubation during emergence. Narcotrend™, BIS™, spectral edge frequency, median frequency, relative power in delta, theta, alpha, beta and hemodynamics were recorded simultaneously. The ability of all parameters to distinguish between awake vs. loss of response, awake vs. loss of eyelash, awake vs. steady state anaesthesia, steady state anaesthesia vs. first reaction and extubation were analysed with the prediction probability (P_K , 3). Effects of remifentanyl during propofol infusion were investigated with Friedman's and post hoc with Wilcoxon's test.

Results and Discussions: Only Narcotrend™ and BIS™ were able to distinguish all investigated states accurately with a $P_K > 0.95$. After start of remifentanyl infusion only hemodynamics changed statistical significantly ($P < 0.05$).

Conclusion(s): Narcotrend™ and BIS™ are more reliable indicators for the assessment of anaesthetic states than classical electroencephalographic parameters and hemodynamics, whereas the analgesic potency of depth of anaesthesia could not be detected by Narcotrend™ and BIS™.

References:

- 1 Schultz B, Grouven U, Schultz A. *Biomed Tech (Berl)* 2002; 47: 9–13.
- 2 Rampil I. *Anesthesiology* 1998; 89: 980–1002.
- 3 Smith WD, Dutton RC, Smith NT. *Anesthesiology* 1996; 84: 38–51.

A-139

Use of ENTROPY to assess depth of sedation in postoperative patients

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Background and Goal of Study: Sedation is commonly required by ICU patients. However, sedation is rarely monitored, exposing these patients to potentially deleterious complications¹. Traditionally, the monitoring of sedation has been performed by means of subjective scales, but in the last years different devices, such as the Bispectral index (BIS™) have been proposed for this purpose. ENTROPY™ is a new monitor based on the analysis of the EEG signal². The State Entropy (SE) is computed over the frequency range from 0.8 Hz to 32 Hz and primarily reflects the cortical state of the patient. The Response Entropy (RE) is computed over a frequency range from 0.8 Hz to 47 Hz, and includes both the EEG-dominant and EMG-dominant part of the spectrum. Our aim has been to evaluate the depth of sedation in intubated critically ill patients by means of the Ramsay sedation score, BIS™ and ENTROPY™ (SE), and to analyze the correlation between these variables.

Methods: Sedation was assessed prospectively in 26 non-paralysed post-operative intubated patients 1 hour after admission to the ICU. A 5 min steady-state period (absence of any kind of stimulation) was allowed before each assessment. Sedation agents were propofol or midazolam/fentanyl according to the expected duration of treatment.

Results: Mean values for SE and BIS were 62 ± 25 and 72 ± 22 respectively. The median value for the Ramsay was 4 (range 2–6). A significant correlation was found between the three variables (SE-BIS: $\rho = 0.71$, $p < 0.001$; SE-Ramsay: $\rho = -0.653$, $p > 0.001$; BIS-Ramsay: $\rho = -0.73$, $p < 0.001$).

Conclusions: ENTROPY™ may be useful for the assessment of sedation in ICU patients as compared to the Bispectral index and the Ramsay scale.

References:

- 1 HM Soliman, C Mélot, J-L Vincent. *Br J Anaesth* 2001;87:186–92.
- 2 J Bruhn, H Röpcke, A Hoefl. *Anesthesiology* 2000;92:715–26.

A-140

Depth of anaesthesia: A clinical study comparing Entropy and BIS in cardiac surgery patients during cardiopulmonary bypass

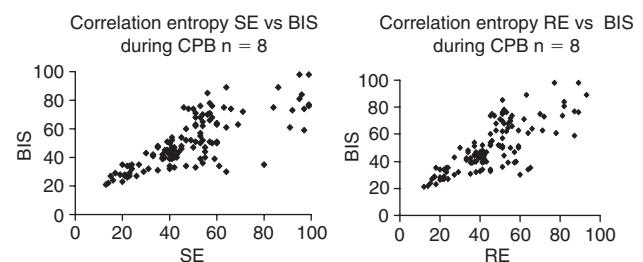
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Background and Goal of Study: During cardiopulmonary bypass (CPB) for cardiac surgery, most clinical signs of anaesthetic depth are not reliable (1, 2). In this study we compared two anaesthetic depth monitors BIS (bispectral index) and an Entropy monitor yielding both "State Entropy" (SE) and "Response Entropy" (RE).

Materials and Methods: Eight patients (age 54–82, weight 75–115) were monitored during CPB. Induction with fentanyl and midazolam, maintenance with sevoflurane until CPB during which propofol was infused. BIS and Entropy (RE & SE) indices were registered every 5 minutes during CPB (BIS Aspect 2000 ver.3.3; Entropy M-Entropy Module S/5™, Datex-Ohmeda). Registrations were blinded to the anaesthetist.

Results and Discussions: The figures show all simultaneous BIS and entropy measurements during CPB. Although there was good agreement between BIS and Entropy, a wide variation in indices were observed during this critical period of anaesthesia. Anaesthesia was clinically considered adequate, no signs of awareness were noted, and no patients had any post-operative recall. There was no variation with time (data not shown).



Conclusion: BIS and Entropy indices show good agreement, however both methods show a wide range of values indicating episodes of light anaesthesia even in the absence of clinical signs of awareness during cardiopulmonary bypass.

References:

- 1 Bruhn J. *Anesthesiology* 2003; 98:621–7.
- 2 Johansen J. *Anesthesiology* 2000; 93:1336–44.

A-141

Alaris AEP or BIS monitoring during desflurane–remifentanyl anaesthesia – a comparison with a standard practice group

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Background: The BIS monitor (Aspect, USA) is currently the standard device used to assess the depth of anaesthesia and was shown to reduce drug consumption and shorten recovery times. The Alaris AEP monitor (Alaris, UK, version 1.4) is the first commercially available auditory evoked potential (AEP) monitor designed to measure the depth of anaesthesia. It generates an “Alaris AEP index” (AAI) which is a dimensionless number scaled from 100 (awake) to 0. This study was designed to investigate the impact of AAI or BIS monitoring on recovery times when compared to standard anaesthetic practice.

Methods: With IRB approval and written informed consent 200 adult patients who underwent minor surgical procedures were randomised to receive a desflurane–remifentanyl anaesthetic controlled either by AAI or by BIS or solely by clinical parameters. Anaesthesia was induced with 0.4 µg/kg/min remifentanyl and 2 mg/kg propofol. After intubation remifentanyl was infused at a constant rate of 0.2 µg/kg/min whereas desflurane in 1.5 l/min O₂/air was adjusted according to clinical parameters (e.g. heart rate, blood pressure, movements) or target values: during maintenance of anaesthesia to a value of “30” (AAI) or “50” (BIS), 15 min before the end of surgery to “45” (AAI) or “60” (BIS), whereas in the standard practice group desflurane was controlled according to clinical parameters (e.g. heart rate, blood pressure, movements). Recovery times were recorded by a blinded investigator. Statistics: ANOVA with *P < 0.05, data are mean ± SD.

Results: The groups were comparable for demographic data, duration of anaesthesia and mean remifentanyl dosages.

	Standard practice	BIS	AAI
Desflurane vol%	2.9 ± 0.5	3.3 ± 0.9	2.6 ± 0.5
Open eyes (min)	5.6 ± 2.5	5.9 ± 3.4	5.0 ± 3.1
Extubation (min)	6.3 ± 2.4	6.6 ± 3.5	5.6 ± 3.0
Calling name (min)	7.3 ± 2.4	7.6 ± 3.5	7.3 ± 6.6

Conclusions: Compared to standard anaesthetic practice AAI and BIS monitoring do not result in a reduction of recovery times. This is best explained by the low tissue solubility and rapid wash-out of desflurane.

A-142

A comparison of state and response entropy and bispectral index values during induction of anaesthesia and mild hypothermic cardiopulmonary bypass

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Background and Goal of Study: The concept of state entropy (SE) and response entropy (RE) as a quantitative EEG derived index has been recently introduced into clinical practice as a monitor for assessing consciousness during sedation and general anaesthesia [1]. While SE includes only the EEG dominant part of the EEG frequency spectrum, RE includes the frequencies generated by the electromyogram (EMG) as well. This observational study was designed to compare SE and RE with the bispectral index (BIS) with respect to their values during induction of anaesthesia, as well as to assess changes in their respective values during cooling after initiation of the cardiopulmonary bypass (CPB).

Materials and Methods: After IRB approval, 44 ASA III patients scheduled for elective cardiopulmonary bypass grafting (CABG) were enrolled in the study. Induction of anaesthesia was performed standardized with 2 ml kg⁻¹ propofol and 0.5 µg kg⁻¹ sufentanil, and maintenance was adjusted to achieve a BIS level between 40 and 50. Comparative SE, RE and BIS values were obtained at baseline and at specific time intervals during the induction, maintenance, cooling and rewarming period.

Results and Discussions: Correlation analysis showed a significant correlation between BIS and SE ($r = 0.883$, $p < 0.01$), between BIS and RE ($r = 0.886$, $p < 0.01$), and between RE and SE ($r = 0.986$, $p < 0.001$) during induction of anaesthesia. In contrast, during cooling and rewarming there was no correlation between BIS and neither RE and SE. Comparing the values before and after cooling and during rewarming, BIS, SE and RE showed no significant temperature related difference. RE was significant ($p < 0.05$) higher than SE throughout anaesthesia.

Conclusion(s): SE and RE could be a useful alternative to BIS for assessing the level of consciousness during induction of anaesthesia. However, since clinical endpoints for SE and RE values are still lacking, further studies are necessary. Higher RE values suggest EMG activity throughout anaesthesia.

Reference:

1 IEEE Trans Biomed Eng. 1998;45(9):1186–91.

A-143

SNAP index and Bispectral Index during propofol/remifentanyl anaesthesia

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Background and Goal of Study: Monitoring “depth of anaesthesia” is of enormous clinical interest to increase the safety of the patient and to reduce costs by avoiding drug overdosing. The recently developed SNAP™ electroencephalogram monitor is now commercially available, which analyses the low (0–20 Hz) and high (80–420 Hz) frequency components of the electroencephalographic signal to produce a derived measurement (SNAP™ index). The aim of the present study was to compare the accuracy of the new SNAP™ Index with the Bispectral Index™ (BIS™, 1) to distinguish different states of propofol/remifentanyl anaesthesia.

Materials and Methods: Following IRB approval and written informed consent we investigate 19 female patients during minor gynaecologic surgery. The ability of SNAP™ Index, BIS™, spectral edge frequency, mean arterial blood pressure and heart rate to distinguish between the steps of anaesthesia: *awake vs. loss of response, awake vs. anaesthesia, anaesthesia vs. first reaction and anaesthesia vs. extubation* were analysed with the prediction probability (P_K , 2). Moreover, we calculated the P_K to differentiate between two interesting nuances of anaesthetic states: *loss of response vs. first reaction*.

Results and Discussions: Only BIS™ showed no overlap between the investigated steps during anaesthesia ($P_K = 1.0$). Both SNAP™ Index and BIS™ failed to differentiate the nuances of anaesthesia (*loss of response vs. first reaction*; $P_K < 0.72$). SNAP™ Index and BIS™ were superior to mean arterial blood pressure and heart rate and spectral edge frequency to distinguish between different steps of anaesthesia with propofol and remifentanyl ($P < 0.05$).

Conclusion(s): SNAP™ Index and BIS™ provided useful additional information for the anaesthesiologist.

References:

1 Rampil I. Anesthesiology 1998; 89: 980–1002.
2 Smith WD, Dutton RC, Smith NT. Anesthesiology 1996; 84: 38–51.

A-144

Assessment of benzodiazepine-induced sedation using bispectral index monitoring

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Background and Goal of Study: Benzodiazepines are considered to be the golden standard of oral premedication because of their sedative and anxiolytic properties (1). Bispectral index (BIS) has been reported to be an objective monitoring of sedation (2). Our aim was to objectively assess the sedative properties of oral benzodiazepine premedication with BIS monitoring.

Materials and Methods: We studied 49 surgical patients in a randomized, prospective, placebo-controlled, double-blinded setting. We recorded demographic data, ASA status and BIS (BIS XP, Aspect Medical Systems, Natick MA, USA) in a standardized manner at baseline (evening before operation), morning baseline before administration of premedication/placebo (morning) and 1 and 2 hours after premedication/placebo, respectively (T1, T2). All Patients received 50 mg chlorazepate dipotassium (CD) at 10 pm after baseline measurement. Patients were randomized to one of the following groups: Group I received 25 mg CD at 7 am, group II received placebo. Statistics were performed using the Mann-Whitney-U-Test and Wilcoxon’s signed rank test

Results and Discussions: Both groups had a significantly lowered BIS at morning, T1 and T2 compared to baseline. Group I had lower BIS values than group II at T1 and T2. There were no significant differences in demographic data or ASA status.

Table 1. BIS values at different times (mean ± SD).

Groups	Baseline	Morning	T1	T2
I	95 ± 3.8	91 ± 6.6	90 ± 5.4*	87 ± 7*
II	96 ± 2.7	94 ± 3.9	93 ± 4.3	91 ± 6.3

* $p < 0,05$ between groups.

Conclusions: (1) BIS-Monitoring is able to detect sedation caused by CD. (2) Sedation caused by 50 mg CD lasts until next day. (3) Sedation level is significantly higher when supplemented at the morning of operation day, indicating a more comfortable time waiting for the operation.

References:

- 1 Anaesthetist 1996; 45: 1–8.
- 2 Hirota K. et al. Eur J Anaesthesiol 1999; 19: 516–518.

A-145

Bispectral Index (BIS) and Entropy monitoring differ in classification of depth of anaesthesia

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Background and Goals: The present study aimed to compare bispectral index (BIS) (1) and Entropy (SE, RE) (2) based monitoring of depth of anaesthesia in the same patient in a routine clinical setting.

Materials and Methods: Patients (n = 34) scheduled for elective minor gynaecological surgery were anaesthetized with propofol and remifentanyl. Simultaneous monitoring of BIS and Entropy started in each patient at 3 minutes before induction of anaesthesia and continued till discharge of the patient to the post anaesthesia care unit.

Results: During uneventful anaesthesia (n = 28) BIS values indicated deep anaesthesia more frequently than Entropy (SE, RE) values. In patients (n = 6) with accidental movement due to surgical stimulus Entropy but less BIS values shifted to flat anaesthesia. Neither Entropy nor BIS values, however, were able to predict accidental movement.

	Deep anaesthesia (<40)	Optimal anaesthesia (40–60)	Flat anaesthesia (>60)
(n = 28), Uneventful			
BIS	73%	25%	3%
RE	45%	50%	6%
SE	54%	43%	2%
(n = 6), Movement			
BIS	42%	45%	14%
RE	26%	36%	38%
SE	30%	51%	19%

Conclusion: During uneventful anaesthesia BIS and Entropy differed in classification of depth of anaesthesia. In patients with accidental movement Entropy values shifted more pronounced to flat anaesthesia than did BIS values. Prediction of movement, however, cannot be expected from BIS or Entropy monitoring.

References:

- 1 Kreuer S. *Br J Anaesthesiology* 2003; 91(3): 336–340.
- 2 Bruhn J. *Anesthesiology*; 2001; 95: 30–35.

A-146

Auditory evoked potentials (AEP) and Entropy monitoring differ in classification of depth of anaesthesia and prediction of accidental movement

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Background and Goals: The present study aimed to compare auditory evoked potentials (AEP) (1) and Entropy (SE, RE) (2) based monitoring of depth of anaesthesia in the same patient in a routine clinical setting.

Materials and Methods: Patients (n = 33) scheduled for elective minor gynaecological surgery were anaesthetized with propofol and remifentanyl. Simultaneous monitoring of AEP and Entropy started in each patient at 3 minutes before induction of anaesthesia and continued till discharge of the patient to the postanesthesia care unit.

Results: During uneventful anaesthesia (n = 27) 74% of AEP but 95% (RE) and 97% (SE) of Entropy values were classified as deep or optimal anaesthesia. In patients (n = 6) with accidental movement due to surgical stimulus AEP but less Entropy values shifted to flat anaesthesia. Furthermore, AEP but not Entropy values increased significantly at 60s prior to accidental movement.

	Deep	Optimal anaesthesia	Flat anaesthesia
	AEP < 15 SE, RE < 40	AEP 15–25 SE, RE 40–60	AEP > 25 SE, RE > 60
(n = 27), uneventful			
AEP	32%	42%	26%
RE	47%	49%	4%
SE	56%	41%	2%
(n = 6), movement			
AEP	21%	37%	43%
RE	26%	36%	38%
SE	30%	51%	19%

Conclusion: AEP and Entropy values differ in classification of uneventful anaesthesia. The increase of AEP values classified as flat anaesthesia in patients with accidental movement is more pronounced than that of Entropy values. Prediction of movement can be expected from AEP but not Entropy monitoring.

References:

- 1 Kurita T. *Anesthesiology* 2001; 95: 364–370.
- 2 Bruhn J. *Anesthesiology* 2001; 95: 30–35.

A-147

Interest of automated on line tonometry during mesenteric graft for chronic mesenteric ischemia

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Background and Goal of Study: Chronic mesenteric ischemia (CMI) is a rare disease (1/100000) in which the principle risk is the development of an acute form. To avoid such complication, surgical mesenteric revascularization is proposed. However, the lack of technique to assess gastrointestinal perfusion makes difficult the possibility to control the quality of the reperfusion. Automated on line tonometry by displaying semi-continuous measurement of gastric-to-end tidal partial pressure of carbon dioxide (Pr-etCO₂) has been reported as an index of gastrointestinal perfusion during surgery (1). This study aimed to evaluate the interest of automated on line tonometry (Tonocap®) during surgical treatment of CMI.

Materials and Methods: Eight patients undergoing mesenteric graft were consecutively analyzed. After anaesthesia induction, the tonometer was inserted into the stomach and was connected to the Tonocap® allowing the measurement of Pr-etCO₂ every 10 min. Pr-etCO₂, heart rate (HR), mean arterial pressure (MAP) were registered intra and postoperatively within the first 12 H. Data [median (quartile 25–75%)] were analyzed by using Wilcoxon test (after induction vs following times). Statistical significance was accepted at P < 0.05.

Results and Discussions: Seven men and 1 woman [58 (38–78) years] were operated on superior mesenteric graft. After anaesthesia induction, Pr-etCO₂ was already high reaching 31 (10–37) mmHg. These values increased significantly during aortic clamping [69 (31–71) mmHg] before to decrease at the end of surgery. At intensive care unit admission, Pr-etCO₂ was 12 (7–19) mmHg, but did not reach statistical significance when compared with values obtained after anaesthesia induction (p = 0.06). Pr-etCO₂ continued to decrease postoperatively with a median value at 10 (10–11) mmHg at the end of the study. The intra- and post-operative HR and MAP remained stable throughout the study.

Conclusion: In a rare disease as CMI, this study seems to demonstrate that automated on line tonometry could be useful to evaluate the quality of gastrointestinal reperfusion after mesenteric graft.

Reference:

- 1 Lebuffe et al. *Eur J Anaesthesiol* 2003, 20:147–152.

A-149

Depth of anaesthesia monitoring: a clinical study comparing BIS and AAI during heart surgery

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Background and Goal of Study: Developing a reliable depth of anaesthesia monitor, which quantifies with a simple numerical index the complex interaction between depressant anaesthetics/analgesics and noxious stimulation, has proven difficult. This study compares the anaesthetic depth indices BIS (bispectral index of passive EEG) and the A-line monitor based

on the mid-latency-auditory evoked response (AAI) in patients undergoing heart surgery with cardio-pulmonary bypass (CPB).

Materials and Methods: Ten patients (age 44–83, weight 72–96). Induction with fentanyl/midazolam, maintained with sevoflurane until CPB when propofol was infused. BIS and AAI were registered every 5 minutes during CPB (BIS Aspect 2000 version 3.3; A-line AEP monitor version 1.4, Danmeter), the anaesthetist being blinded as to the registration. BIS and AAI indices were classified as “good”, “moderate” or “poor” agreement.

Results and Discussions: A total of 126 duplicate recordings were made during CPB. AAI index showed a higher occurrence of low values while BIS is more evenly distributed over the full range (Figure 1). A majority (65%) of measurements showed “good”, while 31 (25%) “moderate” and 13 (10%) “poor” agreement (Table 1).

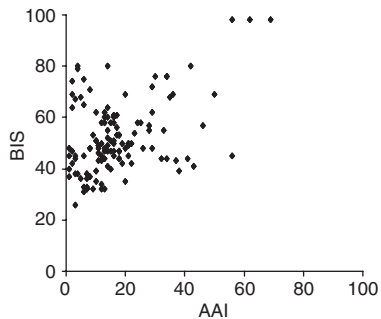


Figure 1.

Table 1.

	AAI < 10	AAI 10–25	AAI > 25
BIS < 40	17	4	2
BIS 40–60	10	52	12
BIS > 60	11	5	13

Conclusion: When BIS and AAI are recorded simultaneously during CPB, a high proportion of readings give contradictory information.

References:

- Johansen J, *Anesthesiology* 2000;93:1336–44.
- Jensen EW, *Methods of Information Medicine* 1996;35:256–60.

A-150

Auditory evoked potential changes in laparoscopic cholecystectomy

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Background and Goal of Study: Auditory evoked potential (AEP) was used to measure the level of consciousness during general anesthesia. Because hearing is the last sense that leaves and the first that returns during anesthesia. AEP is just the brain response to the click stimuli through the acoustic nerve. Low AEP means a considerable suppression is taking place caused by the effect of the anesthetics or something else. Carbon dioxide pneumoperitoneum had been widely discussed for the haemodynamic changes and vasopressin release, and we would like to know its influence in AEP.

Materials and Methods: Twenty-one ASA I or II patients scheduled for laparoscopic cholecystectomy were included in the study. General anesthesia was induced with Fentanyl 2 mg/kg and Pentothal 5 mg/kg. After loss of response to verbal commands, 0.5 mg/kg of Atracurium was given to facilitate intubation. Anesthesia was then maintained with 1 MAC of Sevoflurane. Data of AEP, NIBP, HR, ET_{CO}₂ were recorded, and ANOVA was utilized for statistics.

Results: Our patients were composited of ten men and eleven women, with a mean age of 56 years old (range 33–84) and a mean body weight of 70 kg (range 40–88). The mean duration of pneumoperitoneum was 40 minutes, (range 25–55). During CO₂ pneumoperitoneum, ET_{CO}₂ showed an increase from 26 to 35, and AEP changed from 12 to 9.

Conclusion: Though auditory evoked potential showed mild suppression while the end-tidal CO₂ increased during CO₂ pneumoperitoneum, there is no statistically significant difference found between AEP before and after CO₂ insufflation. It implies that this modest change in CO₂ concentration does not influence the conscious level during adequate anesthesia of short duration.

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Monitoring intraoperative global tissue oxygenation in children using the gastric to end-tidal PCO₂ difference

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Background and Goal of Study: Monitoring adequacy of intraoperative global tissue oxygenation in paediatric patients is usually limited to periodic assessment of the acid–base status. The aim of this study was to evaluate the efficacy of the gastric to end-tidal PCO₂-difference [P(g-et)CO₂] for non-invasive, continuous monitoring of global tissue oxygenation in children at risk for tissue hypoxia.^{1,2}

Materials and Methods: With hospital ethics committee approval and parental consent, 20 children scheduled for major orthopaedic and cranio-facial surgery were studied. After tracheal intubation a tonometer catheter was inserted naso-gastrically in the anaesthetised patient. End-tidal PCO₂ and gastric mucosal PCO₂ were measured both by the Tonocap™ and recorded at intervals of 10 minutes. Arterial blood samples were taken every hour for determination of arterial base excess (aBE). Data are presented as median and ranges. P(g-et)CO₂ values were compared with aBE using linear regression analysis. Specificity and sensitivity of the hourly P(g-et)CO₂ changes to reflect occurrence of global tissue hypoxia as indicated by decreasing aBE values were calculated.

Results and Discussions: Median age of the patients was 9.9 years (1.0–17.8) and weight was 20.3 kg (8.1–46.0). Blood loss ranged from 13–247 ml/kg (36). P(g-et)CO₂ was 0.3 kPa (–0.8 to 4.1) and aBE was –2.8 mmol/l (–12.4 to 3.8). Overall correlation (n = 117 measurements) between P(g-et)CO₂ and aBE values was poor (R = –0.24). This may be a result of inter-individual differences in deadspace ventilation, inter-individual differences in baseline aBE, occurrence of ketoacidosis and transfusion of acidic blood products. However, relative P(g-et)CO₂ changes of ≥0.4 kPa demonstrated a specificity/sensitivity of 100/84.6% to indicate a decrease in arterial base excess. Specificity/sensitivity further increased with relative P(g-et)CO₂ changes of ≥0.8 kPa to 100/100%.

Conclusion: Not absolute P(g-et)CO₂ values but relative P(g-et)CO₂ changes provide a non-invasive, continuous method to detect intraoperative global tissue hypoxia in children as indicated by decreasing aBE.

References:

- Uusaro A et al. *Br J Anaesth* 2000; **85**: 563–569.
- Lebuffe G et al. *Eur J Anaesthesiol* 2003; **20**: 147–152.

A-153

Heart rate variability for anaesthetic depth monitoring

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Background and Goal of Study: Heart rate variability (HRV) was reduced by inhalation anaesthetics and fentanyl (1). We hypothesized that HRV induced by noxious stimulation would reflect different levels of surgical anaesthesia.

Materials and Methods: 86 ASA I or II patients anesthetized with propofol TCI, remifentanyl and vecuronium were randomly assigned to different BIS levels and effect site remifentanyl concentrations (ng/ml). When the selected levels were achieved an electrical stimulus was applied to the ulnar nerve. Linear and non-linear (Poincaré analysis) parameters of HRV (2) of the 60 sec post-stimulation were computed from the digitized ECG and normalized to 60 sec pre-stimulation. The response to tracheal intubation defined as HR > 90 bpm or systolic BP increase >20 mmHg was recorded. BIS, remifentanyl effect site conc., probability of response to intubation (P R_{int}) and HRV were compared.

Results and Discussions: Data are mean (SEM), normalized RRI data (RR interval).

	Gr 1	Gr 2	Gr 3	Gr 4	Gr 5
BIS	46 (1.4)	45 (1.5)	43 (1.2)	32* (1.0)	57* (0.9)
Remifentanyl	1.1* (0.02)	2.1 (0.1)	4.7* (0.2)	2.0 (0.1)	2.1 (0.1)
P R _{int}	0.77	0.47	0.059 [#]	0.18	0.52
RRI mean	1.008 (0.011)	1.015 (0.005)	1.009 (0.004)	1.017 (0.006)	1.015 (0.008)
RRI SD	1.85 (0.26)	1.78 (0.16)	1.75 (0.19)	1.67 (0.15)	2.47 [§] (0.25)
RRI SD1	1.40 (0.15)	1.31 (0.10)	1.22 (0.07)	1.27 (0.08)	1.61 (0.17)
RRI SD2	1.98 (0.28)	1.85 (0.17)	1.92 (0.24)	1.82 (0.18)	2.63 [§] (0.28)

* p < 0.05 vs. all other Gr; [#]p < 0.01 vs. Gr 1 and 2; [§]p < 0.05 vs. Gr 2 and Gr 4.

Conclusion: HRV reflects hypnotic but not analgesic level or hemodynamic responsiveness.

References:

- 1 Galletly DC, Westenberg AM, Robinson BJ, et al. *Br J Anaesth* 1994; 72: 177–180.
- 2 Tulppo MP, Makikallio TH, Takala TE, et al. *Am J Physiol* 1996; 271: H244–H252.

A-154

Regular clinical use of BIS monitoring may result in average higher BIS values

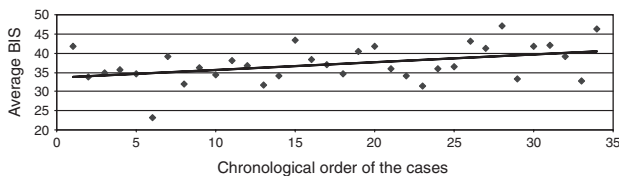
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Background and Goal of Study: Monitoring depth of anesthesia with BIS reduces the incidence of awareness or insufficient anesthesia.¹ Excessive anesthesia, BIS below 45, is associated with bad outcome.² We hypothesized that regular clinical use of BIS monitoring might result in reduced occurrence of excessive anesthesia. Data from patients monitored with BIS and anesthetized with the same protocol over one year were examined to see if with time there was a trend towards higher BIS values.

Materials and Methods: Data collected from neurosurgical patients anesthetized over one year by the same anesthesiologist, with the same protocol was examined. Patients received TIVA with TCI for propofol and remifentanyl. Rugloop II® software was used to collect BIS data. Only patients with a pre-op Glasgow of 15, awakened at the end and devoid of complications or technical problems were selected for analysis. BIS data was stored every 5 seconds. Average BIS during the maintenance phase was calculated and related to the chronological order of the case using linear regression.

Results and Discussions: There were 34 patients that met the selection criteria. Patients were 52.3 ± 16 years, 69.7 ± 13 kg, 161.7 ± 8 cm, 25 female. Case duration was 281 ± 136 min. There was a positive correlation between average BIS and chronological order of the case: BIS increased significantly with time ($p = 0.019$); the linear regression module slope was significantly positive with a 99% confidence level.



Conclusion: Our data suggests that regular use of BIS may lead to higher average BIS values during anesthesia. It is possible that as the anesthesiologist becomes more used to BIS monitoring, patients can be safely managed at a lower depth of anesthesia. A larger study should be done to specifically and assess this hypothesis.

References:

- 1 Anesthesiology 2003:A-320.
- 2 Anesthesiology 2003:A-1361.

A-155

Does using bispectral index (BIS) during craniotomy effect the quality of recovery?

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Introduction: The aim of the neuroanaesthesia, is to provide postoperative early recovery and early neurological examination, in patients undergoing supratentorial operation. In this study our aim was to search for the role of using BIS in recovery in patients who are undergoing craniotomy.

Materials and methods: After approval of local ethics committee, ASA I–II 30 patients undergoing craniotomy were included to the study. The patients were divided into two groups randomly and 5 mg kg⁻¹ thiopental, 2 µg kg⁻¹ fentanyl and 0,15 mg kg⁻¹ cisatracurium were administered to both groups. 50% O₂ – air mixture and 0,8–15% sevoflurane were used for maintenance of anaesthesia. In the 1st group the concentration of sevoflurane was titrated to maintain BIS 40–60. In the 2nd group; BIS was placed in such a position that the physician couldn't see and the concentration of sevoflurane was changed according to the patients hemodynamic changes. The hemodynamic data BIS value and sevoflurane concentration (Feks) were recorded in every 15 minutes. Also BIS value was recorded by the primary

anesthetist in the 1st group, by another independent anesthetist in the 2nd group. At the end of the study; recovery criteria and Alderate Recovery Scores were recorded in every 15 minutes. The time for Alderate Score 9–10 and total fentanyl dose were recorded. Independent Sample T test and Mann Whitney U test were used for statistical analyse.

Results: Demographic data, hemodynamic changes, BIS value and Feks were similar in groups ($p > 0,05$). Extubation time was significantly shorter in the first group (Group I: $4,27 \pm 2,45$ min, Group II: $8,02 \pm 4,56$ min) ($p = 0,035$). Other recovery criteria and the time for Alderate Score 9–10 was also shorter in the 1st group but the difference was not statistically significant. The dose of fentanyl was significantly less in the 1st group (Group I: $0,37 \pm 0,13$ mg, Group II: $0,50 \pm 0,13$ mg) ($p = 0,04$).

Conclusion: Using BIS during craniotomy makes recovery better but the difference is not clinically meaningful.

A-156

Monitoring the bispectral index during spinal surgery

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Background and Goal: We present two situations of abrupt increases of the bispectral index (BIS) coinciding with the surgical stimulation of the spinal roots.

Materials and Methods: *Situation 1:* Two men (66 and 41 years old) and a 60 years old woman undergoing lumbar arthrodesis, and a resection of thoracic vertebral body respectively, had general anaesthesia with propofol, remifentanyl and NO₂/O₂. When the surgeon adjusted a screw in the vertebral pedicles or during the vertebral body resection, the BIS values suddenly increased from 55–60 to over 90, without changes in the cardiovascular parameters. After informing the surgeon, the procedure was immediately interrupted and the BIS values returned to below 60 within three minutes.

Situation 2: A 69 year old male undergoing lumbar arthrodesis, anaesthetised with sevoflurane, alfentanil and N₂O/O₂ presented during rhizolysis, a sudden increase in BIS value (from 55 to 90), associated with increases of 34% and 29% in mean arterial pressure (MAP) and heart rate (HR), over baseline. After increasing the rate of infusion of remifentanyl (from 0,72 to 1,0 µg kg⁻¹ min⁻¹), MAP, HR and BIS returned to the preceding values after 10 minutes. At this time, alfentanil was restored to the initial infusion rate, and the cardiovascular parameters remained stable for the duration of surgery. However the BIS value increased again to above 90, and continued elevated until the end of the surgery.

None of the patients had intraoperative recall evaluated 48 h after surgery.

Conclusions: The excision or stimulation of a spinal root, could activate the transmission of non-nociceptive stimuli to supraspinal sites, and thus induce a persistent increase in the BIS number. In *situation 1* a transient stimulation could increase the BIS value without a sympathetic response.

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Oversensitivity of artefact detection by Narcotrend monitoring compared to bispectral index monitoring

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Background and Goal of Study: Artefact detection is an essential feature of automatic EEG monitoring systems used in anaesthesia. Clinical experience indicates that Narcotrend monitoring (Monitor Technik, Bad Bramstedt, Germany, version 4.0) excludes more EEG epochs because of artefacts than bispectral index monitoring (BIS, Aspect Medical Systems, Natick, MA, version XP). Whether this increased exclusion of epochs is justified has not been proven yet.

Materials and Methods: 18 adult patients undergoing radical prostatectomy were investigated. Induction of anaesthesia was performed with a fentanyl bolus and a propofol infusion. Additionally, patients received 15 ml bupivacaine 0.5% epidurally following intubation. After a waiting period of 45 minutes depth of anaesthesia was varied two times by increasing and decreasing propofol target concentrations using a commercially available target controlled infusion system. Narcotrend index, BIS values and calculated propofol plasma effect site concentrations were automatically recorded at intervals of 5 seconds. We tested the hypothesis whether exclusion of the artefacts detected by the Narcotrend monitor would possibly improve

the prediction probability of the BIS monitor, which would justify a more rigid artefact suppression as it is implemented in the Narcotrend monitor.

Results and Discussions: The Narcotrend monitor excluded a significantly higher percentage of epochs because of artefact detection ($12.6 \pm 1.0\%$) than the BIS ($0.4 \pm 0.1\%$). The performance of the BIS as an indicator of predicted propofol effect site concentrations did not differ when including ($P_K = 0.86 \pm 0.05$) or excluding ($P_K = 0.85 \pm 0.04$) the data pairs where Narcotrend monitor but not bispectral index monitor indicated an artefact.

Conclusion: We found an oversensitivity of artefact detection by Narcotrend monitoring. Exclusion of data pairs that were detected as artefacts by Narcotrend but not by BIS did not improve the performance of bispectral index as an indicator of propofol effect site concentration.

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The effects of bispectral index monitoring on end-tidal desflurane concentration

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Background and Goal of Study: The aim of the study is to assess whether the concentration of end-tidal desflurane decreases or not with the addition of BIS monitoring to standard anaesthetic practice in patients whom desflurane is given.

Materials and Methods: After institutional ethics committee approval, 40 ASA I-II patients ($n = 20$), scheduled for elective open abdominal surgery. The bispectral index was recorded continuously beginning before the anaesthetic induction. Haemodynamic parameters and end-tidal CO_2 were recorded 5 min intervals. Anaesthesia was induced with $1 \mu\text{g}/\text{kg}$ fentanyl and $5 \text{ mg}/\text{kg}$ thiopental. The trachea was intubated using $1 \text{ mg}/\text{kg}$ vecuronium. Anaesthesia was maintained with desflurane, in a mixture of nitrous oxide $1 \text{ L}/\text{min}$ and oxygen $1 \text{ L}/\text{min}$. Desflurane 5% (initial inspired concentration) was administered to patients for 5 min after endotracheal intubation. In addition $1 \mu\text{g}/\text{kg}$ fentanyl was given before skin incision and no more was given. The desflurane concentration was then changed every 5 min as follows. Group I: if the patients displayed autonomic signs consistent with inadequate anaesthesia, hypotension or bradycardia, the inspired desflurane concentration was increased/decreased by 1%. BIS monitor was placed as the anaesthetist couldn't see it. The criteria for inadequate anaesthesia and hypotension/bradycardia were accepted as follows: blood pressure $>20\%$ increase from baseline, heart rate >90 beats/min, movement, grimacing, eye opening, coughing and blood pressure $<20\%$ decrease from baseline, heart rate $<20\%$ decrease from baseline. Group II: the anaesthetist adjusted the concentration of desflurane to achieve a target BIS in the range of 50 ± 5 . Student's t-test and repeated measures of ANOVA were used statistical analysis. Significance was taken as $p < 0.05$.

Results and Discussion: The BIS index mean of the Group I was 35.98 ± 2.3 and Group II was 45.68 ± 5.3 . BIS levels during surgery were significantly lower in Group I ($p = 0.001$). The end-tidal desflurane concentrations in Group I were significantly higher than Group II (Group I: 4.61 ± 0.48 , Group II: 3.92 ± 0.61) ($p = 0.007$).

Conclusion: These findings indicate that the use of BIS, as it decreases the end-tidal concentrations of desflurane, has become a technique in which the residents feel safe because it determines the depth of anaesthesia.

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The effect of titration with AEP Monitor/2 and BIS on sevoflurane consumption and recovery times in children under combined general and regional anaesthesia

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Background and Goal of Study: The aim of the study was to determine whether titration with the AEP Monitor/2™ (hypnosis monitor based in the Autoregressive extraction of mid-latency auditory evoked potentials, and expressed in the AAI index) or BIS™ (would reduce sevoflurane requirements and improve recovery times in pediatric patients (1).

Materials and Methods: Thirty-one pediatric patients aged 6 months to 11 yrs, scheduled for elective herniorrhaphy or minor urologic surgery were randomized in three groups. Group 1 ($n = 9$, controls): administration of sevoflurane guided by clinical signs (heart rate within 20% of basal value). Group 2 ($n = 12$, guided by the AEP Monitor/2™): sevoflurane is titrated to obtain AAI between 20 and 25. Group 3 ($n = 10$, guided by BIS): sevoflurane was administered to keep BIS index between 50 and 60. In all cases the

patient had both monitors attached and the anesthesiologist was blinded to one of them. Penile or caudal block was completed after sevoflurane induction and laryngeal mask insertion. Anaesthesia was fully maintained with sevoflurane and 50% $\text{N}_2\text{O}/\text{O}_2$. After surgery the gas was discontinued and the laryngeal mask removed on intolerance. BIS and AAI values were recorded every second and end tidal minutely. ANOVA test and Pearson correlation analysis was applied to the results.

Results and Discussion: There are no significant differences between the three groups regarding age, weight, ASA, surgery, type of block, and anaesthesia or surgery duration. Mean (SD) values are summarized below.

	Recovery time (s)	Mean Et Sevo (%)
Group 1	419 (378)	1.71 (0.37)
Group 2	411 (550)	1.50 (0.73)
Group 3	396 (244)	1.87 (0.80)
Sig ($p < 0.05$)	0.993	0.442

Conclusion: In pediatric patients under general anaesthesia with sevoflurane and $\text{N}_2\text{O}/\text{O}_2$ combined with regional block, gas titration with the BIS or AEP monitors does not decrease sevoflurane consumption or recovery time.

Reference:

1 Bannister CF. *Anesth Analg* 2001;92:877-81.

A-160

Effect of lidocaine on the bispectral index (BIS) and cardiovascular responses during induction of anaesthesia using target-effect site controlled infusion of propofol

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Background and Goal of Study: Lidocaine has been found to be inconsistently effective to blunt cardiovascular responses to endotracheal intubation (1) and lidocaine's sedative effect has not been known well. The purpose of this study was to evaluate its sedative and cardiovascular effects during induction of anaesthesia.

Materials and Methods: One hundred patients, ASA I-II were randomized into two groups (lidocaine or control group) in a double-blind manner, with or without lidocaine intravenous injection ($1.5 \text{ mg}/\text{kg}$ before induction followed by $40 \mu\text{g}/\text{kg}/\text{min}$). The BIS, blood pressure and heart rate were measured at before and 2 min after normal saline or lidocaine injection, preintubation, and 1, 2, 5 and 10 min after intubation. Anaesthesia was induced with the infusion of propofol at $3.5 \mu\text{g}/\text{ml}$ as targeted-effect site concentration using target-controlled infusion (TCI). The data were analyzed with unpaired t-test and ANOVA one way. Statistical significant was considered at $P < 0.05$.

Results and Discussions: In lidocaine group, BIS was significantly lower than that in control group at 1, 2, 5, and 10 min after intubation ($P < 0.05$). There was no difference in blood pressure and heart rate between both groups.

Conclusions: Lidocaine reduces BIS after induction of anaesthesia with propofol using TCI. However, it does not attenuate cardiovascular response to endotracheal intubation.

References:

1 Miller C.D., Warren S.J. *Br J Anaesth* 1990; 65: 216-19.

2 Nielsen J.C., Arendt-Nielsen L., Bjerring P. *Reg Anesth* 1991; 16: 28-33.

A-161

The combination of fentanyl and midazolam shortens time of disappearance of consciousness on the anaesthetic induction

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Background and Goal: The interactions of sedatives and opioids have not been completely understood (1). The purpose of this study is to investigate the effect of fentanyl on the pharmacokinetics (2) and the pharmacodynamics of midazolam (MD) during induction of anaesthesia.

Materials and Methods: After study approval by the Ethics Committee of Shinshu University Hospital and written informed consent, 37 patients of ASA I-II, age 17-69 years, admitted for elective surgery, were enrolled in an open study. Patients were randomized to one of three groups: group A0 ($n = 13$) induction by $0.15 \text{ mg}/\text{kg}$ MD i.v. without fentanyl, group A2 ($n = 14$) $2 \mu\text{g}/\text{kg}$ fentanyl i.v. with MD i.v., and group A4 ($n = 10$) $4 \mu\text{g}/\text{kg}$ fentanyl i.v.

with MD i.v. Five minutes after injection of fentanyl, 0.15 mg/kg MD was administered to the patients. Blood samples were drawn from a peripheral vein at 5, 30, 60 and 180 minutes after MD injection. Statistical analysis was paired or unpaired student's t-test, Kruskal-Wallis rank test and Spearman's correlation as applicable.

Results: Three patients in A0, and one in A2 did not lose their consciousness within 120 seconds after MD i.v. injection. Importantly, the increase in heart rates and blood pressure at intubation was equally controlled by the fentanyl injection of 2 and 4 $\mu\text{g}/\text{kg}$. Antecedent injection of fentanyl or the lack there of did not affect the reduction of the BIS score after injection of MD. Likewise, during intubation BIS score increased without significant differences between groups. The time until lack of response to verbal commands was significantly shorter in patients co-administered fentanyl and MD (Data; mean/SD, *: $p < 0.05$ vs. pre, #: $p < 0.05$ vs. A0). Surprisingly, MD kinetic and the plasma concentration of MD (as applicable) were not significantly different between groups.

Group	A0	A2	A4
BIS pre intubation (Min)	61/10	63/10	60/10
BIS post intubation (Max)	69/5	73/9*	72/10*
Time to sleep (sec)	105/91	41/26#	26/8#

Conclusions: Despite a marked reduction of the time to sleep compared to MD alone, the combination with fentanyl did not effect to BIS score. Thus, BIS score only partly reflected depth of anaesthesia in this investigation.

References:

- 1 Mi WD. *Can J Anaesth* 1998; 45: 19–22.
- 2 Hase I. *Br J Anaesth* 1997; 79: 740–743.

A-162

Bispectral (BIS) index monitoring reduces drug consumption and recovery time of total intravenous anaesthesia for knee-arthroscopy, but is not cost-effective

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Background and Goal of Study: Bispectral (BIS) index monitoring has previously been shown to reduce consumption of anesthetic agents and recovery times in intravenous anaesthesia combined with nitrous oxide (1). Can clinically relevant savings be accomplished during total intravenous anaesthesia?

Materials and Methods: Propofol/alfentanil infusion anaesthesia were used for 40 patients during knee-arthroscopy. The BIS index was monitored in all patients. In the first 20 patients the BIS index was blinded to the anesthetist (control group), in the last 20 patients the anaesthesia was regulated according to the BIS index (BIS group).

Results and Discussions: BIS index during the last 3 minutes of surgery was 40.0 ± 8.0 (SD) in the control group, 48.7 ± 7.9 (SD) in the study group ($P = 0.002$).

Recovery time (from end of surgery to awake) was reduced from 10.6 ± 6.0 (SD) to 5.7 ± 5.0 (SD) in the BIS group ($P = 0.008$).

The cost of monitoring was €16,40 per patient; the average saving of medicine was €0,74. Calculation of amount saved due to shortened recovery times based on per minute price of anaesthesia is not useful, since the saving can only be "harvested" if more patients can be scheduled as a result of the intervention.

Conclusion(s): Use of BIS monitoring did reduce the average recovery time after intravenous anaesthesia with approx. 5 minutes. The high price of this monitoring procedure can only be justified if extra patients can be scheduled as a result of the time saved. This is not likely to be the case in most settings, and the method is thus not cost-effective.

Reference:

- 1 Yli-Hankala A, Vakkuri A, Annala P, et al. *Acta Anaesthesiol Scand*. 1999; 43: 545–9.

A-163

Sevoflurane titration by using bispectral index: effects on haemodynamics, emergence and cost effectiveness

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Background and Goal of Study: The bispectral index (BIS) has been shown to be a quantifiable measure of the sedative and hypnotic effects

of anesthetic drugs. The aim of this randomised, prospective study was to assess the effects of sevoflurane titration by using BIS on haemodynamics, emergence and cost effectiveness during abdominal surgery.

Materials and Methods: After approval of the ethics committee and informed consent, forty patients (ASA I–II, aged 20–65) scheduled for elective abdominal surgery were randomly assigned into two groups of twenty patients each. Sevoflurane was titrated to BIS values of 40–65 in Group I and based on clinical symptoms of depth of anaesthesia in Group II for maintenance of general anaesthesia with nitrous oxide 60% in oxygen after standardised induction sequence consisting of 2 $\mu\text{g}/\text{kg}$ fentanyl, 2–2.5 mg/kg propofol and 0.1 mg/kg vecuronium intravenously. Immediately after tracheal intubation, the inspired concentration of sevoflurane was adjusted to maintain the measured end-tidal concentration constant at a predetermined value. Measurement of hemodynamics occurred 2 min prior to skin incision and 5 min thereafter. Total consumption of sevoflurane was calculated in both groups. The times for discontinuation of inhaled anaesthetics to spontaneous eye opening, extubation, response to verbal command, orientation to date and place. SPSS for Windows 10.0 were used in statistical analysis and p values less than 0.05 was considered statistically significant.

Results and Discussions: The patient characteristics and mean anaesthesia duration in the two groups were similar. The two groups did not differ with respect of hemodynamic stability. Sevoflurane consumption was 36.45 ± 13.62 and 43.64 ± 13.94 ml in Group I and II respectively ($p > 0.05$). Total cost was significantly higher in Group I with the addition of price of BIS electrodes and monitorization ($p = 0.001$). The time to opening eyes on verbal command, extubation, orientation to date and place was shorter in Group I but the difference was not significant. None of the patients reported recall of intraoperative events.

Conclusion: Titration of sevoflurane using BIS decreased the consumption and provided faster emergence. On the other hand, it's not a cost effective method when considered all necessary supplies. Haemodynamic stability and unawareness could also be managed with the standard titration methods.

References:

- 1 *Anesthesiology* 1997; 87(4): 842–7.
- 2 *Anesthesiology* 2001; 95: 1151–9.

A-164

Assessment of sedation: the comparison of BIS with OAA/S and modified Wilson scales

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Background and Goal of Study: Clinical measures of recovery may be observer dependent. This prospective study was designed to evaluate the effectiveness of the bispectral index (BIS), the observer's assessment of alertness/sedation (OAA/S) scale and the modified Wilson's scale (MWS) for assessing the level of sedation and impact of them on recovery from propofol-fentanyl anaesthesia during daycase gynecological procedures.

Materials and Methods: After local ethics committee approval, written informed consent was obtained from 60 female outpatients scheduled for daycase gynecological procedures under deep sedation with propofol and fentanyl. Sedation was assessed with BIS, OAA/S or MWS. Intravenous sedation was achieved with fentanyl and propofol. Bispectral index levels (0 to 100) and OAA/S scores (1 to 5) and MWS (1 to 4) were recorded every 3 min with arterial blood pressures, heart rate and oxygen saturation. At the end of the surgical procedure the total dosages of the sedative and analgesic medications administered during the procedure were recorded. Postoperative recovery (Aldrete's scores) and mobilization (able to sit and walk) were assessed in the recovery room. Patient and surgeon satisfaction were also questioned.

Results and Discussions: BIS group had shorter recovery times with respect to other groups ($p < 0.01$) and patient there was no difference between the groups for the time to eye-opening and orientation scores. Postoperative mobilization was significantly shorter ($p < 0.01$) and Aldrete's score at 1 min was significantly higher ($p < 0.05$) in BIS group. There was no difference between OAA/S and MWS scores. The dose of propofol in total was lower ($p < 0.01$) in BIS group so the cost was lower in this group. Patient and surgeon satisfaction were higher ($p < 0.05$) in this group.

Conclusion(s): BIS is an objective and valid measure of recovery. BIS monitoring facilitates a reduction of recovery times in daycase procedures with higher patient and surgeon satisfaction and low cost.

References:

- 1 *Anesthesiology* 1997; 87: 808–15.
- 2 *Anesthesiology* 2001; 95(5): 1151–9.

A-165

How nail polish alters oxygen saturation determined by pulse oximetry in the ICU setting

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Background and Goal of Study: Nail polish on finger nails may lead to inaccurate and imprecise readings of pulse oximetry [1,2]. False readings may result in an inadequate oxygen supply. The aim of our study was to evaluate the error of measurement for oxygen saturation determined by pulse oximetry in the presence of nail polish.

Materials and Methods: The study was performed after approval of the local ethics committee. In 50 ventilated critically ill patients of an ICU nail polish of nine different colors was applied on finger nails. Additionally 50 patients were matched, their natural finger nails served as reference. Functional oxygen saturation (SpO₂) was determined in each patient by pulse oximetry (Siemens SC1281, Danvers/USA) and cross-checked by an arterial blood gas analysis (SaO₂, Radio-meter ABL 625, Copenhagen/Denmark). The accuracy was calculated as Bias, the precision as standard deviation [1]. For the statistical analysis t-test was used.

Results and Discussions: 500 data points for the measurement with nail polish applied (Group ^{NPP}) and 500 data points for the measurement with natural finger nails (Group ^{NATP}) were acquired. The patients mean age was 57 ± 16.0 years. Main findings were:

	Group ^{NATP} (natural nails), N = 500	Group ^{NPP} (nail polish applied), N = 500
SpO ₂	96.0 ± 5.99	96.8 ± 2.75
SaO ₂ (ABGA)	96.1 ± 5.76	97.8 ± 1.32
Bias	+0.1 ± 2.02*	+1.0 ± 2.53*
B = SaO ₂ - SpO ₂	*P = 0.337	*P < 0.0001

Conclusion(s): Nail polish reduces both accuracy and precision of pulse oximetry. Although the effect is statistically significant, it is clinically not relevant. Accordingly removing nail polish is generally not obligate.

References:

- 1 Cote CJ et al. *Anesth Analg* 1988; 67:683-686.
- 2 Hinkelbein J et al. *Abstracts EuSEM* 2003: 62.

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Accuracy of pulse oximetry in a case of severe anemia from gastrointestinal hemorrhage

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Case History: The case of an 18 year old female Jehovah's Witness with acute gastrointestinal hemorrhage is reported. She complained of a weakness since weeks and hematemesis. Endoscopy revealed varicose veins in the distal oesophagus and proximal stomach. The initial documented hematocrit (Ht) was 12.5% (hemoglobin 3.8 g/dl, Hb), the transfusion of blood was resolutely declined. She was intubated, ventilated (F_IO₂ 100%) and admitted to the ICU due to acute respiratory failure. The initial Ht after admission to the ICU was 7.2% (Hb 2.2 g/dl). She died after two days due to myocardial infarction and cardiac shock despite maximum intensive care treatment. Since low hematocrit levels are presumed to cause low accuracy of pulse oximetry [1,2], the readings of pulse oximetry are compared to arterial blood gas analysis (ABGA).

Materials and Methods: A Siemens pulse oximeter (SC1281, Siemens Medical Equipment, Danvers/USA) was used to monitor functional oxygen saturation (SpO₂) continuously. Oxygen saturation was cross-checked with repeated arterial samples (SaO₂) using ABGA (ABL 625, Radiometer, Copenhagen/Denmark) which were taken from an arterial line already in place. The bias was calculated for each pair of readings (B = SaO₂ - SpO₂). The t-test was used to proof significance, P < 0.05 was defined as significant.

Results and Discussions: 10 paired readings were obtained in this case during clinical routine. Mean Hb was 2.4 ± 0.4 g/dl (Ht 8.1 ± 1.3%). Mean SpO₂ (99 ± 1.89%) was determined by pulse oximetry and was compared to mean SaO₂ (98.1 ± 2.2%) from ABGA (P < 0.12). The bias was calculated as B = -0.9 ± 2.1% (range, -6.0 to +2.0%).

Conclusion(s): Although a discrepancy in measurement between pulse oximetry and arterial blood gas analysis is sometimes anticipated, a good

correlation between these two parameters was found in this case. Pulse oximetry slightly tended to underestimate oxygen saturation determined by arterial blood gas analysis, but with no clinical relevance.

References:

- 1 Ramsing T. *Intensive Care Med* 1992; 18: 125-126.
- 2 Hinkelbein J. *Abstracts ASA* 2003: A-622.

A-168

Detection of a systolic pulse pressure level for reliable readings in pulse oximetry

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Background and Goal of Study: Pulse oximetry determines the functional oxygen saturation in arterial blood [1]. A reduced perfusion (e.g. at hypotension) may affect accuracy and precision [2]. The aim of our study was to determine the error of measurement in pulse oximetry with a decreased arterial pressure at low perfusion and to identify a systolic pulse pressure level for first possible and reliable readings of pulse oximetry.

Materials and Methods: After approval of the local ethics committee, a baseline oxygen saturation was determined by pulse oximetry in ventilated critically ill patients. At the same arm an arterial line was already in place for routine monitoring. A blood pressure cuff at the upper arm was inflated to decrease the arterial pulsatile flow down to zero. The cuff was deflated in steps of 5 mmHg and the resulting oxygen saturation was determined with a pulse oximeter (SpO₂, Siemens SC1281, Danvers/USA). The error of measurement (bias) was calculated for each blood pressure level. A systolic pulse pressure level for (a) first possible and (b) correct reading of oxygen saturation was identified.

Results and Discussions: 25 patients (9 female, 16 male, 48 ± 16 years old) with a mean SpO₂ of 98.3 ± 1.5% and a blood pressure of 129 ± 18.4 mmHg participated after consent of their guardians. The mean systolic arterial blood pressure to obtain first readings with pulse oximetry was 45.8 ± 17.7 mmHg (range, 25 to 101) (35% of baseline pressure (range, 17 to 82%)) resulting hereby in lower readings of pulse oximetry (mean, 11.5 ± 13.6%, range -45% to 0%). With an systolic arterial blood pressure of >70 mmHg the mean bias was within the manufacturers limits of ±2%.

Conclusion(s): Pulse oximetry is reliable with a systolic arterial pressure >70 mmHg. The lower the blood pressure is, the lower are the readings of pulse oximetry leading to a bias of up to -45%.

References:

- 1 Severinghaus JW et al. *Anesthesiology* 1992; 76: 1018-1038.
- 2 Lawson D et al. *Anesthesiology* 1987; 67: 599-603.

Acknowledgements: We received no financial support to perform this study.

A-169

How artificial nails with applied nail polish do alter oxygen saturation determined by pulse oximetry

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Background and Goal of Study: Pulse oximetry is a mandatory technique during peri-operative anesthesia and intensive care medicine to determine functional oxygen saturation. In general, artificial nails do not compromise the measurement in a clinically relevant way [1], whereas nail polish has been reported to cause a significant effect [2]. The combination of both - artificial nails plus nail polish - may lead to incorrect measurements and misinterpretation. So far, data for ventilated critically ill patients with artificial nails and applied nail polish are not available.

Materials and Methods: After approval of the local ethics committee acrylic paste (Resin F[®], Wilde Cosmetics, Eltville/Germany) was applied at the third finger of each patients' right hand and hardened. Then black nail polish (ASTOR, Barcelona/Spain) was applied standardized in one layer. Oxygen saturation was simultaneously determined at this finger (psaO₂^(Ac+NpPO)) and at another finger of the same hand (psaO₂^(NATPO)) as reference (Siemens SC1281, Danvers/USA and attached Sensor DS-100A, Nellcor, Pleasanton/USA). The statistical analysis was performed with SAS[®] (Release 8.02).

Results and Discussions: 25 patients (18 male, 7 female, 57.5 ± 15.1 years old) participated in this study. The mean oxygen saturation at the natural nail (psaO₂^(NATPO)) was 96.9 ± 2.23% and decreased to 96.6 ± 2.78% (psaO₂^(Ac+NpPO)) at the finger with the artificial nail and nail polish applied. This resulted in a mean bias of -0.35 ± 1.82% (P = 0.35). Therefore the

precision was lower as well (higher standard deviation) but was not statistically different ($P > 0.05$).

Conclusion(s): Artificial acrylic fingernails in combination with black nail polish do not impair the measurement of oxygen saturation by pulse oximetry clinically relevant. Further on, the indicated mean oxygen saturation is obviously lower with both in contrast to natural nails.

References:

- 1 Peters SM. AANA J 1997; 65: 361–363.
- 2 Hinkelbein J. Abstracts EuSEM 2003: 62.

Acknowledgements: We received no financial support to perform this study. Acrylic paste was supplied by Wilde Cosmetics, Germany.

A-170

Near infrared spectroscopy as a guide to anaesthetic management during carotid endarterectomy

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Goal of Study: Near infrared spectroscopy (NIRS) monitoring was used to guide anaesthetic management in patients undergoing carotid endarterectomy (CEA).

Methods: After board approval and patient informed consent 17 consecutive patients aged 50–80 yrs underwent CEA under general anaesthesia. Changes in ipsilateral and contralateral regional O_2 saturation (rSO_2) were monitored by NIRS. Heart rate, pulse oximetry (SpO_2) and direct arterial blood pressure were continuously monitored and recorded in one minute intervals. Changes in rSO_2 were recorded in absolute percent change. The relative changes of rSO_2 from baseline were calculated (absolute change in rSO_2 /baseline rSO_2). The anaesthetic management included head positioning, mean arterial pressure (MAP), F_iO_2 , $PaCO_2$ and anaesthetic depth adjustment. The patients were evaluated neurologically and Ramsey and Sedation Agitation Scale (SAS) values were taken before induction and 15 min after emergence.

Results: Baseline rSO_2 values varied significantly among patients (47–80%). In 2/17 (12%) patients the relative rSO_2 change due to head malpositioning was 0–35% (0–20% in absolute values) and immediate repositioning was made. After emergence there was no neurological deficit and they had SAS score 3–4 and Ramsey score 2–3. In 5/17 (29.5%) cases the relative rSO_2 change was 10–17% (5–14% absolute value) which was corrected when the MAP was adjusted to 130–150 mmHg. After emergence there was no neurological deficit and they had SAS score 3–4 and Ramsey score 2–3. In 4/17 (23.5%) patients the relative rSO_2 change was 5–23% (5–12% in absolute values) due to $PaCO_2$ values (28–38 mmHg) which was adjusted to $PaCO_2$ 40–50 mmHg where the rSO_2 was normal. After emergence there was no neurological deficit and they had SAS score 3–4 and Ramsey score 2–3. In 1/17 (6%) patient relative rSO_2 increase was noticed up to 15% (0–12% in absolute values) after CEA. After emergence the patient had no neurological deficit with SAS score 6 and Ramsey score 1. In 1/17 (6%) patient the relative rSO_2 decrease was 10–25% (5–12% in absolute values). After emergence the patient had no deficit with SAS score 2 and Ramsey score 5.

Conclusion: NIRS may prove a useful non-invasive diagnostic tool in early detecting intraoperative cerebral ischemia and guide to anaesthetic interventions.

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Near infrared spectroscopy as a guide to surgical intervention during carotid endarterectomy

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Goal of Study: Near infrared spectroscopy (NIRS) monitoring was used to define the need for shunting in patients undergoing carotid endarterectomy (CEA).

Methods: After board approval and patient informed consent 17 consecutive patients aged 50–80 yrs underwent CEA under general anaesthesia. Changes in ipsilateral and contralateral regional O_2 saturation (rSO_2) were monitored by NIRS. Heart rate, pulse oximetry and direct arterial blood pressure were continuously monitored and recorded in one minute intervals. Changes in rSO_2 were recorded in absolute percent change. The relative decreases of rSO_2 from baseline were calculated (absolute decrease in rSO_2 /baseline rSO_2). A shunt was placed when rSO_2 decrease was above 15%. The patients were

evaluated neurologically and Ramsey and Sedation Agitation Scale (SAS) values were taken before induction and 15 min after emergence.

Results: Baseline rSO_2 values varied significantly among patients (47–80%), and also between sides of an individual patient. The median duration of carotid cross clamping (CCC) was 63 min (range 4–110). In 7/17 (41%) patients the relative ipsilateral rSO_2 change during CCC was 0–13% (0–10% in absolute values) and no shunt was used. After emergence there was no neurological deficit and they had SAS score 3–4 and Ramsey score 2–3. In 1/17 (6%) case the relative rSO_2 change was 6% (0–10% absolute value) and no shunt was used. The patient had no neurological deficit but SAS score was 6 and Ramsey was 1. In 7/17 (41%) patients the relative ipsilateral rSO_2 change during CCC was from 12% to 30% (5–12% in absolute values) and a shunt was placed. After emergence there was no neurological deficit and they had SAS score 3–4 and Ramsey score 2–3. In 1/17 (6%) patient the relative ipsilateral rSO_2 change during CCC was 27% (10–12% in absolute values) and a shunt was placed. After emergence the patient had blurry speech and had SAS score 4 and Ramsey score 3. In 1/17 (6%) patient the relative ipsilateral rSO_2 change during CCC was 20% (5–12% in absolute values) but the absolute value was 38 and a shunt was placed. After emergence the patient had no deficit with SAS score 4 and Ramsey score 2.

Conclusion: NIRS may prove a useful non-invasive diagnostic tool in early detecting intraoperative cerebral ischemia and guide to surgical interventions.

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Visualisation of one-dimensional gastric- CO_2 -tonometry values

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Background and Goal of Study: The gastric- CO_2 -tonometry ($PgCO_2$) is a minimal invasive procedure for semi-continuous measurement of tissue perfusion in the splanchnic region (1). The $PgCO_2$ as a prognostic criteria for the critical ill patient is discussed controversially (2). The interpretation of pathological $PgCO_2$ in progression unalteredly allegorates a challenge. Additional information in the form of specific patterns can be offered by visual data exploration.

Materials and Methods: $PgCO_2$ was measured every 10 min with a gastric tube (TRIP, NGS catheter) and an automatic gas analyzer (Tonocap, Datex, Helsinki, Finland). We recorded the values continuously and the frequency distribution in an 8 h-interval and in an area between 20 and 130 mmHg (increment 5), has been calculated. The display of that histogram occurred as a contour-plot. The 2 contour-plots show the evaluation of two patients with different patterns: 19 y., m, multiple injured, APACHE II Score 26, 1980 measurements (graph 2); 49 y., f, ARDS, APACHE II Score 19, 1944 measurements (graph 3).

Results and Discussions: This new form of visualization offers additional information. The 3-dimensional display of the frequency distribution of numerous measurements clarifies the information, which is not readily identifiable considering the numerical results. A visual graph of complex circumstances allows a much easier, intuitional and more effective analysis of the data.

Conclusion(s): In information technology, visualization techniques are used for processing large data sets (3). These is suitable for the presentation of $PgCO_2$ in progression and procure complex information at a glance. The aim of future activities has to be the ideal visual conditioning of $PgCO_2$ for recognition of pathological patterns.

References:

- 1 Crit. Care 2000; 4(5):269–28.
- 2 British Journal of Anaesthesia 2000; 84(1):74–86.
- 3 Comm. of the ACM 2001; 44(8):39–44.

A-174

Performance of fourth- and fifth-generation pulse oximeters during cardiac arrhythmia

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Background and Goal of Study: This study was designed to quantify spurious pulse rate (PR) readings (1) during cardiac arrhythmia and to additionally determine to which extent arrhythmia involves errors in the saturation estimates of fourth- and fifth-generation pulse oximeters.

Materials and Methods: After institutional approval and informed consent, two groups of SICU patients (A: $n = 71$, ASA II–IV, mean age 69 yrs; B:

n = 110, ASA II–IV, mean age 65 yrs) suffering from arrhythmia were simultaneously connected to either a Nellcor N-3000 and an IVY 2000 Masimo SET (A), or a Nellcor N-595 and a Radical Masimo SET (B) pulse oximeter. Alarm limits of PR were set at 60 and 120 bpm, respectively, those of SpO₂ to $\pm 3\%$ of the fractional hemoglobin saturation (SaO₂) subsequent to an initial *in vitro* blood sample analysis. SpO₂ and PR were recorded continuously and an experienced anesthesiologist classified the alarms into technical/physiological and false/correct to calculate sensitivity and specificity.

Results and Discussions: The time in which data were unavailable for technical reasons, was significantly decreased in B (N-3000 6.7%, IVY 2000 1.8% vs. N-595 3.3%, Radical 1.0%). Comparing SaO₂ to SpO₂ yielded low correlation coefficients (A: N-3000 0.77, IVY 2000 0.69; B: N-595 0.78, Radical 0.70), however, correlating the pulse oximeters to each other returned slightly increased correlation coefficients for SpO₂ (A: N-3000 vs. IVY 2000 0.76;

B: N-595 vs. Radical 0.85). Sensitivity appeared consistently high in both groups (96% to 100%), whereas specificity was lowest with Radical (45.0%) when compared to IVY 2000 (52%), N-3000 (75%), and N-595 (72%). False positive (FP) alarms were least frequent with N-3000 (1.7 per hr), followed by N-595 (2.4 per hr), IVY 2000 (4.3 per hr) and Radical (4.3 per hr).

Conclusion(s): The dropout rate is decreased to approximately 50% in fifth-generation pulse oximeters with Masimo SET performing superior to Nellcor. The Nellcor devices cause less frequent FP alarms when compared to Masimo SET, however, new technology does not imply increased specificity. The inadequate agreement with SaO₂ and the significant variation of SpO₂ between the devices evidently reflect a decreased accuracy of SpO₂ indications.

Reference:

1 Lutter N, Kroeber S, Urankar S, et al. *Anesthesiology* 2001; 95:A550.

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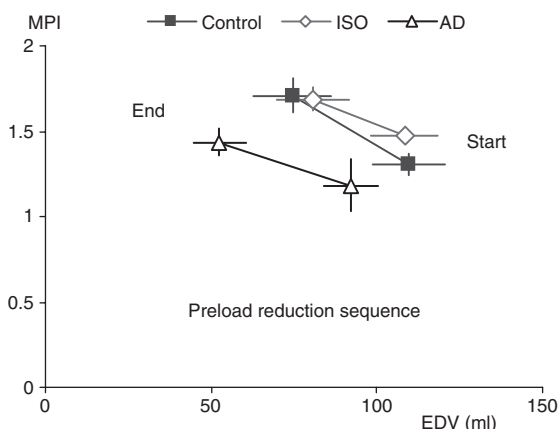
Dynamic myocardial performance index during preload variation

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Background and Goal of Study: The myocardial performance index (MPI) describes myocardial contractile status and thought to be resistant to alterations in loading conditions. The aim was to identify systematic variation in MPI during experimental alteration in preload.

Materials and Methods: 8 juvenile pigs, 40.1 ± 1 kg, were anaesthetised and instrumented with left ventricular pressure and conductance² volumetry catheters. Measurements were collected before and during isoflurane 1% (ISO) and adrenaline (AD) infusion $0.3 \text{ mcg kg}^{-1} \text{ min}^{-1}$. Preload alteration was brought about by transient vena cava balloon occlusion (IVCBO). A linear regression slope was calculated. This slope and the MPI intercept for the end-diastolic volume (EDV) at 'start' and 'end' were used to plot summation points and average slope. All variations are expressed as \pm SEM).

Results and Discussions: There was an average of 10 ± 0.4 beats during the measurement sequences. There is a negative slope for MPI during preload reduction by IVCBO for all groups. Responses to ISO and AD suggest that MPI identified an altered contractile state.



Conclusions: MPI appears to increase during preload reduction, suggesting that a relation to preload needs to be established during serial measurements of MPI. MPI is sensitive to inotropic interventions, even over a broad range of preload conditions.

References:

- 1 Tei C, Ling LH, Hodge DO, et al. *J Cardiol* 1995; 26(6): 357–66.
- 2 Baan J, Van der Velde ET, deBruin HG, et al. *Circulation* 1984; 70(5): 812–23.

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A-178

Choice of the primary anesthetic regimen can influence intensive care unit length of stay after coronary surgery with cardiopulmonary bypass

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Background: Volatile anesthetics protect the myocardium during coronary surgery (1,2). However, the impact of this phenomenon on the clinical recovery remains to be established. This study hypothesized that the use of a volatile agent in the anesthetic regimen would be associated with a shorter intensive care unit (ICU) and hospital length of stay (LOS).

Materials and Methods: Elective coronary surgery patients were randomly assigned to receive either propofol (n = 80), midazolam (n = 80), sevoflurane (n = 80), or desflurane (n = 80) as a part of the anesthetic regimen. Cardiac function was assessed perioperatively and during 24 hours postoperatively using a pulmonary artery catheter. Perioperatively, a high-fidelity pressure catheter was positioned in the left ventricle (LV). Response to increased cardiac load, obtained by leg elevation, was assessed before and after CPB. Postoperative levels of cardiac troponin I were followed during 48 hours. ICU and hospital LOS were related to pre- and intraoperative variables.

Results: Patient characteristics were similar in all groups. Systemic and LV hemodynamics were similar with the different anesthetic regimens before CPB. After CPB, stroke volume index and dP/dt_{max} in the early postoperative period were significantly ($p < 0.01$) higher with sevoflurane and desflurane and the postoperative troponin I levels were significantly ($p < 0.01$) lower. ICU and hospital LOS were shorter with sevoflurane and desflurane ($p < 0.01$). Prolonged ICU LOS (> 48 hours) was associated with the choice of anesthetic agent ($p = 0.009$), the occurrence of atrial fibrillation ($p < 0.001$), an increased troponin I $> 4 \text{ ng/ml}$ ($p < 0.001$), and the need for prolonged inotropic support (> 12 hours) ($p < 0.001$).

Conclusion: The use of sevoflurane and desflurane resulted in a preserved early postoperative myocardial function after CPB and a lower release of troponin I. ICU and hospital LOS were also shorter in these groups.

References:

- 1 De Hert et al. *Anesthesiology* 2003; 99: 314–23.
- 2 Julier et al. *Anesthesiology* 2003; 98: 1315–27.

A-179

The value of stroke volume variation in patients after cardiac surgery ventilated with low tidal volumes

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Background and Goal of Study: Stroke volume variation (SVV) was shown to be a predictor of fluid responsiveness (1). However, the reliability of SVV is unproven in patients ventilated with low tidal volumes.

Materials and Methods: 14 patients (age 63 ± 12 years) ventilated in a pressure-controlled mode (tidal volume: $7.5 \pm 1.2 \text{ ml kg}^{-1}$) were studied after coronary artery bypass grafting. SVV was assessed by pulse contour

analysis during a volume challenge induced by tilting the patients from anti-Trendelenburg to Trendelenburg position.

Results: Linear regression analysis revealed a significant relationship between pre-challenge values of SVV and changes in stroke volume index (SVI) induced by volume challenge ($r = 0.61$; $p < 0.05$). In addition, changes in SVV during volume challenge were significantly correlated to changes in SVI ($r = -0.70$; $p < 0.0001$) and in left ventricular enddiastolic area index ($r = -0.77$; $p < 0.001$).

Conclusion: SVV predicts fluid responsiveness and enables assessment of left ventricular preload in patients after cardiac surgery ventilated with low tidal volumes.

Reference:

1 Reuter DA, et al. *Crit Care Med* 2003; 31:1399–1404.

A-180

Smoking alters VEGF and eNOS expression during coronary artery bypass graft surgery

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Background and Goal of Study: Impaired endothelial function may affect the patency and function of internal mammary artery (IMA) coronary artery bypass grafts. Cardiopulmonary bypass (CPB) is acknowledged to be one of the major causes of a complex systemic inflammatory response after cardiac surgery. The deleterious effects of smoking on coronary arteries are mainly resulted by abnormal endothelial function.¹ In this study we aimed to compare eNOS and iNOS concentrations and VEGF expression in IMA specimens during CABG in smoker and nonsmoker patients.

Materials and Methods: IMA sections were studied immunohistochemically from 30 selected patients who were scheduled for elective cardiopulmonary bypass grafting with CPB and assigned to smoker or nonsmoker group. Representative sections of IMA were stained with monoclonal antibodies of eNOS, iNOS and VEGF and stained cells in the adventitia, endothelium and muscle were counted, respectively.

Results and Discussions: VEGF and eNOS immunoreactivity increased significantly during bypass comparing to baseline values in the endothelium ($P = 0,0156$, $P = 0,0313$) and adventitia ($P = 0,0313$, $P = 0,0001$) and muscle respectively ($P = 0,0039$, $P = 0,0005$) but iNOS did not increase in non-smoker patients. In smoker patients VEGF and eNOS and iNOS decreased during bypass in the endothelium comparing to baseline levels ($P = 0,0156$, $P = 0,002$, $P = 0,002$).

Conclusion(s): Here we showed that cigarette smoking significantly reduces the expression of VEGF under hypoxic conditions.

Reference:

1 Michaud SE. *FASEB* 2003; 17: 1150–1155.

A-181

Mixed venous oxygen saturation as a predictor of outcome in postoperative cardio-surgical patients with low cardiac output syndrome under intra-aortic balloon pump assistance

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Background and Goal of Study: To evaluate SvO₂ as a predictor of the outcome of patients with postcardiotomy low cardiac output syndrome.

Materials and Methods: 71 patients with low cardiac output syndrome who underwent cardiac surgery under CPB, on maximal inotropic support and IABP, were analyzed in a retrospective study. The values of SvO₂ at 2 hours after the arrival in ICU were introduced into a correlation and regression tree model by univariate analysis.

Results and Discussions: It was found a cutoff point value of SvO₂ of 60.3% between survivors and non-survivors. Among the 39 patients with SvO₂ > 60.3% the mortality was 10.25% (4 patients) and among the 32 patients with SvO₂ < 60.3% the mortality was 96.87% (31 patients) ($p < 0.01$). Another cutoff point permit the separation of non-survivors in two subgroups: patients weaned and non-weaned of ventricular mechanical assistance. The first subgroup were the patients with SvO₂ > 51.4% but lower than 60.3% who were weaned of IABP but died later due to MSOF. Among those 16 patients were weaned 62.5% (10 patients). The second subgroup were the patients with SvO₂ < 51.4% who most of them died early due to acute heart failure. The weaning rate among those 16 patients was 25% (4 patients).

SvO ₂ (%)	<51.4	>51.4 <60.3	>60.3	Total
Survivors	16 0	16 1	39 35 (89.75%)*	71 36 (50.7%)
	Total = 1 (3.2%)*			
Non-survivors	16	15	4 (10.25%)	35 (49.29%)
	Total = 31 (96.8%)			
W/N (No. pts)	W	N	W	N
	4	12	10	6
			36	3

W – weaned of IABP; N – not weaned; * $p < 0.01$

Conclusion(s): We can conclude that SvO₂ can predict early after implantation the success or failure of IABP support in terms of survival or not (SvO₂ > 60% predict survival >90%). Patients with SvO₂ < 60% will die by MSOF even if they will be weaned of IABP. In these cases we should think to another method to improve cardiac function and prevent MSOF (LVAD, transplantation, etc.).

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Mechanisms of induced atrial flutter with propofol in an experimental model of atrial arrhythmias

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Background and Goal of Study: Atrial tachyarrhythmias (AT) can complicate the perioperative period. We have previously developed a closed-chest porcine model in which AT are facilitated by an infusion of ethanol. In this model propofol was associated with a higher proportion of induced atrial flutter (AFL). Our aim was to study the electrophysiological parameters than favour AFL with propofol anaesthesia.

Materials and Methods: Large white pigs were premedicated with ketamine and anesthetized with P (2 mg/kg for induction followed by 3 mg/kg/h). Then, a right atrial electrical stimulation protocol with up to three extrastimuli and burst pacing was performed on the baseline and during a continuous ethanol infusion (mean venous ethanol concentration 2.6 ± 0.8 g/L). Statistical test used: t-Student.

Results and Discussions: 48 experimental protocols were analyzed 20 with AFL and 18 without AFL. Electrophysiological data are shown in the Table.

	AFL	No AFL	P
ERP400	138 ± 21	148 ± 21	NS
ERP300	135 ± 14	145 ± 19	0.05
CI400	51 ± 9	52 ± 9	NS
CI300	53 ± 10	53 ± 9	NS
Min. CL	157 ± 26	161 ± 21	NS
CI min. CL	86 ± 23	74 ± 11	NS
D.CL	33 ± 19	21 ± 7	0.02
PWD	121 ± 15	112 ± 14	0.09

ERP400, 300: effective refractory period at paced cycle length of 400 and 300 ms. Min. CL: is the shortest CL with 1:1 atrial capture CI 400, 300, min. intraatrial conduction interval measured between 2 atrial sites 4 cm apart, at a CL of 400, 300 and min. CL. D-CL (in ms): rate-related slowing in conduction, represented by difference in CI between the shortest CL and CL of 300 ms. PWD: P wave duration.

Conclusion(s): Protocols resulting in induction of AFL had a more intense rate-related slowing in conduction. Interestingly enough in these protocols, refractory periods were also shorter, thus resulting in a shorter wave-length, that favours reentrant mechanisms. In fact, all episodes of long-lasting atrial flutter could be terminated by atrial pacing, suggesting a reentrant mechanism.

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Influence of iloprost on the human myocardial contractility

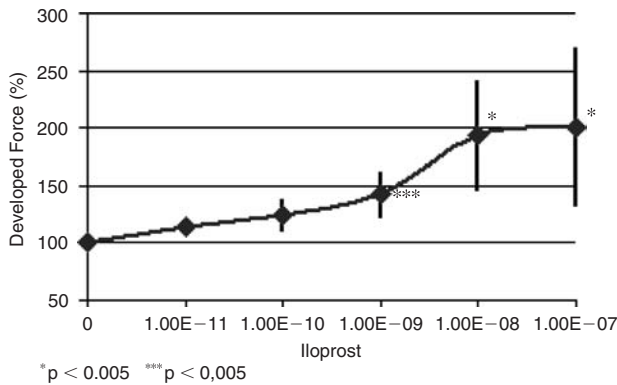
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Background and Goal of the Study: Iloprost, is used in the therapy of pulmonary hypertension and acute right heart failure. If iloprost exerts direct positive inotropic effects, is unclear. We studied the dose-dependent contractile response of human atrial trabeculae to administration of iloprost.

Materials and Methods: 17 trabeculae from right atrial appendices were obtained. Developed force (F), time to peak tension (TPT), time to 50% of contraction (T_{sys50}) and to 50% relaxation (Tdia50) were registered at a pacing frequency of 1 Hz at 37°C. Ilomedin concentration was increased from 10^{-11} to 10^{-7} M. Results are given as mean \pm SEM. Statistical analysis was performed by paired t-test.

Results and Discussion: Iloprost exerted a positive inotropic effect in 10 of 17 human trabeculae. 10^{-9} M iloprost increased developed force (F) to $142.5\% \pm 19.6\%$ of baseline values ($p = 0.001$). In 7 trabeculae no change in contractility was observed. At concentrations above 10^{-9} M iloprost caused arrhythmias in 29.4% of the trabeculae.



Conclusion: Our data suggest, that iloprost exerts direct positive inotropic effects in 10 of 17 isolated human atrial trabeculae. However, a relevant number of trabeculae did not respond to iloprost, the underlying mechanism of needs further investigation.

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Cardiac function impairment induced by laparoscopy for aortic surgery: an echocardiographic study

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Background and Goal of Study: Cardiovascular diseases are frequent among patients operated for an aortic surgery and hemodynamic changes could be deleterious for their cardiac function. Pneumoperitoneum (P) with CO_2 increases arterial pressure and, sometimes, decreases cardiac output. We conducted a transesophageal echocardiographic (TEE) study for assessing the effects of a P on the cardiac function of these patients.

Materials and Methods: TEE was performed in 15 patients (63 ± 13 years, 6 ASA II and 9 ASA III) scheduled for a totally laparoscopic infra-renal aortic surgery (10 stenosis, 5 aneurysms). General anaesthesia was standardized with thiopental, sufentanil, atracurium and isoflurane in Air/ O_2 mixture. Evaluations were realized in supine position without P (SP 0) and with a P of 14 mmHg (SP 14). Then, patients were turned in a strict right lateral decubitus without P (LP 0) and P was insufflated to 7 (LP 7) and to 14 mmHg (LP 14). TEE was performed with a Toshiba "CoreVision" model SSA-350A equipped with a multiplane 5 MHz transducer.

Results: Data (Mean \pm SEM) are compared with an ANOVA for repeated measurements. Results with a $P < 0.05$ are shown in the table.

	SP 0	SP 14	LP 0	LP 7	LP 14
HR	72 \pm 3	76 \pm 3	70 \pm 4	73 \pm 12	77 \pm 12
MAP	77 \pm 4	86 \pm 4	78 \pm 3	89 \pm 3	102 \pm 7
P_{AW}	13 \pm 1	19 \pm 1	15 \pm 1	18 \pm 1	24 \pm 1
LVSI	49 \pm 3	41 \pm 3	48 \pm 2	44 \pm 2	40 \pm 3
LVWS	64 \pm 6	88 \pm 11	64 \pm 8	72 \pm 7	87 \pm 8
LVEF	64 \pm 3	48 \pm 6	64 \pm 5	61 \pm 3	52 \pm 3
E/A_M	1.3 \pm 0.1	1.2 \pm 0.1	1.2 \pm 0.1	1 \pm 0.1	1 \pm 0.1
SVCd	18 \pm 0.8	19 \pm 0.9	20 \pm 0.9	19 \pm 0.9	20 \pm 1.3
$\Delta RVSI$	14 \pm 4	21 \pm 4	29 \pm 3	24 \pm 4	40 \pm 5

HR: heart rate; MAP: mean arterial pressure; P_{AW} : end-inspiratory airway pressure; LVSI: LV stroke index; LVWS: LV wall stress; LVEF: LV ejection fraction; E/A_M : ratio of E to A wave velocity; SVCd: superior vena cava diameter; $\Delta RVSI$: change (%) in RV stroke index.

Conclusions: P induced significant arterial pressure and LV afterload increases. Consequences were LV diastolic and systolic impairments. Volume

status remained optimal. RV systolic function was also impaired, according to P and body position.

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Post operative elevated troponin Ic in vascular surgery patients: aortic vs peripheral surgery

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Background and Goal of Study: The incidence of elevated troponin Ic (cTnI) rates (cTnI $> 0,1$ ng ml^{-1}) in post operative vascular surgery patients is 18%^[1]. This incidence of coronary events was evaluated without distinction regarding the type of vascular surgery. The goal of our study was to compare the incidence of post operative coronary events (elevated cTnI) in aortic surgery (AS) and lower extremity bypass surgery (LEBS).

Materials and Methods: Fifty patients scheduled for AS or LEBS were prospectively included. Anaesthesia was standardized: remifentanyl, propofol TCI. Studied parameters were daily post operative rates of cTnI from day 1 to 5. Myocardial damage (MD) was defined as a cTnI rate between 0,2 and 1,5 ng ml^{-1} , myocardial infarction (MI) as a rate above 1,5 ng ml^{-1} . Statistical analysis used Mann & Whitney and Fischer tests. A $p < 0,05$ was considered statistically significant.

Results: The incidences of coronary events in AS ($n = 24$) and LEBS ($n = 26$) were respectively 12,5% (2 MD, 1 MI) and 15,4% (3 MD, 1 MI). Post operative cTnI rates measurements (means \pm SD) in AS and LEBS are reported in the table. None of the coronary events were fatal within a one month follow up period.

cTnI rates (ng ml^{-1})	D1	D2	D3	D4	D5
AS ($n = 24$)	0,03 $\pm 0,03$	0,37 $\pm 0,33$	0,19 $\pm 0,12$	0,12 $\pm 0,08$	0,10 $\pm 0,06$
LEBS ($n = 26$)	0,14 $\pm 0,07$	0,10 $\pm 0,04$	0,08 $\pm 0,02$	0,07 $\pm 0,02$	0,06 $\pm 0,01$

No between groups difference at any time.

Conclusion: These preliminary results show that the incidence of post operative coronary events (MD & MI), assessed by cTnI measurement, is equivalent in both AS and LEBS. This must be considered for the anaesthetic care of LEBS. These results must be confirmed on a larger study.

Reference:

1 Andrews N et al, *Cardiovascular Surgery*, 2001; 9: 254-65.

A-186

Benefits of off-pump coronary artery bypass grafting

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Background and Goal of Study: To avoid harmful effects of cardiopulmonary bypass (CPB) off-pump coronary artery bypass grafting (OPCABG) is becoming increasingly important. However, effects on outcome improvement using this technique are controversial^{1,2}. The aim of this observational data base analysis was to determine short-term outcome in patients undergoing CABG using CPB or OPCABG.

Materials and Methods: 697 patients undergoing CABG procedures were available for statistical analysis from 1/2001 to 12/2001. In 269 patients (38%) cardiopulmonary bypass and aortic cross-clamping (ACC) (group A), in 116 patients (17%) cardiopulmonary bypass without ACC (group B) and in 312 patients (45%) the off-pump technique (group C) was used. In 95% of patients multiple grafting (≥ 2 grafts) was performed. Euroscore, 30-day mortality, ischaemia 24 h after the intervention, transfusion requirements, duration of respiratory support and hospital stay were compared using Kruskal-Wallis and χ^2 -test. $P < 0.05$ was considered statistically significant.

Results: Euroscore was comparable for the 3 groups (A = 4.2 ± 0.9 , B = 4.7 ± 0.9 , C = 4.6 ± 1.0). There was no significant difference between the groups for 30-day mortality (A = 1.6%, B = 2.6%, C = 1.4%) and incidence of perioperative ischaemia (A = 5.8%, B = 7.8%, C = 3.3%). Significantly reduced transfusion requirements could be observed for C compared to A and B (red blood cells: A = 2.1 ± 0.7 U, B = 3.6 ± 0.7 U, C = 1.5 ± 0.4 U [$p = 0.0001$]; fresh frozen plasma: A = 2.0 ± 0.4 U, B = 4.1 ± 0.8 U, C = 1.2 ± 0.4 U [$p = 0.0001$]; platelets: A = 1.0 ± 0.2 U, B = 2.4 ± 0.4 U, C = 0.4 ± 0.2 U [$p = 0.0001$]). Also, duration of respiratory support (A = 14.2 ± 4.5 h, B = 21.4 ± 6.3 h, C = 11.4 ± 4.1 h, [$p = 0.0001$])

and length of hospital stay (A = 10.5 ± 1.4 d, B = 11.0 ± 1.6 d, C = 9.9 ± 1.3 d, [p = 0.0006]) differed significantly between groups.

Conclusion: In this series of patients undergoing CABG procedures a significant reduction of transfusion requirements, shortening of respiratory support duration as well as shorter hospital stay was found in patients using the off-pump approach.

References:

- 1 *J Cardiothorac Vasc Anesth* 2003; 17:447–51.
- 2 *Ann Thorac Surg* 2003; 76:1510–15.

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Effects of magnesium administration prior to aortic cross clamping on cardiac function and rhythm after cardiopulmonary bypass with potassium crystalloid cardioplegia

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Background and Goal of Study: Although Mg is widely used in cardiac surgery, its mechanism of action and clinical effects are still not fully understood. This study evaluated the effects of magnesium before aortic cross-clamping on need for inotropic drugs and occurrence of malignant arrhythmias after cardiopulmonary bypass.

Materials and Methods: 1) Prospective controlled single-centre study of 138 patients for coronary and aortic valve surgery randomised to Mg (4 g = 16 mmol before aortic cross clamping) or no Mg. 2) Database review of cardiac surgical patients receiving Mg and not receiving Mg at this centre from 1998–2001.

Results and Discussions: In the Mg groups we found a significant reduction in need for inotropic support: 16/69 = 23% (Mg) vs. 35/69 = 51% (no Mg) (p < 0.04) and 19/55 = 35% (Mg) vs. 140/224 = 63% (no Mg) (p < 0.02) and a non-significant trend to less arrhythmias post-cardiopulmonary bypass.

Conclusion(s): Our findings are in agreement with other studies indicating that Mg is associated with improved myocardial protection and recovery after cardiopulmonary bypass. This might be due to preservation of cellular energy levels and less cellular calcium influx during ischaemia-hypoxia. Routine Mg use in cardiac surgery could lead to clinical benefits and cost savings from reduced perioperative complications and less use of inotropic and antiarrhythmic drugs.

References:

- Satur CMR. Magnesium and its role in cardiac surgical practice: a review. *J Clin Basic Cardiol* 2002; 5: 67–73.
- Yeatman M, Caputo M, Narayan P, Lotto AA, Ascione R, Bryan AJ, Angelini GD. Magnesium-supplemented warm blood cardioplegia in patients undergoing coronary artery revascularization. *Ann Thorac Surg* 2002 Jan; 73(1):112–8.

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Influence of xenon on heart rate variability in high risk cardiovascular patients

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Background: Xenon anaesthesia (XE) has a high degree of cardiovascular stability (1) and could be advantageous in patients with cardiovascular risk factors. Autonomic nerve system activity was analysed by heart rate variability (HRV). Modulations of HRV during XE compared to total intravenous anaesthesia (TIVA) were investigated.

Material and Methods: After IRB approval 44 ASA III patients scheduled for abdominal aortic surgery (XE: n = 22; TIVA: n = 22) HRV and hemodynamics were studied at 5 different events: I: Baseline, II: after induction of anaesthesia, III: start of XE, IV: 5 min after XE, V: end-tidal XE = 65% ± 5%. Standardized anaesthesia as TIVA until XE was administered to patients of XE group. Mean arterial pressure (MAP), heart rate (HR), relative low frequency (LF), relative high frequency (HF), LF/HF ratio were analysed. Statistics: Two Way Anova for matched pairs, Mann-Whitney-U test, and Wilcoxon-Rank test for comparison between and within groups, means ± SD, * = p < 0.05.

Results and Discussions: Hemodynamics and HRV parameters are shown below. During XE the parasympathetic drive increased and the sympathetic drive decreased compared to TIVA. HR decreased significantly in the XE group without clinical relevance.

	I	II	III	IV	V
HR (1 min ⁻¹)					
TIVA	75 ± 13	68 ± 13	64 ± 12	66 ± 14	68 ± 12
XE	65 ± 13	62 ± 13	54 ± 8*	58 ± 13*	59 ± 13
MAP (mmHg)					
TIVA	100 ± 10	84 ± 15	84 ± 18	83 ± 14	86 ± 13
XE	102 ± 12	86 ± 17	86 ± 16	72 ± 15	85 ± 12
LF/HF					
TIVA	1.8 ± 1.1	1.8 ± 1.4	1.9 ± 1.2	2.3 ± 1.0*	2.5 ± 1.3*
XE	1.9 ± 1.0	1.7 ± 1.3	1.5 ± 1.1	0.7 ± 0.4*	0.6 ± 0.4*
LF					
TIVA	32 ± 14	26 ± 14	30 ± 11	35 ± 13*	38 ± 11*
XE	36 ± 14	31 ± 16	32 ± 12	24 ± 12*	19 ± 11*
HF					
TIVA	25 ± 15	21 ± 16	31 ± 15	50 ± 18*	57 ± 23*
XE	20 ± 9	20 ± 12	22 ± 13	23 ± 14*	23 ± 12*

Conclusions: In high risk patients undergoing major abdominal vascular surgery XE in contrast to TIVA showed a higher parasympathetic and lower sympathetic drive in HRV without signs of hemodynamic instability. This might be beneficial in this patient population.

Reference:

- 1 Luttrupp HH, et al. *Anaesthesia* 1993.

A-189

The effects of beating heart surgery on left ventricular diastolic function

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Background and Goal of Study: Cardioplegic arrest during cardiopulmonary bypass (CPB) is often associated with left ventricular diastolic dysfunction in the post-CPB period. Only few data are available concerning the effects of beating-heart surgery (BHS) on diastolic function.

Materials and Methods: 41 patients (age 63 ± 9 years) undergoing coronary artery bypass grafting were studied. 15 patients (group H) were randomised to the CPB group (HL-20, Jostra AG, Hirrlingen, Germany). Cardiac arrest was induced by infusion of 2000 ml crystalloid cardioplegic solution. 26 patients underwent BHS under assistance of a simplified bypass system (SBS) consisting of a blood pump and the oxygenator. 12 patients (group D) were randomised to the DeltaStream™-system (Medos AG, Stolberg, Germany) and 14 patients (group C) to the CORx™-system (CardioVenton, Inc., Santa Clara, CA, USA). Left ventricular diastolic function was studied with transesophageal doppler-echocardiography using the following parameters of the transmittal flow signal: mitral deceleration time (DT), E/A-wave flow velocity ratio (E/A) and A-wave-duration (A_{Dur}).

Results: Data (mean ± SD) are presented in the table:

	Group H	Group D	Group C
Duration of CPB (min)	99 ± 27	114 ± 17	107 ± 43
Ischemia Time (min)	55 ± 16	–	–
Number of grafts	3.3 ± 0.8	2.9 ± 0.8	2.9 ± 0.9
DT (ms)			
Pre-CPB	180 ± 46	175 ± 34	179 ± 32
Post-CPB	147 ± 17**	130 ± 31**	128 ± 10**
E/A			
Pre-CPB	1.1 ± 0.3	1.2 ± 0.3	1.1 ± 0.3
Post-CPB	0.8 ± 0.2**	0.9 ± 0.2**	0.9 ± 0.1*
A _{Dur} (ms)			
Pre-CPB	154 ± 17	160 ± 23	149 ± 16
Post-CPB	139 ± 19**	149 ± 25**	139 ± 18

(**)-P < 0.05 (0.01) vs. pre-CPB (MANOVA for repeated measurements, post-hoc testing with Fisher LSD test).

Conclusions: Beating heart surgery was not able to attenuate diastolic dysfunction after CPB, despite unloading of the heart with the SBS. Temporary occlusion of coronary arteries and displacement of the heart during the surgical procedure led to regional myocardial ischaemia deteriorating diastolic function to a comparable extent as with cardioplegic arrest.

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Effect of early and late use of intraaortic balloon pumping in patients undergoing cardiac surgery on parameters of tissue oxygenation

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Background and Goal of Study: The intra-aortic balloon pumping (IABP) is used to treat cardiac failure. Little is known about the effects on regional, e.g.

splanchnic oxygenation (1,2). In postcardiotomy low output syndrome the available data suggests that early IABP use improves outcome (3). We studied the effects of IABP on global and regional oxygenation in patients undergoing cardiac surgery with different IABP insertion timepoints.

Materials and Methods: After approval of the local ethics committee we prospectively studied 26 patients undergoing cardiac surgery requiring IABP therapy for hemodynamic support. Hemodynamic and Tonometric variables, arterial lactate, and use of adrenaline were measured hourly. Seventeen patients had an initial IABP insertion after cardiopulmonary bypass, no baseline values could be recorded (Group: Initial). Nine patients developed low cardiac output syndrome during intensive care therapy and had later IABP insertion (Group: Later).

Results and Discussions:

Table 1.

	Baseline	1 hour	7 hours	12 hours
CI l/min/m ²				
Initial		3,1 ± 0,9	3,5 ± 1,0	3,3 ± 0,7
Later	3,1 ± 0,4	3,5 ± 0,7*	3,8 ± 0,6*	3,7 ± 0,7*
Lactate mmol/l				
Initial		4,6 ± 3,6#	4,4 ± 3,3#	3,1 ± 2,4
Later	8,4 ± 6,1	12,2 ± 7,5*	9,1 ± 5,5	5,2 ± 3,4*
aiDCO ₂ mmHg				
Initial		7,7 ± 4,3	11,8 ± 4,9	13,5 ± 3,5
Later	26,4 ± 9,8	7,1 ± 6,5*	10,6 ± 9,3	9,7 ± 8,5
Adren. µ/kg/m ²				
Initial		,05 ± ,04#	,05 ± ,04#	,05 ± ,03#
Later	,09 ± ,03	,1 ± ,02	,11 ± ,03	,09 ± ,04

CI, Cardiac index; aiDCO₂, arterial intestinal CO₂-Difference; Adren., Adrenalin. Data are expressed as mean ± SD. *p < 0,05 compared with baseline, #p < 0,05 between groups.

Conclusion(s): In our patients IABP therapy improved splanchnic oxygenation in postcardiotomy low cardiac output syndrome. Patients with later IABP insertion and longer cardiogenic shock needed more catecholamine therapy to achieve similar hemodynamic and oxygenation values.

References:

- Janssens U, et al. *Crit Care Med* 28: 3449–3455, 2000.
- Landreneau R, et al. *J Surg Res* 51: 281–287, 1991.
- Mehlhorn U, et al. *Thorac Cardiovasc Surg* 47 Suppl 2: 298–303, 1999.

A-191

Myocardial protective effects of metoprolol and diltiazem given during cardiopulmonary bypass

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Introduction: Administration of beta-adrenergic and calcium antagonists contributes to myocardial protection during hypothermic arrest for cardiac surgery. However, beta-adrenergic and calcium antagonists have been avoided during cardiopulmonary bypass (CPB) because of concern that the negative inotropic effects induced may make it difficult to terminate CPB. The purpose of this study was to compare the clinical and biochemical effects of diltiazem and metoprolol given during cardiac surgery, and to examine the effects of these agents about the termination of CPB.

Patients and Methods: Forty-five patients over 35 years old scheduled for coronary artery surgery involving CPB and aortic cross-clamping were randomized to three groups: the metoprolol group (group M), who were to receive a metoprolol infusion during surgery; the diltiazem group (group D), who were to receive a diltiazem infusion during surgery; and the control group (group C). In diltiazem group a loading dose of 0.25 mg/kg diltiazem IV was given followed by a continuous infusion of 0.15 mg/kg. In metoprolol group 0.2 mg/kg metoprolol IV was given in one hour. Baseline coronary sinus blood for lactate and malondialdehyde measurement was drawn through a cannula placed into the coronary sinus by the surgeon, and arterial blood for lactate and malondialdehyde measurement was drawn through the radial artery line. A 12-lead ECG obtained the evening before and 12 h after surgery. ECG information included rhythm, presence of ST- or T-wave changes, PR interval, QRS duration and QT interval. Arterial and coronary sinus blood for lactate and malondialdehyde were measured at 2, 10 and 20 min after removal of the cross-clamp. Finally, at 12 h after the cross-clamp removal, a 12 lead ECG was repeated, and the MB fraction of creatine kinase and creatine kinase was measured in all patients. CK-MB as a percent of CK was calculated. Post-CPB outcome variables included the number of patients experiencing dysrhythmias, the number of requiring countershocks and the amount of nitroglycerine infusion. After the operation cross-clamp time, CPB time and operation time was noted.

Conclusion: In metoprolol group dysrhythmias, number of the countershocks, number of the ischemic ST and T changes, malondialdehyde level was insignificantly lower, and lactate levels was significantly lower than

other groups. In addition hemodynamic control was more easy and unproblematic for anesthesiologist in metoprolol group. Therefore, in coronary artery surgery administration of metoprolol in patients who have better cardiac functions may be beneficial to protect heart from ischemic injury.

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Comparison of biphasic and monophasic internal defibrillation during cardiac surgery

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Background and Goal of Study: Recently it has been shown, that biphasic external shocks were more effective in the treatment of ventricular fibrillation (VF) compared to monophasic external shocks in terms of numbers of defibrillation and maximal energy used for termination of VF. To our knowledge only less data exist concerning the effects of biphasic internal shocks in patients undergoing heart surgery. The aim of this study was to compare different internal shock wave forms for termination of VF in patients undergoing open heart surgery.

Materials and Methods: 134 patients scheduled for elective heart surgery were prospectively randomised either to monophasic (group A) or biphasic (group B) internal defibrillation. Defibrillation was started with 7 Joule and increased stepwise to 30 joule in each group until successful termination of (VF) after aortic declamping. The number of defibrillations, cumulative and maximal energy for termination of VF were determined. Pre-, peri- and postoperatively, Troponin T, total creatine phosphokinase (CPK) and CPK-MB isoenzyme were measured.

Results and Discussions: In 64 patients (47%) ventricular fibrillation occurred. Thus the groups consisted of 32 patients each. The number of defibrillations (1.3 ± 0.6 vs. 1.9 ± 1.2, p = 0.013) maximal energy per patient (7.9 ± 2.5 vs. 11.6 ± 7.32; p = 0.005), and cumulative energy (10.1 ± 6.1 vs. 21.3 ± 24.1, p = 0.013) for successful termination of VF was significantly reduced in group B. Troponin T, CPK, and CPK-MB revealed no difference between groups.

Conclusion(s): Preliminary results of this study indicate, that biphasic internal defibrillation is more effective in the treatment of VT during cardiac surgery equal to monophasic defibrillation.

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Comparative study of echocardiographic indexes of systolic function during dobutamine administration

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Goal of the Study: To study the accuracy of echocardiographic indexes of systolic function to monitor inotropic stimulation obtained with graded administration of dobutamine.

Study Protocole: Nine ICU patients with cardiac failure and mechanically ventilated were included. All patients showed a low cardiac output (cardiac index < 2.4 l/mn/m²) and decreased left ventricular area ejection fraction (AEF < 40%). Complete TEE examination was included before (T0) and at each step of graded dobutamine infusion: 2,5 (T1), 5 (T2), 7,5 (T3), 10 mcg/kg/mn (T4). Different systolic indexes were compared: AEF, mean velocity of myocardial fibers shortening rate corrected (mVcf-c), myocardial performance index (MPI) as the sum of isovolumetric interval divided by ejection time and peak power pre-load corrected (Pmaxi) as the product of maximal flow and pressure indexed on LV end diastolic area (EDA). The minimal and maximal dose (compare to preceding step) of dobutamine inducing a significant change (Anova t-test for repeated measures) were calculated for each index. The maximal response was also calculated with the rate of change compare to basic values (%). The normalized slope of dose-response curve and correlation factor were also calculated.

Results:

Variables	Minimal dose (mcg/kg/mn)	Maximal dose (mcg/kg/mn)	Maximal response (%)	Normalized slope	Correlation (r ²)
AEF (%)	5	7,5	72	0,83	0,62
meanVcf-c (circ/s)	7,5	7,5	62	0,77	0,52
MPI	7,5	7,5	-54	-0,54	-0,26
Pmax (W)	2,5	10	94	0,93	0,87
Pmaxi (mW/cm ²)	2,5	10	96	0,96	0,88

Discussion: Fair correlation was obtained for all indexes except for MPI. Pmax and Pmaxi showed the best response to inotropic stimulation at low

dose (2.5 mcg/kg/mn) and high dose (10 mcg/kg/mn) with the maximal rate of change. The best slope for dose-response curve was with Pmax and Pmaxi. For ethical reason the dose of dobutamine was limited to 10 mcg/kg/mn and we could not clearly show a plateau for dose-response curve. Among all different methods used for evaluation of LV systolic function available with TEE, peak power pre-load corrected seems to be most accurate method to monitor change of inotropic state.

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Effects of hemofiltration and mannitol treatment on cardiopulmonary-bypass induced immunosuppression

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Background and Goal of Study: Ischemic insults during surgery, such as cardiopulmonary bypass (CPB), can cause a systemic inflammatory response syndrome, possibly resulting in multiple organ dysfunction. We have previously shown that the LPS-stimulated tumor necrosis factor (TNF)- α response in whole blood assays is suppressed under these conditions (1), correlating with an unfavorable postoperative course (2). We have also identified humoral factors contributing to the observed impaired cytokine response (1). Therefore, goal of the present study was to assess the ability of hemofiltration during CPB (filtration of humoral factors) and mannitol (potent antioxidant) to blunt this suppression of the unspecific immune system.

Materials and Methods: 30 patients undergoing elective coronary-aortic bypass surgery (CABG) with CPB were randomized into three groups (control, mannitol 50 g iv after induction, hemofiltration 15 ml/kg after rewarming). Whole blood assays were used to assess the LPS-stimulated cytokine response. CD 14-expression on peripheral blood mononuclear cells (PBMCs) was assessed by FACS-analysis.

Results and Discussions: Compared to controls and hemofiltration, we found a non-significant trend towards an increased LPS-stimulated TNF- α response after CPB in patients who received mannitol. Low expression density of CD 14 (CD 14⁺) on PBMCs, indicating a greater proinflammatory potency, was observed after both, mannitol treatment and hemofiltration compared to the controls.

Conclusion(s): Our results may suggest a modulation of the TNF- α response through mannitol and the expression density of CD 14 on PBMCs through mannitol and hemofiltration after CPB. The immune response might thereby be affected favorably.

References:

- 1 Grundmann U, Rensing H, Adams HA et al. *Anesthesiology* 2000; 93: 359–369.
- 2 Ziegenfuß T, Wanner GA, Grass C et al. *Intensive Care Med* 1999; 25: 179–187.

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Preservation of myocardial function after coronary surgery with sevoflurane anesthesia: is timing of administration involved?

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Background: In coronary surgery with CPB, the cardioprotective effects of a volatile anesthetic regimen seem more pronounced compared to the preconditioning protocols, were sevoflurane (S) is only given during the period before ischemia (1,2). We hypothesized that the cardioprotective effects of S were related to the time of administration. Therefore, the myocardial effects of S given only during the preconditioning period (group A), only during the reperfusion period (group B) and S given throughout the whole procedure (group C) were compared to a total intravenous regimen with propofol (group D) during coronary surgery with CPB.

Methods: Elective coronary surgery patients were randomly assigned to four different anesthetic protocols (n = 50 each). Cardiac function was assessed perioperatively and during 24 hours postoperatively using a pulmonary artery catheter. Perioperatively, a high-fidelity pressure catheter was positioned in the left ventricle. Response to increased cardiac load, obtained by leg elevation, was assessed before and after CPB. Postoperative levels of cardiac troponin I were followed during 48 hours. Data were compared using analysis of variance for repeated measurements followed by the Bonferroni test when appropriate.

Results: After CPB, stroke volume index and dP/dt_{max} were significantly ($p < 0.01$) higher in group C than in the group D. The values were intermediate

in groups A and B. Before CPB the changes in dP/dt_{max} with leg elevation were similar in all groups. After CPB, dP/dt_{max} decreased with leg elevation in group D ($-6.0 \pm 2.7\%$), increased in group C ($+5.4 \pm 2.0\%$) and showed no changes in groups A and B ($+0.4 \pm 2.5\%$ and $-1.0 \pm 2.7\%$ respectively). The levels of troponin I were significantly lower in group C compared with group D. The values of troponin I were intermediate in the two other groups.

Conclusion: In patients undergoing coronary artery surgery with CPB, the cardioprotective effects of sevoflurane were most apparent when the agent was administered during the whole procedure.

References:

- 1 De Hert et al. *Anesthesiology* 2003; 99:314–23.
- 2 Julier et al. *Anesthesiology* 2003; 98:1315–27.

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Gastric tonometric variables during mechanical cardiac assistance

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Background: Multiorgan-failure is a death related complication of cardiogenic shock treated by mechanical cardiac assistance (MCA). Gastric intramucosal tonometry (PCO_{2g}), calculated intramucosal pH (pHi) and gastric-arterial PCO₂ gap have been proposed as non invasive monitoring of tissue perfusion (ref). The goal of this study was to assess these parameters as prognosis index.

Materials and Methods: Single centre, cohort study of consecutive patients treated by pneumatic MCA (Thoratec®). Data including hemodynamics, PCO_{2g}, pHi, arterial lactate were measured before surgery (P), at the admission in ICU (H0), at 24 hours and 48 hours and after the end of norepinephrine (NEPI). They were compared as a prognosis index of mortality to severity scores. Statistics included descriptive (mean \pm SD), one way ANOVA between survival group (Surv) and dead group (DD). Sensibility and specificity was assessed by ROC curve.

Results: 56 patients (50 male) were included after informed consent (age: 46 ± 13 , 91% biventricular support). Parsonnet score was 45 ± 15 , 27 patients died. Significant parameters between groups are expressed in table 1. The most valuable index of mortality for tissue perfusion was PCO_{2g} at H0 (ROC area: 0.695). The cut-off point was 31.5 mmHg (sensibility of 70% and specificity of 62%).

Table 1. Significant differences between groups.

	SURV group	DD group
Weight (kg)	66.5 \pm 10.3	75.8 \pm 16.7
Duration of surgery (min)	174.2 \pm 30.9	256.6 \pm 156.7
pHi H0	7.46 \pm 0.07	7.30 \pm 0.18
Lactate H0 (mmol/l)	2.56 \pm 1.56	6.68 \pm 1.39
PCO _{2g} H0 (mmHg)	31.7 \pm 7.75	39.7 \pm 14.2
NEPI dose (μ g/kg/min)	0.12 \pm 0.06	0.28 \pm 0.15
APACHE II score	12.3 \pm 5.95	17.7 \pm 7.8

Conclusion(s): CPB is related to a CO₂ washout that could be responsible for the negative predictive value of PCO_{2g} during surgery. Early measurement of PCO_{2g} at the admission in ICU is a prognosis index. Mortality could be related to a tissue ischemic disease, assessed by an increased risk in case of high weight (limited cardiac output), hyperlactatemia and high norepinephrine dosage.

Reference:

- O'Malley; *Ann Thorac Surg* 2003; 75:1886–91.

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Correlation between delta-down and inferior vena cava diameter respiratory variations assessed by echocardiographic examination

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Background and Goal of Study: The δ -down is an excellent indicator to foresee the usefulness of a fluid infusion among patients with hypovolemia under mechanical ventilation (1). The aim of this study was to research if δ -down was closely related with the inferior vena cava (IVC) diameter respiratory variations, new dynamic echocardiographic parameters (2).

Materials and Methods: We conducted a prospective, preliminary open study, in intensive care patients undergoing mechanical ventilation and arterial pressure monitoring. For each patient requiring blood volume expansion,

δ -down, IVC inspiratory (ID) and expiratory diameter (ED) were measured and IVC diameter respiratory variations were calculated [(ED-ID)/average diameter] before fluid resuscitation. Measurements were performed with sub-costal views TM-echocardiography, 1 cm above sus-hepatic vena. The feasibility of echographic measurements was evaluated by a visual analogic scale, ranging from 1 (easiest possible) to 10 (most difficult possible). For each patient, ID, ED and IVC diameter respiratory variation were compared with δ -down. Statistical analysis was performed using non-parametric Spearman test ($p < 0.05$).

Results and Discussions: Twenty-two patients were included. The δ -down was neither closely related to IVC-ID ($p = 0.49$) nor to IVC-ED ($p = 0.08$). On the other hand, δ -down was closely related to IVC diameter respiratory variations ($p = 0.009$). Global ease of measurements was scored under 5 in 20 patients.

The lake of correlation between δ -down and ID or ED was in agreement with studies regarding patients in septic shock (2). Further prospective and comparative studies are needed to establish if the IVC diameter respiratory variations are a pertinent indicator of blood volume expansion response and to determine the threshold with the best specificity and sensitivity.

Conclusion(s): The IVC diameter respiratory variations are a new, non invasive, dynamic echocardiographic parameter to assess blood volume status in mechanically ventilated patients.

References:

- 1 Coriat P et al. *Anesth Analg* 1994; 78:46–53.
- 2 Feissel et al. *Resuscitation* 2003; 12:145–152.

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Sedation with propofol and opioids have no effect on the cardiac conduction system

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Background and Goal of Study: Propofol (P), fentanyl (F) and remifentanyl (R) are known to be negative chronotropic drugs but their effects on the cardiac conduction system have not been completely evaluated. The aim of the study was to investigate the effect of these drugs on cardiac conduction when used in sedative doses.

Materials and Methods: 36 patients scheduled for electrophysiological (EP) studies were distributed into 3 groups (12pts each). Cycle length (CL), corrected sinus node recovery time (CSNRT), AH and HV intervals, QRS duration, ventricular (V), anterograde (AVN) and retrograde (RVN) AV nodal effective refractory periods (ERP), anterograde (AW) and retrograde (RW) Wenckebach CL where measured before and 15 min after sedation with P (1 mg kg⁻¹ bolus/3 mg kg⁻¹ h⁻¹ infusion), PF (same dose of P, F [1 µg kg⁻¹]) or R (0.1 µg kg⁻¹ min⁻¹).

Results: Data (ms, mean ± ESM). * $P < 0.05$ vs basal.

	P	P/F	R
CL			
Basal	838 ± 32	915 ± 37	897 ± 41
Sedation	793 ± 32*	1006 ± 42*	915 ± 56
CSNRT			
Basal	219 ± 46	249 ± 36	305 ± 58
Sedation	224 ± 24	292 ± 42	252 ± 63
AH			
Basal	95 ± 5	109 ± 10	127 ± 14
Sedation	94 ± 7	115 ± 10	130 ± 15
HV			
Basal	46 ± 7	40 ± 6	52 ± 5
Sedation	45 ± 7	45 ± 4	54 ± 5
QRS			
Basal	121 ± 6	111 ± 10	115 ± 12
Sedation	123 ± 7	108 ± 11	116 ± 12
VERP			
Basal	242 ± 6	251 ± 6	258 ± 10
Sedation	243 ± 6	265 ± 9*	255 ± 10
AVNERP			
Basal	307 ± 17	334 ± 32	371 ± 37
Sedation	307 ± 14	332 ± 31	364 ± 39
RVNERP			
Basal	325 ± 38	512 ± 37	491 ± 55
Sedation	330 ± 44	524 ± 36	482 ± 51
AWCL			
Basal	361 ± 16	465 ± 47	425 ± 28
Sedation	350 ± 16	473 ± 50	448 ± 30
RWCL			
Basal	413 ± 29	542 ± 23	528 ± 31
Sedation	420 ± 31	543 ± 28	518 ± 33

Conclusions: Propofol, fentanyl and remifentanyl do not alter AV node conduction. Propofol and propofol + fentanyl induced mild variations on the cycle length, probably centrally mediated. The association propofol + fentanyl (but not propofol alone) enhances ventricular refractoriness suggesting an antiarrhythmic effect of fentanyl.

A-199

Influence of xenon inhalation on right ventricular pump performance

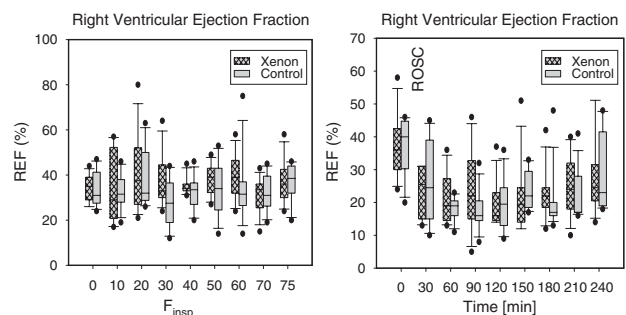
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Background and Goal of Study: Xenon is thought to have minimal haemodynamical side effects and to be an almost ideal anaesthetic, specially in cardiac patients scheduled for cardiac and non-cardiac procedures. As there are no published data about right ventricular pump performance, goal of this study is the evaluation of the right ventricular ejection fraction (RVEF) before and after cardiac arrest during xenon inhalation in an animal model as compared to TIVA.

Materials and Methods: After approval by the local animal care committee we investigated 24 pigs (12–16 weeks) in a randomised design. The TIVA anaesthetized and oxygen ventilated animals were randomly assigned in two groups to receive either xenon or air in stepwise increased concentration until FiO_2 25% in both groups was reached. Haemodynamic parameters, pulmonary artery pressure and right ventricular ejection fraction were determined using a Baxter REF catheter (Baxter Corporation, Irvine, CA, USA). After 15 min, ventricular fibrillation of 4 min and CPR for 1 min ROSC was established and an investigation time of 240 min was performed. For statistical data analysis ANOVA was performed.

Results and Discussions:



Conclusion(s): Although PAP was significantly increased during inhalation of xenon >40% ($p < 0.05$), there was no significant difference in REF values for xenon vs. control, neither before nor after cardiac arrest in a pig model.

Acknowledgements: The study was funded by AGA Linde Healthcare, Germany.

A-200

Optimizing cardiac preload with right ventricular volumetry

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Background and Goals: The enddiastolic pressure volume relationship of the heart could be described with an exponential function which is influenced by drugs and cardiac disease like ischemia. Thus, enddiastolic pressures or volumes alone have a bad correlation with parameters of ventricular contractility and are not able to predict the response cardiac output increase to volume load. This study was designed to calculate preload parameters from pressure and volume measurements of the right ventricle.

Materials and Methods: 14 patients with reduced left ventricular function (LVEF 34.6 ± 10.5%) were monitored during cardiac operation with a volumetric Swan Ganz catheter (model 774HF75, Edwards) and semi-continuous measurement technique (Vigilance, Edwards). During infusion of 500 ml colloids the right atrial pressure (CVP), stroke index (SI), right ventricular ejection

fraction (REF) and enddiastolic volume (EDV) were monitored. Enddiastolic wall stress (EWS), a definition of preload, was calculated, regarding the law of LaPlace, as the product of CVP and EDV. EDV, CVP and EWS were correlated with SI. Patients with an increase of SI > 10% were classified as responders. **Results:** No correlation was found between SI and CVP or EDV, but a good correlation with EWS ($r = 0,795$, Fig. 1). Only patients with an EWS less than 1000 mmHg/ml/m² respond with an increase of SI and REF to volume load (Fig. 2).

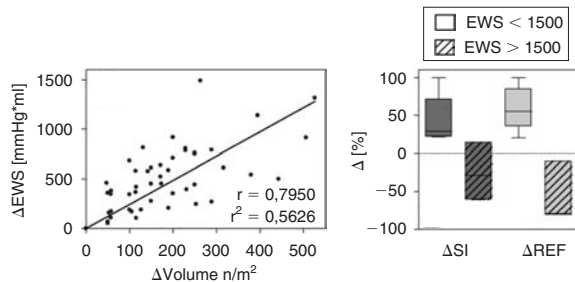


Fig. 1

Fig. 2

Conclusions: This measurement technique and the calculation of preload as the product of pressure and volume enable the physician to predict the response to volume load to improve cardiac output.

Reference:

Squara P. Chest 1997; 111: 351–358.

A-201

Limitation of reperfusion injury and myocardial infarct size by administration of Perflubron prior to myocardial ischemia-reperfusion in rats

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Background: Perfluorochemicals (PFC) like Fluosol were able to reduce the extent of experimental myocardial infarction when given during ischemia and before reperfusion and to reduce reperfusion injury when given before or after reperfusion (1). The aim of the present experimental study was to assess the efficacy of therapeutic (prior to reperfusion), and for the first time of prophylactic (prior to ischemia) administration of Perflubron (60% PFC, Alliance, San Diego, CA) on reperfusion injury and myocardial infarction size after coronary ischemia and reperfusion.

Methods: After approval of the animal ethics committee 32 Sprague Dawley rats were subjected to 25 min of coronary artery occlusion followed by 120 min reperfusion. After induction of general anesthesia, rats underwent tracheotomy and mechanical ventilation (FIO₂: 1.0). The animals were randomized to one of three groups: G1 was treated with prophylactic administration of 6 g kg⁻¹ Perflubron intravenously 10 min before occlusion of the left coronary artery, G2 received a therapeutic application of the same dose 10 min after occlusion and G3 received the same Volume of saline. At the end of the experiment, the area of impaired perfusion (NR) was identified by an intravenous injection of the fluorescent dye thioflavin-S that stains the endothelium of blood vessels. Thus vascular reperfusion injury was represented by non fluorescent regions. The size of the ischemic area at risk (AR) was determined by *in vivo* injection of patent blue and infarct size by *in vitro* triphenyltetrazolium staining. Statistics were performed by ANOVA with one sided Dunnett post hoc test (vs Control G3) with $p \leq 0.05$ = significant. Data are given as mean \pm SD.

Results: NR as percentage of AR was $31.3 \pm 9\%$ in G1 ($p < 0.001$ vs G3), $40.8 \pm 13\%$ in G2 and $52.2 \pm 9\%$ in G3. Infarct size as percentage of the AR was $82.4 \pm 13\%$ in G1 ($p = 0.047$ vs G3), $84.6 \pm 14\%$ in G2 and $94.5 \pm 7\%$ in G3.

Conclusions: The prophylactic application of Perflubron provides a reduction of NR and infarct size, thus offering a new opportunity in the perioperative treatment of cardiac risk patients.

Reference:

1 Hale SL. Basic Res Cardiol 90:404–409 (1995).

A-202

Predictors of medical mortality after aortic abdominal surgery

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Background: In hospital mortality after abdominal aortic repair could be related both to surgical (ie: bleeding) and to medical complications (ie: myocardial infarction). Therefore two kinds of predictors for mortality may exist, associated either with surgical characteristics or with patient's preoperative medical conditions. The aim of the study was to consider predictors for death related to postoperative medical complications.

Materials and Methods: 1152 patients undergoing abdominal aortic surgery from September 1995 to November 2002 were included. Patients dead surgical complications were excluded. Adjusted Relative Risks (aRR) for postoperative death were calculated, and a propensity score was built. Accuracy of the score to predict death was then assessed.

Results and Discussion: Global observed mortality is 4.2%. Frequency of death associated or not with surgical complications are equivalent (2.4% vs 1.7%; $p = NS$). The final logistic model correctly classified 97.8% of the patients. Hosmer-Lemeshow's goodness of fit statistics is 0.56.

Table. OR and RR from the multivariate analysis.

	aRR	OR	OR 95% CI
Coronary artery disease	2.6	2.67	[1.26;5.64]
Heart failure	2.4	2.50	[0.93;6.70]
Diabetes mellitus	2.2	2.27	[0.83;6.18]
Chronic renal failure	2.9	3.10	[1.46;6.51]

Linear transformation of age summed with RR defined the score. Area under the ROC Curves was 0.83 for prediction of death unrelated with surgical complication. Scores ranged from 0 to 2.2. A value greater than 1.57 predicted mortality with a sensitivity of 93.3% and a specificity of 60.1%.

Conclusions: Postoperative death without surgical complication after aortic surgery could easily be predicted preoperatively. Identification of patients with high risk of mortality should allow us to select more homogenous groups of patients for further comparative studies. However additional part of mortality is highly related to the surgical procedure and appears more difficult to predict before the end of the surgery.

A-203

Sevoflurane-induced preconditioning did not improve renal function after ischaemia/reperfusion

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Background and Goal of Study: The heart can be preconditioned by ischaemia as well as by volatile anaesthetics. In renal tissue, only protection by ischaemic preconditioning has been shown so far. We investigated the effect of sevoflurane-induced preconditioning in the rat kidney *in vivo*.

Materials and Methods: Fourteen days after right sided nephrectomy, 45 s-ketamine anaesthetized male rats were randomly assigned to one of the following groups: In the control group (CON, $n = 18$) renal ischaemia was induced by 45 min of left renal artery occlusion. In the sevoflurane preconditioning group, rats received 1 MAC sevoflurane for 15 min followed by 10 min of washout prior to 45 min of renal ischaemia (S-PC, $n = 19$). The kidney was reperused for three days in the awake rat. Eight rats were sham operated and received 70 min anaesthesia without renal artery occlusion (Sham). Blood creatinine (CREA, mg/dl), blood urea nitrogen (BUN, mg/dl) and sodium excretion (Na-E, calculated as sodium clearance divided by CREA clearance) were used to evaluate renal function. Statistics: ANOVA. All data are mean values \pm standard deviation.

Results and Discussions: There was no difference between groups in renal function during baseline measurement (CREA: 0.6 ± 0.2 ; BUN: 26 ± 5 ; Na-E: 0.04 ± 0.02). Renal function remained constant during the experimental course in the sham group (end of experiment: CREA: 0.8 ± 0.2 ; BUN: 34 ± 6 ; Na-E: 0.06 ± 0.03). Both, CREA and BUN increased after renal ischaemia in CON (2.0 ± 1.4 , $p < 0.05$ vs. S-PC; 126 ± 94) and in the S-PC group (4.0 ± 1.1 ; 254 ± 62 , both $P < 0.05$ vs. Sham) at the end of reperfusion. Na-E also increased at day 1 and 2 in the CON (2nd day: 0.5 ± 0.7) and the S-PC (1.1 ± 0.7 , $P < 0.05$ vs. Sham), but no difference to sham was detectable at the end of reperfusion (0.2 ± 0.5 ; 0.5 ± 0.3).

Conclusion: Renal artery occlusion for 45 min leads to severe deterioration of renal function. Sevoflurane-induced preconditioning had no protective effect on this ischaemia induced deterioration of renal function in rats.

A-205**Xenon-induced pharmacological preconditioning involves activation of p38 MAPK *in vivo***

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Background and Goal of Study: We could previously show that the noble gas Xenon induces myocardial protection by pharmacological preconditioning (PC) *in vivo*¹, and that this mechanism involves an increased PKC- ϵ phosphorylation. The p38 mitogen activated protein kinase (MAPK) is a potential downstream target of PKC and was suggested to play a key role in PC mechanisms. Therefore, we investigated the influences of xenon on p38 MAPK, and if p38 MAPK is causally involved in xenon-induced PC.

Materials and Methods: For infarct size measurements (percent of area at risk, TTC staining), anaesthetized rats were subjected to 25 min of left coronary artery occlusion followed by 120 min of reperfusion. Rats received Xenon 70% (Xe-PC, $n = 14$) during three 5-min periods before ischaemia or remained untreated (Con, $n = 14$). Another group was pretreated with the specific p38 MAPK inhibitor SB203580 (1 mg kg⁻¹, Xe-SB, SB, each $n = 8$) with or without subsequent xenon administration. Six additional hearts of each group and six hearts pretreated with the PKC inhibitor Calphostin C (Xe-Calph.C, $n = 6$) were excised at the end of the last washout period and subjected to western blot assay. Statistical analysis: Student's *t*-test with Bonferroni's correction for multiple comparison. Data are expressed as arbitrary units of average light intensity (AVI, western blot), means \pm SD.

Results and Discussions: Xenon reduced the infarct size from 41 \pm 10% in controls to 28 \pm 10%. This effect was blocked by SB203580 (53 \pm 15% vs. Xe-PC, $p < 0.01$). Phosphorylation of p38 MAPK was significantly induced after xenon treatment (Xe-PC: 6.3 \pm 3.4; vs. Con: 3.1 \pm 1.9, $p < 0.001$) and this effect was blocked by Calphostin C (Calph.C: 3.3 \pm 2.0; vs. Xe-PC, $p < 0.001$).

Conclusion: Xenon activates p38 MAPK. The activation of p38 MAPK is necessary for the cardioprotection by xenon-induced preconditioning and is located downstream of PKC- ϵ .

Reference:

1 ASA Meeting Oct 2003, abstract A-1540.

Acknowledgements: This study was supported by a grant of the Else Kröner-Fresenius-Stiftung, Bad Homburg, Germany. O. Toma was supported by the KAAD.

A-206**Translocation of PKC-epsilon is involved in Xenon-induced preconditioning *in vivo***

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Background and Goal of Study: Myocardial protection offered by Xenon-induced pharmacological preconditioning (PC) could be blocked by the specific PKC inhibitor Calphostin C¹. Furthermore, PKC- ϵ phosphorylation was strongly increased after xenon administration, suggesting PKC as a key mediator of Xenon-induced PC. In the present study, we investigated whether the increased PKC- ϵ phosphorylation after Xenon preconditioning is also associated with a translocation of PKC- ϵ within the myocardial cell.

Materials and Methods: Anaesthetized rats of the PC-groups received either Xenon 70% (Xe-PC, $n = 6$) or isoflurane (0.6%, Iso-PC, $n = 6$) during three 5-min periods interspersed with two 5-min wash-out periods and one 10-min final washout before left coronary artery occlusion. Rats of the control group (Con, $n = 6$) remained untreated for 35 min. Additional rats (Xe-Calph.C, Iso-Calph.C, Calph.C, each $n = 6$) were pretreated with the PKC inhibitor calphostin C (0.1 mg kg⁻¹). Hearts were excised at the end of the last washout period and frozen in liquid nitrogen. After tissue fractionation, the cytosolic and membrane fraction were subjected to western blot assay. For immunohistochemistry, cryocuts (5 μ m) were stained for PKC- ϵ location using a Cy3-conjugated secondary antibody. Statistical analysis: Student's *t*-test with Bonferroni's correction for multiple comparison. Data are expressed as arbitrary units of average light intensity (AVI, means \pm SD).

Results and Discussions: As shown by western blot assay and immunohistochemistry, translocation of PKC- ϵ to the membrane was significantly increased after xenon and isoflurane administration compared to the control group (5.9 \pm 2.2 and 4.4 \pm 1.8 vs. 2.9 \pm 1.1, respectively, $p < 0.001$ and $p < 0.05$). Calphostin C abolished the observed translocation (4.2 \pm 2.1

and 4.2 \pm 2.3 vs. Xenon and isoflurane treatment, respectively, both $p < 0.05$).

Conclusion: Xenon induced PC involves increased phosphorylation and translocation of PKC- ϵ from cytosol to membrane regions.

Reference:

1 ASA Meeting Oct 2003, abstract A-1540.

Acknowledgements: This study was supported by a grant of the Else Kröner-Fresenius-Stiftung, Bad Homburg, Germany. O. Toma was supported by the KAAD.

A-208**Extracellular signal-regulated kinase (ERK1/2 MAPK) mediates desflurane-induced pharmacological preconditioning in the rat heart *in vivo***

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Background and Goal of Study: Like other volatile anaesthetics, desflurane exerts cardioprotective effects against ischaemia/reperfusion injury by pharmacological preconditioning (PC).¹ However, so far few is known about molecular targets involved in this myocardial protection. Besides other enzymes, the family of mitogen activated protein kinases (MAPK) is suggested to play an important role in PC mechanisms. Therefore, the present study examined for the first time the role of ERK1/2 MAPK in desflurane-induced PC in the rat heart *in vivo*.

Materials and Methods: In four separate groups (each $n = 7$), anaesthetized rats received either vehicle (0.9% saline) or the MEK/ERK inhibitor PD98059 (1 mg kg⁻¹ i.v.) in the presence or absence of two 5-min episodes of 1 MAC desflurane, respectively. Rats were subjected to 25 min regional myocardial ischaemia followed by 120 min of reperfusion and infarct size was measured (IS, % of area at risk; TTC staining). Statistical Analysis: Student's *t*-test with Bonferroni's correction for multiple comparisons. Data were considered significant when $p < 0.05$. All data are expressed as mean \pm SD.

Results and Discussions: Desflurane reduced IS from 57.2 \pm 4.7% in controls to 35.2 \pm 16.7% ($p < 0.05$) and this effect was abolished by preinfusion of the MEK/ERK inhibitor PD98059 (64.2 \pm 15.4%, $p < 0.05$ vs. desflurane PC). IS was not significantly affected by PD98059 alone (48.8 \pm 11.6%, $p = 0.3$ vs. controls).

Conclusion(s): Desflurane PC activates ERK1/2 MAPK in rat myocardium *in vivo*. This effect was demonstrated to be an important step in the signal transduction as proved by the complete loss of desflurane-induced cardioprotection after ERK1/2 inhibition.

Reference:1 Toller WG *et al.*: Sarcolemmal and mitochondrial adenosine triphosphate-dependent potassium channels. Mechanism of desflurane-induced cardioprotection. *Anesthesiology* 2000; 92:1731-9.

Acknowledgements: Supported in part by Baxter Germany. Octavian Toma was supported by the German Catholic Academic Exchange Service.

A-209**Time dependent protein kinase C epsilon activation during desflurane-induced pharmacological preconditioning in the rat heart *in vivo***

O. Toma, N.C. Weber, J.I. Wolter, B. Preckel, W. Schlack

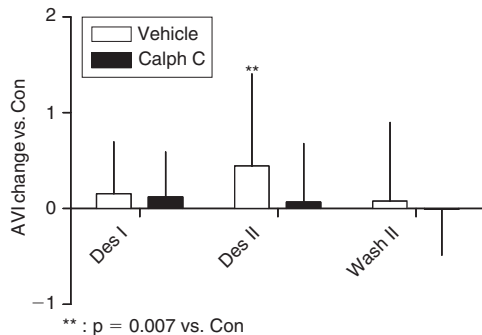
Klinik fuer Anaesthesiologie, Universitaetsklinikum Duesseldorf, Duesseldorf, Germany

Background and Goal of Study: Protein kinase C epsilon (PKC- ϵ) activation seems to be important for the strong cardioprotection by preconditioning. The present study examined the involvement of PKC- ϵ in desflurane (Des) induced preconditioning (PC) and the time course of PKC- ϵ activation.

Methods: In four groups (each $n = 7$), anaesthetized rats received either vehicle (0.9% saline) or the PKC inhibitor calphostin C (0.1 mg kg⁻¹ i.v.) in the presence or absence of two 5-min periods of 1 MAC Des, respectively. After 10 min washout, rats were subjected to 25 min regional myocardial ischaemia followed by 120 min of reperfusion and infarct size was measured (IS, % of area at risk; TTC staining). In eight additional groups (each $n = 4$), rats received either vehicle or calphostin C, and the hearts were excised without other treatment (Con), after the first or the second desflurane administration (Des I, respective Des II), or after the last washout phase (Wash II), respectively. Cytosolic PKC- ϵ was determined by Western blot (average light intensity, AVI). Statistical analysis: Student's *t*-test with Bonferroni's

correction for multiple comparisons. Data are mean \pm SD with $p < 0.05$ significant.

Results: Desflurane reduced IS from $57.2 \pm 4.7\%$ in controls to $35.2 \pm 16.7\%$ ($p < 0.05$) and this effect was abolished by preinfusion of calphostin C ($58.8 \pm 13.2\%$, $p < 0.05$ vs. des-PC). IS was not significantly affected by calphostin C alone ($66.1 \pm 14.2\%$, $p = 0.4$ vs. controls). PKC- ϵ was increasingly phosphorylated during Des-PC:



Conclusion(s): PKC is a key mediator of Des-PC. During Des-PC, PKC- ϵ is activated in a time dependent manner and returns to the basal level after the second washout period before the onset of infarct inducing ischaemia.

Acknowledgements: Supported in part by Baxter. O.T. was supported by the German Catholic Academic Exchange Service.

A-212

Isocapnic hyperoxia and hypoxia do not affect endothelium-dependent vasodilatation in healthy males

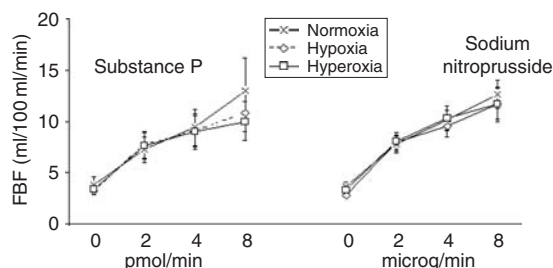
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Background and Goal of Study: Hyperoxia and hypoxia may have vasomotor effects by altering endothelial function^{1,2}. We studied endothelial function and forearm blood flow (FBF) during hyperoxia and hypoxia.

Methods: We used a 3 way, randomised, cross-over design. On separate visits, healthy male volunteers breathed hyperoxic, hypoxic, or normoxic gas mixtures via a tight-fitting facial mask. For hyperoxia, we targeted $F_{E}O_2$ of 0.85, for hypoxia we aimed for S_pO_2 80%, for normoxia we gave air. End-tidal CO_2 was held constant throughout the study. Substance P (2, 4, and 8 pmol/min) and sodium nitroprusside (2, 4, and 8 microg/min) were infused into the non-dominant brachial artery for 10 mins at each dose to cause endothelium-dependent and endothelium-independent vasodilatation respectively. FBF was measured by venous occlusion plethysmography at 10 min intervals, and the data were analysed using Chart™ software. FBF data were examined by two factor ANOVA with repeated measures. Based on previous data, the power to detect a 20% change in FBF was 0.8.

Results and Discussions: We studied 8 men (aged 38 (5), 19–53 (mean, (SEM), range). Both SP and SNP increased FBF dose-dependently. Neither hypoxia nor hyperoxia affected this vasodilatation.



Conclusions: Hyperoxia and hypoxia do not have a clear effect on endothelial function in healthy subjects. In diseases known to impair endothelial function, such as hypertension or heart failure, further study may be justified, since oxygen therapy is commonly used in these conditions.

References:

- Messina EJ, Sun D, Koller A, et al. *Microvasc Res* 1994; 48:151–160.
- Blitzer ML, Loh E, Roddy M-A, et al. *JACC* 1996; 28: 591–596.

A-213

Hemodynamic and metabolic profiles of anaphylactic shock in anesthetized Brown Norway rats

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Background and Goal of Study: The aim of this study was to evaluate global hemodynamic and tissue blood flow and oxygenation profiles of anaphylactic shock (AS) in an ovalbumin (OVA) sensitized Brown Norway rat model compared to a model where arterial hypotension was induced with nicardipine (NCP).

Materials and Methods: Anesthesia was induced and maintained with thiopentone sodium. Mean arterial pressure (MAP) and aortic blood velocity (ABV) measured by a Doppler flow probe positioned around the aorta were continuously monitored. A Clark-type electrode and 5 microdialysis probes were implanted in both quadriceps to monitor tissue O_2 partial pressure ($P_{ti}O_2$) and lactate (L) and pyruvate (P) interstitial concentrations. Changes in tissue blood flow were estimated by the ethanol clearance technique¹ assessed by the ratio of ethanol concentration in the dialysate divided by a known concentration of ethanol added to the microdialysis perfusate (Cout/Cin). After stabilization for 120 minutes, the animals were randomized to the AS group ($n = 12$) or to the NCP group ($n = 12$). OVA or NCP was injected at Time 0. Values are expressed as mean \pm SEM. Intra and between groups comparison were achieved using ANOVA followed by Fisher's test when appropriate ($p < 0.05$ was considered as significant).

Results and Discussion:

	Basal value		Time 0 + 20 min		Time 0 + 60 min	
	NCP	AS	NCP	AS	NCP	AS
MAP (mmHg)	120 \pm 3	127 \pm 3	59 \pm 3*	41 \pm 4*	53 \pm 6*	38 \pm 5*
ABV (cm sec ⁻¹)	27 \pm 3	25 \pm 2	27 \pm 5	33 \pm 4	23 \pm 4	22 \pm 4
$P_{ti}O_2$ (mmHg)	43 \pm 4	42 \pm 5	40 \pm 4	11 \pm 3*†	34 \pm 8*	5 \pm 2*†
Cout/Cin	0.4 \pm 0.02	0.46 \pm 0.03	0.42 \pm 0.02	0.46 \pm 0.03	0.44 \pm 0.03*	0.52 \pm 0.02*
Lactates (mmol L ⁻¹)	0.536 \pm 0.09	0.446 \pm 0.1	0.866 \pm 0.1*	1.274 \pm 0.31*	0.843 \pm 0.1*	1.741 \pm 0.4*
L/P ratio	17 \pm 2	16 \pm 6	32 \pm 8*	101 \pm 38	26 \pm 5	311 \pm 105*†

* $p < .05$ vs. baseline values; † $p < .05$ -2way-ANOVA.

Despite a similar MAP reduction in both groups without significant modification in ABV, AS was characterized by a rapid and dramatic decrease in $P_{ti}O_2$ resulting from a 50% decrease in muscle blood flow¹. This decrease was associated with an anaerobic metabolism attested to by an increase in interstitial lactate, a decrease in interstitial pyruvate and therefore an increase in L/P ratio.

Conclusion: AS was characterized by muscular hypoxia and anaerobic metabolism. This could be explained by redistribution of blood flow to other organs in AS.

Reference:

- Hickner R et al. *J Appl Physiol* 1995; 79: 638–647.

Acknowledgement: Supported by an institutional SFAR grant.

A-214

Levosimendan is superior to Milrinone and Dobutamine in selectively increasing microvascular gastric mucosal oxygenation

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Background and Goal: Effects of levosimendan (LEVO) on microvascular gastric mucosa hemoglobin oxygenation ($\mu\text{Hb}O_2$, spectrometry [1]) are unknown, also in relation to systemic O_2 -transport (DO_2) and O_2 -consumption (VO_2).

Materials and Methods: Anesthetized dogs ($n = 6$ in each group) randomly received LEVO (10 $\mu\text{g}/\text{kg} + 4$ steps 0.125–1.0 $\mu\text{g}/\text{kg}/\text{min}$), MIL-rinone (5.0 $\mu\text{g}/\text{kg} + 1.25$ –10 $\mu\text{g}/\text{kg}/\text{min}$) or DOB-utamine (2.5–10 $\mu\text{g}/\text{kg}/\text{min}$). Since inotropes may modify fluid responsiveness, a defined volume challenge was also performed (HES 6%, 10 ml/kg).

Results and Discussions: LEVO increased $\mu\text{Hb}O_2$ from baseline ($\sim 55\%$, all groups) to $63 \pm 3\%$ (max. effective dose) and further $67 \pm 2\%$ (fluid) ($x \pm \text{sem}$). LEVO increased DO_2 at stable VO_2 . MIL failed to increase $\mu\text{Hb}O_2$. DOB, conversely, increased $\mu\text{Hb}O_2$ similarly to LEVO, but at expense of marked increases in DO_2 and VO_2 . Mucosa-selectivity was determined as

$\mu\text{HbO}_2/\text{DO}_2$ slope (baseline, high dose and fluid): LEVO elicited the highest selectivity (+1.22), compared to MIL (+0.50) and DOB (+0.32).

Conclusion: LEVO most selectively increased gastric mu-cosal oxygenation (μHbO_2), compared to MIL and DOB.

Reference:

1 Scheeren TWL et al. Crit Care Med 2002; 30: 881–7.

A-215

Stroke after deep hypothermic circulatory arrest: mechanisms and opportunities for intervention

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Background and Goal of Study: Stroke after thoracic aortic surgery requiring deep hypothermic circulatory arrest (DHCA) is the *principal perioperative predictor* for mortality, prolonged ICU stay, and prolonged mechanical ventilation.^{1,2} This study tested the *null hypothesis* that cerebral hypoperfusion is not the major stroke mechanism in adult DHCA at an experienced university center with a standardized DHCA protocol.

Materials and Methods: With IRB approval, all adults (2000/1) undergoing ascending aortic/aortic arch surgery requiring DHCA with *retrograde cerebral perfusion* were studied. All patients received an *antifibrinolytic* and were *cooled* during extracorporeal circulation with a standard protocol.^{3,4,5} Anticoagulation with *heparin* was titrated for a therapeutic activated clotting time. Stroke was *defined* as neurologic deficit lasting longer than 72 hours. Every neurological event was reviewed with a neurologist.

Results: The cohort size was 120: 28.3% emergency Type A aortic dissection, and 71.7% elective ascending/aortic arch aneurysm. The stroke incidence was 10.0%. *Timing* was as follows: 41.7% *intraoperative*, 25.0% *postoperative*, and 33.3% *unknown*. *Mechanism* was as follows: 75.0% *focal (embolic)* and 25.0% *watershed (hypoperfusion)*. Significant *univariate predictors* for ($p < 0.05$) stroke in DHCA were emergency status, carotid stenosis, and a *hematocrit* on cardiopulmonary bypass less than 21%.

Conclusions: The null hypothesis is accepted. The major stroke mechanism is *embolic*. The higher stroke risk in Type A dissection may reflect *higher cerebral atheroembolic risk* due to *femoral arterial cannulation* with retrograde aortic perfusion. *Carotid stenosis* may aggravate cerebral hypoperfusion and/or is a marker of atheroma burden. The *DHCA hematocrit* should be kept above 21%.

References:

- 1 Augoustides JG. Anesthesiology 2003; 99: A138; A123; A135.
- 2 Ehrlich MP. Circulation 2003; 108(II): 318.
- 3 Stecker MM. Ann Thor Surg 2001; 71: 14.
- 4 Cheung AT. Anesth Analg 1999; 88: 8.
- 5 Bavaria JE. Ann Thor Surg 2002; 74(5): 1848.

Acknowledgements: Institutional support only.

A-216

Delta opioid receptor antagonism improves splanchnic perfusion in chronically instrumented conscious dogs

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Background and Goal of Study: In a previous study we demonstrated that the non-selective opioid receptor antagonist naloxone improves splanchnic perfusion in chronically instrumented conscious dogs (1). The present study investigates the effects of a selective delta opioid receptor antagonism with naltrindole (NTI) on the regional blood flow distribution of intraabdominal organs.

Materials and Methods: The study was approved by the local Animal Care Committee. Eight healthy dogs were chronically instrumented for measurement of heart rate (HR), left atrial (LAP) and aortic pressure (MAP). Cardiac output was assessed non-invasively by transthoracic Doppler echocardiography. The regional blood flow (RBF) was determined with fluorescent microspheres. Experiments were performed after a postoperative recovery period of 12 days. In all animals, RBF and CO were assessed (1) before application of the selective delta-opioid receptor antagonist (Baseline) and (2) 20 min after pretreatment with NTI (5 mg/kg iv over 10 min). Tissue samples were taken in triplicate in a systematic way. Data were analyzed using Wilcoxon matched pair rank test. Statistical differences were considered significant at $p < 0.05$. Data are presented as mean \pm SD.

Results: In comparison to baseline, NTI resulted in a significant increase in RBF [ml/min/g] of gastric antrum (0.88 ± 0.06 vs. 1.21 ± 0.12), duodenum (0.61 ± 0.03 vs. 1.01 ± 0.08), proximal jejunum (0.22 ± 0.02 vs. 0.55 ± 0.05),

distal jejunum (0.34 ± 0.04 vs. 0.5 ± 0.04), distal ileum (0.45 ± 0.03 vs. 1.05 ± 0.09), proximal colon (0.65 ± 0.07 vs. 1.65 ± 0.13), distal colon (0.8 ± 0.1 vs. 1.67 ± 0.09), pancreas (2.31 ± 0.19 vs. 5.14 ± 0.32), renal cortex (4.6 ± 0.26 vs. 5.59 ± 0.37) and renal medulla (0.35 ± 0.02 vs. 0.43 ± 0.04), and in a significant reduction of RBF of skeletal muscles (0.39 ± 0.04 vs. 0.08 ± 0.01). The arterial RBF of liver (0.19 ± 0.05 vs. 0.23 ± 0.04), spleen (2.42 ± 0.21 vs. 2.61 ± 0.15), gastric corpus (1.31 ± 0.03 vs. 1.38 ± 0.07) and proximal ileum (0.68 ± 0.05 vs. 0.77 ± 0.06) was not significantly changed. CO (3.43 ± 0.45 vs. 2.80 ± 0.36 l/min), HR (106 ± 10 vs. 109 ± 12) and MAD (97 ± 9 vs. 95 ± 10) remained unchanged.

Conclusion: The selective delta opioid receptor antagonist naltrindole improves splanchnic perfusion in conscious normovolemic dogs. This effect is independent of the CO.

Reference:

1 Weber TP, Meissner A, Stypmann J, et al. Anesthesiology 2002; 96:438–41.

A-217

Prophylactic application of bovine hemoglobin-based oxygen carrier HBOC-200 reduced DNA single strand breaks in the poststenotic myocardium of the rat

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Background and Goal of Study: Perioperative myocardial ischemia is frequent in cardiac risk patients. We examined if ultrapurified polymerized bovine hemoglobin HBOC-200 was able to reduce the amount of DNA single strand breaks (DNAssb) in a model of left coronary artery occlusion and reperfusion in the rat¹. DNAssb frequently appear in early stages of ischemia-reperfusion injury² and can be detected by *in situ* Nick Translation Reaction.

Materials and Methods: After approval of the animal care committee 32 Sprague Dawley rats were included. The animals were randomized to four groups. Following induction of general anesthesia and left thoracotomy, a silk suture was placed around the base of the left coronary artery of all animals. The sham control group (G1, n = 8) received general anesthesia for 145 min, while the other groups underwent a 25 min coronary occlusion, followed by 120 min of reperfusion. In the prophylactic group (G2, n = 8) 0.4 g kg^{-1} HBOC-200 were applied 10 min before occlusion, in the therapeutic group rats were treated with 0.4 g kg^{-1} HBOC-200 (G3, n = 8) 10 min after coronary occlusion. In the control group (G4, n = 8) animals received saline. After euthanasia hearts were removed and cut into $15 \mu\text{m}$ slices using a cryostat. DNAssb in heart slices were visualized following DNA polymerase I catalyzed *in situ* incorporation of a nucleotide-cocktail containing (methyl-³H)-thymidine-trisphosphate and were calculated from resulting autoradiograms by densitometric analysis of the left ventricles. Statistical analysis was performed by ANOVA with DUNNETT's post hoc-test ($p < 0.05$ = significant).

Results and Discussions: Reduced amounts of DNAssb were observed in the left ventricle of G1 ($p < 0.008$ vs G4) and G2 ($p < 0.039$ vs G4). No differences in DNAssb were evident between G3 and G4.

Conclusion(s): In accordance with the previously shown reduction of severe cardiac arrhythmias¹, prophylactic application of HBOC-200 was able to reduce the severity of myocardial tissue damage in case of coronary occlusion and reperfusion. HBOC-200 may offer a beneficial strategy in the perioperative treatment of cardiac risk patients in the future.

References:

- 1 Eur J Anaesthesiol 2003, Vol 20 Suppl 30, A-9.
- 2 AINS 2000, 35, 603–605.

A-218

The perioperative renal function in cyanotic versus acyanotic children undergoing desflurane anaesthesia for open heart surgery

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Background and Goal of Study: There are few data on perioperative renal function in children with cyanotic congenital heart disease undergoing open heart surgery. This study aims to investigate the perioperative renal function in cyanotic versus acyanotic children undergoing desflurane anaesthesia for open heart surgery.

Materials and Methods: After receiving ethical committee approval, perioperative renal function in 10 acyanotic patients who underwent open heart surgery (preoperative oxygen saturation (SaO_2) levels $>85\%$) were compared with 10 cyanotic children ($\text{SaO}_2 < 85\%$). The induction of anaesthesia was provided with thiopental, morphine, vecuronium. In both groups desflurane were

administered at concentration levels of 4–6% before cardiopulmonary bypass (CPB) and 3–5% during CPB. Inorganic fluoride, electrolyte, creatinine, urea nitrogen, in serum and urine samples, N-acetyl- β -D-glucosaminidase (NAG) in urine samples were measured, and fractional sodium excretions (FENa) were calculated before induction (t1), before CPB (t2), during CPB (t3), after CPB (t4), at the end of the operation (t5) and 24th hours postoperatively (t6). T-test and chi-square tests were used for statistical analysis.

Results and Discussions: There were no differences between the groups regarding aortic clamping time, the urinary output, serum inorganic fluoride, sodium, calcium, chloride, BUN, and FENa values. Urinary NAG (t5) levels (a marker showing renal tubular damage) were higher in the cyanotic group than the acyanotic group.

	Acyanotic	Cyanotic	p
Age (months)	67.8 \pm 37	65.4 \pm 40	0.89
Female/Male	4/6	5/5	0.50
Weight (kg)	17.6 \pm 5.9	20.5 \pm 10.6	0.46
Serum potassium (t3)	3.2 \pm 0.4	3.8 \pm 0.6	0.03
Serum potassium (t4)	3.3 \pm 0.4	3.8 \pm 0.6	0.03
Serum creatinine (t4)	0.28 \pm 0.2	0.38 \pm 0.1	0.04
Urine sodium (t5)	131 \pm 44	88 \pm 29	0.02
Urine potassium (t3)	51 \pm 33	23 \pm 9	0.02
Urine creatinine (t4)	42.6 \pm 42.5	13.17 \pm 10.8	0.05
NAG (t5)	9.42 \pm 19.3	71.4 \pm 77.18	0.02

Conclusion: We conclude that renal function should be monitored more closely for electrolyte changes and renal tubular damage in cyanotic children undergoing desflurane anaesthesia for open heart surgery.

A-219

Effects of lignocaine on platelet activating factor production

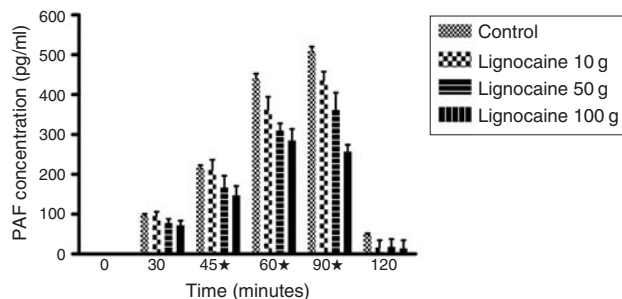
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Background and Goal of Study: Endothelial cells subjected to hypoxia and reoxygenation (HR) enhances synthesis of platelet activating factor (PAF) (1). Local anesthetics inhibit phospholipase A2 activity and attenuate calcium transients (2,3). We hypothesized that lignocaine will attenuate PAF synthesis.

Materials and Methods: Human umbilical vein endothelial cells (HUVECs) were harvested from umbilical cords. HUVECs were pre-treated with lignocaine (5, 10, 50 and 100 μ g ml⁻¹). HUVECs were subjected to 0 to 120 minutes of hypoxia followed by 30 minutes of reoxygenation. PAF concentrations were measured. Data were analyzed with two-way ANOVA.

Results and Discussions: PAF concentrations in HUVEC cultures increased until 90 minutes of HR. Lignocaine decreased PAF concentrations significantly (Figure 1).



* = p < 0.05; values are mean and standard deviation

Conclusion: Lignocaine decreases HR induced PAF synthesis.

References:

- 1 Milhoan KA et al. *Am J Physiol* 1992; 263: H956–H962.
- 2 Kansha M et al. *Anesthesiology* 1999; 91: 1798–1806.
- 3 Kunze H et al. *Biochim Biophys Acta* 1976; 441: 93–102.

A-220

Compensatory acting mechanisms of hypercapnia-induced coronary vasodilation in eNOS-KN mice

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Background and Goals: The importance of NO for the mediation of the hypercapnic flow response was shown in previous experiments. However, in eNOS-knockout mice (eNOS-KN) the hypercapnic flow response is still maintained. Aim of this study was to characterize compensatory acting mechanisms.

Materials and Methods: Isolated, isovolumically working hearts (n = 51) were perfused with Krebs-Henseleit-buffer (perfusion pressure 90 mmHg). After 30 min normocapnic perfusion flow was switched to hypercapnic conditions (pO₂ = 588 mmHg, pCO₂ = 59 mmHg, pH = 7.16) for 10 min. L-NAME (100 μ mol/l), glibenclamide (3 μ mol/l), indomethacin (10 μ mol/l) and TRIM (100 μ mol/l) were used to inhibit the eNOS, K_{ATP}-channels, COX and nNOS, respectively.

Results: Hypercapnic perfusion caused coronary vasodilation, consisting of an initial, rapid and a delayed, persisting flow increase both in WT and eNOS-KN. L-NAME (100 μ mol/l) significantly reduced basal flow and the hypercapnic flow response in WT, but had no significant effect in eNOS-KN. Glibenclamide (3 μ mol/l) decreased basal flow in WT and to a greater extent in eNOS-KN. However, only in eNOS-KN the hypercapnic flow increase was significantly reduced by glibenclamide. Indomethacin (10 μ mol/l) increased basal and hypercapnic flow in eNOS-KN (p < 0.05), but not in WT. TRIM (100 μ mol/l) increased basal flow in both groups, but did not significantly influence the hypercapnic flow increase.

Conclusion: This results indicate that eNOS activity plays an important role in the regulation of basal tone in WT. K_{ATP}-channel dependent relaxation seems to partially compensate for the loss of NO-dependent vasodilation during hypercapnia in eNOS-KN. The nNOS seems to be of minor importance for the mediation of hypercapnic coronary flow response in both strains.

References:

- 1 Godecke A. *Circ Res* 1998;82(2):186–194.
- 2 Huang A. *Am J Physiol Heart Circ Physiol* 2002;282(2):H429–H436.

A-221

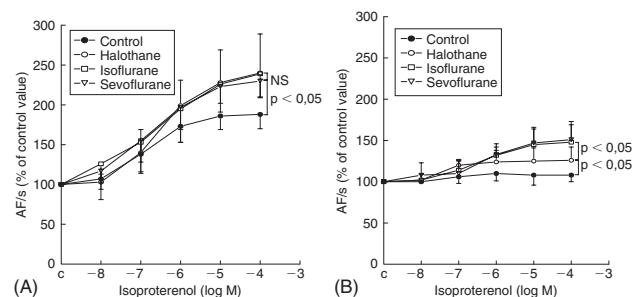
Interaction of halogenated anesthetics with β -adrenoceptor stimulation in diabetic rat myocardium

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Background: Diabetic cardiomyopathy results from sympathetic nervous system alteration (1) and ionic disorders. Halogenated anesthetics potentiate positive inotropic effect of β -adrenoceptor stimulation in healthy rat (2). However, this interaction remains unknown in diabetic myocardium.

Methods: Inotropic effect of β -adrenergic stimulation (isoproterenol 10⁻⁸ to 10⁻⁴M) was studied *in vitro* (Krebs-Henseleit solution, 29°C, pH 7.40, Ca⁺⁺ 0.5 mmol, stimulation of 12/min) in papillary muscles of diabetic rats (four weeks after intravenous injection of streptozotocin). β -adrenergic stimulation was performed either with or without halothane, isoflurane or sevoflurane (1 MAC). Maximum isometric active force normalized per cross-sectional area (AF/s) was measured and comparison between groups was performed using ANOVA.



Figures.

Potentiation of positive inotropic effect of β -adrenergic stimulation with halogenated anesthetics in normal (A) and diabetic (B) myocardium (mean \pm SD).

Conclusion: In diabetes, potentiation of positive inotropic effect remained significantly different with halogenated anesthetics in comparison to control, with a lower magnitude in halothane group. This could result of halothane depressor effect on reticulum sarcoplasmic function, however altered in diabetes.

References:

- 1 Amour J. *Ann Fr Anesth Réanim* 2002;21(suppl. 2):R326.
- 2 Hanouz JL. *Anesthesiology* 1997;86:147–159.

A-223

Blunted responsiveness to Angiotensin II of cultured mesangial cells from kidneys of rats subjected to general anesthesia

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Background and Goal of Study: Induction of general anaesthesia is followed by a significant transient drop of systemic blood pressure, affecting responsiveness of renal glomerular mesangium to vasoconstrictors and intrarenal autoregulatory functions. We investigated proliferative and apoptotic responsiveness to Angiotensin II of mesangial cells isolated from kidneys of rats subjected to general anaesthesia.

Materials and Methods: General anaesthesia was induced in 48 Sprague-Dawley rats by either 2 mg/kg body weight propofol, 4 mg/kg thiopental, 2 mg/kg ketamine, or 0.3 mg/kg midazolam. A normal control group was not subjected to anaesthetic procedures. A sham "stress control" group was injected with 0.9% saline. Systemic blood pressure was measured, and glomerular filtration rate (GFR) was assessed (by 0.1 µg/ml Technetium DTPA injection) before, during and 1 h after anaesthetic procedure. Mesangial cells were subsequently isolated from renal glomeruli and cultured in a specific selective medium. Spontaneous and Angiotensin II stimulated apoptosis was assessed by TUNEL method. Proliferation was measured by ³H-Thymidine incorporation. The results were evaluated by the Students' T-test.

Results: Blood pressure dropped significantly 10 min following induction of anaesthesia (130 ± 3 to 100 ± 5 mmHg, $p = 0.001$, 95% confidence interval). GFR dropped from 5 ± 0.5 ml/min to 1.8 ± 0.5 ml/min ($p = 0.01$, 95% confidence limits). Mesangial cells demonstrated poor spontaneous proliferative rates and blunted proliferative responsiveness to Angiotensin II, compared to anaesthetized or sham anaesthetized rats ($p > 0.05$ in each comparison). Percent apoptosis was significantly augmented in all experimental cultures compared to both control groups (14% through 21% vs control 2%), irrespective of Angiotensin II stimulation.

Conclusion: A decline in systemic blood pressure and GFR following induction of general anaesthesia coincides with a loss of proliferative responsiveness of renal glomerular mesangium to Angiotensin II. Taken together with increased elimination of accidentally injured cells by augmented apoptosis, this might represent a mechanism protecting the kidney from the anaesthesia-related acute injury resulting from systemic hypotension and transient loss of intrarenal blood pressure autoregulation.

A-224

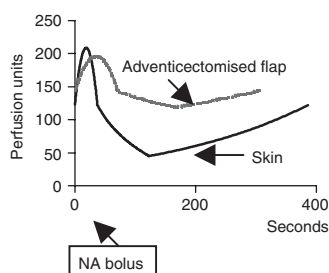
Effect of the sympathectomy on microcirculatory blood flow exposed to noradrenaline infusion

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Background and Goal of Study: During flap surgery, local vasodilatation is wanted. Plastic surgeons often provide a sympathectomy of the dissected area by vascular adventicectomy or locoregional anaesthesia. Our study investigated the effect of the sympathectomy on the microcirculation exposed to iv noradrenaline (NA), assessed by Laser-Doppler Flowmetry (LDF) (Perimed®).

Materials and Methods: After approval of our local Animal Care Committee. 7 wistar rats (± 300 gr) were scheduled in our study. Under anaesthesia with intraperitoneal pentobarbital, microcirculation in the epigastric area was measured using the LDF, before and after an iv bolus injection of NA (20 µg/kg). Epigastric flap was then dissected and the artery pedicle was adventicectomised. LDF on the same area were again measured before and after iv bolus of NA (20 µg/kg). LDF data and area under the curve (AUC) were calculated by Perisoft® logiciels. Data (mean \pm SD) were analyzed by Students't test. p values $< 0,05$ was considered significant.

Results and Discussions: NA injection resulted in early increase in LDF. Sympathectomy did not significantly affect this first change. This increase was followed by a decrease in LDF as compared to baseline values. Sympathectomy significantly reduced the duration (348 ± 134 vs 227 ± 142 sec, $p = 0,04$), the reduction in LDF (-54 ± 18 vs $-8 \pm 41\%$, $p = 0,01$) and the AUC (14505 ± 7098 vs 7524 ± 4040 , $p = 0,01$) of this decrease.



Conclusion: Adventicectomy attenuates the vasoconstriction secondary to NA administration. Sympathectomy may be beneficial to protect the flap from the vasoconstriction induced by endogenous catecholamines release.

Reference:

Microsurgery 2000, 20(5): 217–230.

A-225

Inhibition of I_{to} currents from human heart by bupivacaine

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Background and Goal of Study: Inhibition of I_{to} currents in human heart may contribute to cardiotoxic effects of bupivacaine (1). In human heart I_{to} is a complex formed by Kv4.3 and KChIP2.2 subunits (2). The effects of bupivacaine on these ion channel complex is unknown. We therefore investigated the action of the local anesthetic on Kv4.3/KChIP2.2 channels cloned from human heart.

Materials and Methods: The whole cell patch-clamp technique (3) was used to establish bupivacaine effects on cloned human heart Kv4.3/KChIP2.2 complexes transfected in CHO cells. Data is given as mean \pm SD, $n =$ the number of experiments.

Results and Discussions: Bupivacaine inhibited Kv4.3/KChIP2.2 channels in a concentration-dependent and reversible manner. The IC₅₀-values for inhibition of I_{max} and Q by bupivacaine were 90 ± 33 µM and 55 ± 8 µM ($n = 27$). Bupivacaine accelerated macroscopic current decline in a concentration-dependent manner with an IC₅₀-value of 20 ± 5 µM ($n = 26$). Bupivacaine inhibited the charge traversing the membrane through Kv4.3 channels to a significantly larger degree than that of the complex of Kv4.3/KChIP2.2. The time constant of drug induced inactivation was smaller for Kv4.3 channels (7.4 ± 1.4 ms, $n = 6$) than the time constant of drug induced inactivation for Kv4.3/KChIP2.2 channels (15.1 ± 3.1 ms, $n = 5$).

Conclusion(s): Inhibition of complexes formed by Kv4.3/KChIP2.2 by the local anaesthetic may contribute to the generation of severe ventricular arrhythmia observed during bupivacaine intoxication. The results of our study are consistent with the idea that bupivacaine and KChIP2.2 interfere in the pore region of Kv4.3 channels.

References:

- 1 Castle J *Pharmacol Exp Ther* 1990; 255: 1038–1046.
- 2 Rosati B, Grau F, Rodriguez S et al. *J Physiol* 2003; 548: 815–822.
- 3 Hamill OP, Marty A, Neher E et al. *Pflugers Arch* 1981; 391: 85–100.

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A-226

Effects of candesartan and enalaprilat on the organ-specific microvascular permeability during hemorrhagic shock in rats

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Background and Goal of Study: Angiotensin II is an important vasoconstrictor during hypovolemia and has been suggested to contribute to shock induced ischemic organ damage [1]. Therefore, the interventional pharmacologic blockade of the Renin-Angiotensin-System is under investigation, using angiotensin-I-converting enzyme (ACE) inhibitors or specific AT₁ receptor antagonists [2,3].

Materials and Methods: The investigation was performed in accordance to governmental animal protection laws and was officially approved by the governmental animal care and use committee. We investigated the organ specific alterations in microvascular permeability in lung, heart, kidney, liver, spleen, ileum, skin, and skeletal muscle during severe, nonresuscitated hemorrhagic shock (HS) in rats pretreated with candesartan or enalaprilat. 38 instrumented and anesthetized animals received either candesartan, enalaprilat or vehicle. Within each of the three groups 6 to 7 animals were exposed to HS and 6 animals of each group served as normovolemic controls. After thirty minutes of shock, 50 mg/kg Evans blue (EB) was injected intravenously followed by a distribution period of 20 min. Exsanguination and wash out of the intravascular space was performed by a pressure controlled perfusion with heparinized saline, prior to harvesting organs to quantify albumin-bound EB extravasation.

Results: For reducing cardiac output from 37.5 ± 1.3 to 20.4 ± 1.1 ml/min (mean \pm SEM) in the shock groups, withdrawal of 4.0 ± 0.25 ml (mean \pm SEM) blood was necessary. Simultaneously mean arterial pressure decreased from 77.5 ± 3.2 to 36.1 ± 2 mmHg. Serum lactate increased significantly from 1.3 ± 0.1 to 3.5 ± 0.24 mmol/l. Treatment with candesartan increased

EB extravasation in the kidney in normovolemic controls. Specific AT₁ as well as ACE-blockade before acute nonresuscitated HS significantly increased EB extravasation in the rat ileum by 53 and 66%, respectively.

Conclusion: This observation of increased microvascular permeability may have to be taken into account for any interventional potential of candesartan or enalaprilat during circulatory stress.

References:

- 1 Reilly PM. *Crit Care Med* 1993, 21: S55–68.
- 2 Wall P. *Shock* 2002, 17: 228–233.
- 3 Aneman A. *Crit Care Med* 2000, 28: 818–823.

A-227

Systemic effects of the hyperthermic intraoperative intraperitoneal chemotherapy (HIIC): an experimental model of systemic inflammatory response syndrome (SIRS)?

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Background and Goal of Study: HIIC is an innovating treatment procedure for peritoneal carcinomatosis. The aim of this prospective study was to determine the magnitude of changes that may occur peri-operatively in cardiovascular and metabolic parameters when hyperthermic chemotherapy is applied.

Materials and Methods: 29 patients ASA 1 and 2 without cardiovascular or metabolic diseases were included. The anaesthesia protocol was the same for all patients. Those requiring vasoactive drugs intra-operatively were excluded. Hemodynamic measures were determined via a PA catheter (thermodilution technique). Blood Gases from arterial, mixed and splanchnic venous samples were drawn: just before the HIIC (T0), after 90 min of HIIC (T1) and 12 hours post operatively (T2). SIRS Bone criteria were daily recorded. Statistics: data (mean ± SD), Student *t* and Anova test.

Results and Discussions: 25 patients included (9 M, 16 F)

Age	58 ± 9 years		
Surgery duration	9 ± 2 h		
Post operative vasoactive drugs	7 (25%)		
Post operative SIRS	23 (92%)		
SIRS duration	5 ± 3 j		
ICU	5 ± 2 j		
	T0	T1	T2
T°	34.9 ± 1.1	37.9 ± 0.8*	36.8 ± 0.5**
HR (min ⁻¹)	76 ± 17	100 ± 18*	100 ± 19*
MAP (mmHg)	76 ± 17	71 ± 15*	78 ± 14
Cl (l/min/m ²)	2.8 ± 0.9	4.1 ± 0.8*	4 ± 0.8*
SRV ₁ (dyn/s/cm ⁵ /m ²)	1972 ± 701	1187 ± 425*	1567 ± 376
PAWP (mmHg)	11 ± 5	12 ± 5	6 ± 3**
Art. lact. (mmol/l)	0.9 ± 0.5	2.8 ± 1*	0.8 ± 0.3*
Splanchnic lact.	1.22 ± 0.4	2.9 ± 0.9*	–
DO ₂ (ml/min)	48.7 ± 18	51.2 ± 18	49.4 ± 18
VO ₂ (ml/min)	214 ± 43	270 ± 56*	260 ± 50*

P < 0.05: *T0 vs T1; °T1 vs T2; ° T0 vs T2.

Conclusion(s): HIIC technique induces a hyperdynamic circulatory state and an increased of O₂ consumption with associated SIRS beginning with the procedure and is prolonged during at least 48 hours. The arterial lactate is correlated with splanchnic lactate during the perfusion.

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The effect of positive end expiratory pressure (PEEP) on the agreement between central and peripheral venous pressures

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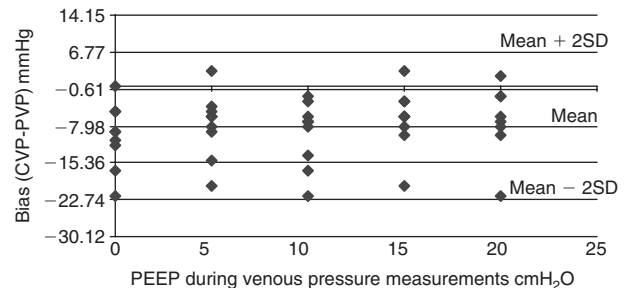
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Background and Goal of Study: A correlation of central venous pressure (CVP) with peripheral venous pressure (PVP) in different clinical setups has been suggested previously (1). We aimed to investigate the effect of positive end expiratory pressure (PEEP) on the agreement between central and peripheral venous pressures.

Materials and Methods: After receiving ethical committee approval, prospective repeated measures study was performed on 9 patients in our ICU. CVP and PVP were measured pairwise at 0, 5, 10, 15, 20 cmH₂O PEEP which, was maintained for at least 10 minutes. All patients were sedated and paralyzed. Except for the changes in PEEP, ventilatory setting (tidal volume 8 mg/kg, respiratory rate 12–16 breath/min, FiO₂ 0.40) remained unchanged.

Three successive measurements (5 min. apart) were obtained at each level of PEEP. Bland Altman assessment for agreement was used for CVP and PVP in all groups (2).

Results and Discussions: The patients were 39 ± 26 yrs old, weighing 64 ± 19 kg. The APACHE II score on admission was 20 ± 11 (mean ± SD). Mean bias (CVP-PVP) corrected for repeated measurements was –7.98 mmHg. All measurements were within Mean ± 2SD limits demonstrating a good agreement between CVP and PVP measurements. PEEP did not influence this agreement.



Conclusions: PVP measurement may be a noninvasive alternative for estimating CVP in the ICU. PEEP does not interfere with the agreement of CVP and PVP.

References:

- 1 Amar D et al. *J Cardiothorac Vasc Anesth* 2001;15:40–3.
- 2 Bland JM, Altman DG. *Lancet* 1986;i:307–10.

A-229

Intestinal metabolism during acute hemorrhage shock and therapy with vasopressin or HES 130 kD

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Introduction: Acute hypovolemia with subsequent tissue hypoperfusion has been suggested to be of major importance in the development of multi organ dysfunction. In critical states of shock disorders on the macro- and microcirculatory level are responsible for subsequent cellular malnutrition. In intensive care treatment hemodynamic parameters still are the “targets” of treatment while it remains unclear, if complete restoration of the hemodynamic situation represents an adequate treatment to the tissue. Aim of the present investigation was to correlate biochemical tissue monitoring of the gastrointestinal tract with hemodynamic observation after acute hemorrhage shock and different therapies.

Materials and Methods: After approval of the local ethics committee 21 German landrace pigs (31,4 ± 5,6 kg b.w.) under general anesthesia and normoventilation were observed for hemodynamic, global oxygenation and blood gas values (MAP, HR, CO, SvO₂) for an observation period of 180 min. A CMA 60 microdialysis catheter was inserted into the jejunum for continuous measurement of interstitial lactate and glycerol concentrations. 7 animals were exposed to an acute blood loss (25 ml/kg b.w.) to a MAP of 30 mmHg without any therapy (C), while 7 animals after 60 min of shock were treated with continuous (V) vasopressin (Pitressin®) infusion or (H) HES 130/0.4 (Voluven®) to a MAP of 60 mmHg.

Results: MAP in both groups during the shock period decreased from 68 ± 5 to 34 ± 6 mmHg, accompanied by a decrease of CO (3,6 ± 1,2 l/min to 1,6 ± 0,5 l/min) and the SvO₂ from 75 ± 10% to 56 ± 7%. During therapy with V and H significant higher values for MAP (59 ± 3 and 61 ± 6 mmHg) were observed, compared to 31 ± 7 mmHg for Control (p < 0.05). CO and SvO₂ remained significantly lower in the V-group compared to H (p < 0.05). Interstitial lactate and glycerol concentrations of the jejunum interestingly were even significantly higher in the V-group compared to the animals without treatment, while HES 130 kD administration reduced interstitial jejunal concentrations to baseline values (p < 0.05 to C and V).

Conclusions: Clinically treatment with vasopressin and HES 130 kD during hemorrhage shock resulted in successful restoration of MAP, compared to control animals. Administration of vasopressin significantly deteriorated interstitial lactate and glycerol accumulation compared to HES 130 kD treatment. Biochemical tissue monitoring as possible with microdialysis should be introduced into the observation of critical ill patients to additionally adjust therapeutical interventions to the effects of tissue metabolism.

A-230**Flow motion in the jejunal mucosa is present during normal and moderately but not severely reduced blood flow**

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Background and Goal of Study: Microcirculatory blood flow (MBF) in the intestinal mucosa is characterized by flow motion (FM), i.e. regular oscillations in flow with a frequency of 3.0–5.5 bpm. Its physiological importance is not known but it may be involved in transcapillary fluid exchange in the intestine. The objective of this experimental study was to investigate how changes in blood flow affected flow motion in the intestinal mucosa.

Materials and Methods: Thirteen pigs were anesthetized and ventilated. In eight animals blood flow in the superior mesenteric artery (SMA) was reduced in steps of 15% to 10% of baseline flow using an occluder (group R). Five animals served as controls. MBF of the jejunal mucosa (mMBF) and muscularis (uMBF) was measured using a multi-channel laser Doppler flowmetry (LDF, three probes on each). All LDF signals were recorded simultaneously and continuously on a computer and processed offline. When regular FM was present more than 50% of the time, amplitude and frequency of the signal were determined. In addition, MBF was visualized on the jejunal mucosa using orthogonal polarization spectral imaging (OPS).

Results and Discussions: MBF of the jejunal mucosa and muscularis decreased linearly to 31% (mMBF) and to 18% (uMBF) of baseline when SMA flow was gradually reduced to 10% of baseline. At 100% SMA flow, regular FM with an average frequency of 5.5 bpm was present in 16 of 24 LDF signals of the jejunal mucosa and in 8 of 24 when SMA flow was reduced to 40% of baseline. When SMA flow was further reduced to 25%, FM was present in only one signal, and at 10% no FM was observed. The amplitude of FM decreased in parallel with MBF while the frequency remained virtually unchanged. FM was present in control animals during the entire experiment and no FM was observed in the jejunal muscularis. OPS recordings confirmed the presence of FM in the intestinal villi.

Conclusion(s): It was concluded that flow motion in the intestinal mucosa is present over a wide range of microcirculatory blood flow. However, it is completely abolished during low flow states. These findings suggest that flow motion in the intestinal mucosa could be a mechanism of trans-capillary fluid exchange – intermittently decreasing capillary pressure – rather than a mechanism of optimizing oxygen transport to the mucosal villi during low flow states.

A-231**Hemodynamic effects of remifentanyl in obese patients**

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Background and Goals: The use of Remifentanyl provides hemodynamic stability and fast awakening after general anesthesia (1). The aim of this prospective study was to compare the effects of remifentanyl (R) and fentanyl (F) on intraoperative hemodynamic responses and on recovery time in obese patients undergoing an open bariatric surgery (OBS).

Material and Methods: After institutional approval and written consent, 82 patients (pts) classified ASA I–II with a body mass index BMI > 30 kg/m² scheduled for an OBS were randomly assigned to receive either F [n = 40] 2–3 mcg/kg (IW) (ideal weight) or R [n = 42] 1 mcg/kg IW/30 sec, then 0.2–0.3 mcg/kg IW/min. All pts received a standardized general anesthesia with sevoflurane MAC [1–2] depending on the bispectral index [30–50]. A bolus dose of tramadol were given for all pts 30 min before the end of surgery depending on pts weight. Heart rate (HR), systolic arterial pressure (SAP) and mean arterial pressure (MAP) were recorded before (T0) and after induction (T1), after intubation (T2), at incision (T3), during surgery (T4–T7), at wound closure (T8) and after extubation (T9). Doses of vasodilators (VD) and vasoconstrictors (VC) administered for a variation of 20% from preoperative value of SAP were registered. Time to extubation and the level of consciousness (1–4) on recovery were noted. Statistical analysis was made with “t” student tests, chi-2 and ANOVA; p < 0.05 was considered significant.

Results: Demographic data were similar between groups. Mean BMI was 44.5 ± 31 Kg/m² and the opioids mean dose were 300 mcg of F and 1800 mcg of R. Doses of VC used were higher in R group (p = 0.18). MAP values dropped at T1, T2 (p = 0.000) and T8 with a concomitant drop of HR at T2 (p = 0.015), T7 and T8 in the R group. Increase of MAP was noted at T8 in F group (p = 0.054). Time to extubation and the level of consciousness were similar at recovery between groups.

Conclusion: R-based anesthesia did not provide hemodynamic stability or better recovery time compared to F during OBS. This leads us to use it cautiously in obese patients with cardiac disease.

Reference:1 *Anaesthesia Analgesia* 2002; 94:163–8.**A-233****Xenon anaesthesia for hypoxic treatment of pancreatic cancer**

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Background and Goals: Xenon anaesthesia is safe and may be useful to obtain cardiovascular stability during anaesthesia. Haemodynamics are seriously disturbed during simultaneous aortocaval occlusion in patients undergoing isolation perfusion for treatment of pancreatic cancer [1, 2]. At present, patients with significant cardiovascular disease are excluded from this perfusion procedure. Therefore, we assessed the haemodynamic effects induced by the onset and removal of such occlusion applying xenon anaesthesia.

Material and Methods: During the different stages of the procedure we measured in 6 consecutive patients: mean arterial pressure (MAP), heart rate (HR), right atrial pressure, pulmonary artery pressure (PAP), pulmonary artery wedge pressure and cardiac output. We also calculated cardiac index (CI), systemic and pulmonary vascular resistance indices, left (LVSWI) and right (RVSWI) ventricular stroke work indices, and the pulse pressure product (PPP), a variable considered to be a non-invasive clinical indicator of the myocardial oxygen consumption. Wilcoxon signed ranks test was used for statistical analysis, with p < 0.05 considered significant. We also compared the found values with the results previously reported during isoflurane anaesthesia for these abdominal isolation perfusion procedures.

Results and Discussions: In all patients the HR decreased after xenon wash-in (28%, p = 0.03). During the perfusion phase, two patients needed intravenous nitroprusside to keep MAP within 20% of its preoperative value; PPP then doubled consequently (p = 0.03). After occlusion release, there was an increase in CI (65%), mean PAP (60%), LVSWI (36%) and RVSWI (67%) (all p = 0.03), while MAP decreased (25%, p = 0.03).

Conclusions: Severe cardiovascular changes induced by simultaneous aortocaval occlusion remain present despite the use of xenon. However, CI and vascular resistances seems less disturbed, and lower values for HR, LVSWI, RVSWI and PPP were found than have been reported in studies using isoflurane for anaesthesia. These findings may indicate that xenon anaesthesia can be beneficial for patients undergoing these perfusion procedures.

References:

- 1 *Rossaint R. Anesthesiology* 2003; 98: 6–13.
- 2 *Hofland J. Br J Anaesth* 2001; 86: 882–6.

A-234**Adenoviral vectors induced cardiovascular complications – pathogenesis and critical care**

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Background and Goal of Study: Adenoviral vectors (Ad) have emerged as an attractive vehicle to introduce genes efficiently into a wider variety of cell types for *in vivo* gene therapy. A major limitation associated with the use of these vectors was their strong immunogenicity leading to significant cellular and humoral immune response. We therefore conducted a series of experiments to understand the innate immunity-related cardiovascular pathogenesis and its clinic implication for critical care.

Materials and Results: Intravenous injection of Ad carrying a β -galactosidase transgene (AdCMVlacZ, 1×10^{11} PFU) into the SD rats induced a lethal hypotension down to 45.3 ± 12.1 mmHg within 5 min. The Ad-induced hypotensive responses were not associated with the increases of the serum nitrite and nitrate, and were insensitive to the systemic pretreatment of NO synthesis inhibitor, ETU (20 μ M), or cyclooxygenase inhibitor, diclofenac (3 μ M). It however could be essentially prevented by transient depletion of Kupffer cells (KCs). Importantly, we found the blood hematocrit increased significantly (+12%) and the vascular permeability elevated by factor of 4 after Ad-injection. Accordingly, treatment with vasopressor agent, epinephrine (0.02 mg/kg/min) restored the blood pressure (BP) to 78.2 ± 24.2 mmHg but still rendered the total mortality of 58% during follow-up. Volume supplements (500 μ l/kg/min), even without a combination of epinephrine, ameliorated the BP and reduced the motility down to 8%. At 3 days after Ad-injection, the transgene expression of β -galactosidase (x-gal staining) predominately found in the liver, but was eventually redistributed to other organs, such as the spleen and the lung, when KCs were deleted, indicating hepatic macrophages were the first defense against adenovirus.

Conclusions: Our results suggest that Ad-induced systemic complications result mainly from the increased vascular permeability due to the innate immunity of hepatic macrophages against adenovirus, whereas the vasodilative

response mediated by NO and prostacyclin plays a minor role. As a consequence, blood volume management is key point in for the critical care.

A-235

Hepatic circulation and oxygen metabolism during sevoflurane, isoflurane or halothane anesthesia with hypoxemia in the dogs

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Background and Goal of Study: Under a critical threshold of hepatic oxygen delivery (HDO₂c), hepatic oxygen consumption (HVO₂) decreases, energy productive metabolism are impaired, and thereafter liver dysfunction occasionally occurs (1). The present study was designed to determine the point of HDO₂c during sevoflurane (S), isoflurane (I) or halothane (H) anesthesia. S and I anesthesia have been postulated to bring on smaller derangement of hepatic circulation than H.

Materials and Methods: Under control ventilation, 30 mongrel dogs were anesthetized with N₂-O₂-1.5MAC of S, I or H (10 dogs with each anesthesia). The inspired oxygen concentration (FIO₂) was gradually reduced from 21% to 15, 12, 10, 8, and 6% by mixing air and nitrogen, and was maintained for 30 min at each FIO₂ during anesthesia. Hepatic arterial blood flow (HAF) and portal venous blood flow (PVF) were measured with electromagnetic flowmeters. HDO₂ and HVO₂ were calculated from HAF, PVF and oxygen content in hepatic arterial, portal and hepatic venous blood at each FIO₂. Hepatic energy charge was assessed by measuring the arterial ketone body ratio (AKBR). Logarithmic correlation equation curves of HDO₂-HVO₂ in the three anesthesia groups were calculated from HDO₂ and HVO₂ at each FIO₂ level.

Results and Discussions: The HDO₂c points of S and I, corresponding with the shoulders of the S and I curves, shifted to lower than that of H. HDO₂c point for H was (HDO₂ = 6.9 ml O₂/dl, HVO₂ = 2.6 ml O₂/dl), whereas (3.8, 2.1) for S and (3.5, 2.0) for I (p < 0.05, S, I vs. H). The AKBR decreased to 0.6 in the H anesthesia group, but stayed at 0.8 in the S and I groups at FIO₂ 0.1.

Conclusion(s): The results indicate that HDO₂c appeared at lower HDO₂ points in the S and I groups compared with H. This HDO₂c appeared at an FIO₂ well below 0.1 on the S and I curves, but it appeared at an FIO₂ above 0.1 on the H curve. In the present study, S and I decreased HDO₂ and HVO₂ less prominently than H at equivalent FIO₂. In conclusion, HDO₂-HVO₂ relationship was maintained better with S and I than with H anesthesia during graded hypoxic hypoxemia.

Reference:

- Schlichtig R, Gayowski T. In Multiple systems organ failure 1993; 193-213.

A-236

Moderate perioperative vasoconstriction does not influence tissue oxygen tension

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Background and Goal of Study: Subcutaneous tissue oxygen tension (P_{sq}O₂) is a strong predictor for postoperative wound infections. Centrally mediated thermoregulatory vasoconstriction during shivering decreases P_{sq}O₂ by approximately 40%. (1) Thus even moderate peripheral vasoconstriction, which is common during the perioperative period, might influence peripheral oxygen availability. Skin-surface temperature gradients (forearm temperature – fingertip temperature) are an accurate measure for thermoregulatory peripheral vasoconstriction and correlate well with arterio venous shunt and capillary blood flow (2). Consequently we simultaneously evaluated temperature gradients and subcutaneous tissue oxygenation in surgical patients.

Materials and Methods: After IRB approval and informed consent, 189 patients undergoing major abdominal surgery were studied during 466 intra- and postoperative conditions. Anesthesia technique and postoperative management were standardized. P_{sq}O₂ was measured with a Clark type electrode (LICOX[®], GMS Inc., Germany) in the upper arm. Skin-surface temperatures were measured on the same arm using a Mon-a-Therm[®] model 6500 thermometer and disposable thermocouples (St. Louis, Missouri). The thermocouples were incorporated into self-sticking, 1-cm diameter disks. A positive temperature gradient was considered as peripheral vasoconstriction.

Results: Data are presented as mean ± SD.

P-values are for two-sided, unpaired t-tests.

	Vasodilation	Vasoconstriction	P-value
Conditions	n = 215	n = 251	
Gradient (°C)	-1.8 ± 1.5	2.7 ± 2.5	<0.001
P _{sq} O ₂ (mmHg)	59.9 ± 26.1	59.0 ± 21.6	NS
Tissue temp. (°C)	34.2 ± 1.6	33.5 ± 1.8	<0.001

Conclusion: Moderate perioperative peripheral vasoconstriction does not alter subcutaneous tissue oxygen tension, while subcutaneous tissue temperature, a marker for peripheral perfusion is significantly reduced.

References:

- Sheffield C.W., et al., Wound Rep Reg 1997,4 p: 339.
- Rubinstein E.H., et al., Anesthesiology 1990,73 p: 541.

A-237

Gastrointestinal tonometry under controlled hypotensive anesthesia

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Background and Goal of Study: There were some reports relevant to the effect of controlled hypotension on gastric intramucosal pH (pHi) (1, 2). We investigated the effect of triple vasodilators on pHi by gastrointestinal tonometry.

Materials and Methods: We studied 40 patients, undergoing mastectomy and subdivided the patients in four groups: normotension (group A), hypotension using nitroglycerine (group B), prostaglandin (group C), and nicardipine (group D). We kept mean arterial blood pressure (MAP) at less than 80% of control value in hypotensive group during resection of mammary carcinoma. We measured pHi, partial pressure of gastric intraluminal carbon dioxide (PgCO₂), arterial CO₂, arterial pH, the difference between gastric intramural and arterial CO₂ (Pg-PaCO₂), MAP, and heart rate during anesthesia. Each value was compared at following points: after inducing anesthesia (T₀), 20, 40 and 60 minutes after hypotension (T₁, T₂ and T₃) and at the end of surgery (T₄). Repeated measures ANOVA were used for statistical analysis.

Results: Data (Mean) are shown in the table:

	Group	T ₁	T ₂	T ₃	T ₄
pHi	A	7.451	7.396	7.375	7.361
	B	7.445	7.375	7.362	7.344
	C	7.418	7.374	7.362	7.332
	D	7.448	7.398	7.386	7.384
Pg-PaCO ₂	A	-1.9	2.7	4.7	5.8
	B	-0.5	5.3	6.8	7.5
	C	1.1	4.5	4.6	7.0
	D	-1.8	2.7	5.0	4.7

The values of PgCO₂, pHi and Pg-PaCO₂ at T₀ were excluded because of initial mechanically instability of tonometry. The changes of values were not statistically significant.

Conclusions: The differences of vasodilators did not make differences of pHi and Pg-PaCO₂ in our study. We suppose that controlled hypotension does not cause inadequate blood flow to gastrointestinal tract.

References:

- Cezary P. Med Sci Monit 2002; 8: CR28-30.
- Andel D. Anesth Analg 2001; 93: 1116-1120.

A-238

Proinflammatory cytokine release under two anesthesia techniques

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Background and Goal of Study: Proinflammatory cytokines release is a reported common response during and after surgical procedures. Any significant exaggeration in this response potentially predispose the host to deleterious consequences such as end-organ damage (1). The studies about the anesthetic technique interference on cytokines release are contradictory (2,3). The goal of study was to assess the influence of two kinds of anesthesia techniques (Epidural vs. General) on the release of proinflammatory cytokines (TNF-α, IL-6, IL-1), C-reactive protein (CRP), fibrinogen and cortisol.

Materials and Methods: We study in a prospective, aleatory randomized way 60 patients, ASA I-II, scheduled for abdominal hysterectomy without exclusion criteria. Two groups were settled: Epidural Anesthesia Group (Group E) and Balanced General Anaesthesia (Group G), both performed under current protocol. Blood samples were withdrawn to determine levels of IL-6, IL-1, TNF-α, CRP, cortisol and fibrinogen at times: T0 (just before anesthesia), T1 (6 hours after the intervention), T2 (3rd postoperative day). Inter and intragroups cytokine plasma levels has been compared. Student T test was used, error type I of 0,5%.

Results and Discussions: Main data (Mean \pm SD) are shown in the table. Measures of cytokines are done in pg/ml.

	T0	T1	T2
TNF- α (G)	4,73 \pm 1,5	4,75 \pm 1,8	6,14 \pm 5,37*
TNF- α (E)	5,20 \pm 3,5	12,8 \pm 10,7*#	11,4 \pm 7,37*#
IL-1 (G)	12,95 \pm 12,6	14,82 \pm 21,8*	12,52 \pm 20,9
IL-1 (E)	11,84 \pm 10,60	16,16 \pm 18,9*#	12,93 \pm 16,16
IL-6 (G)	4,96 \pm 1,5	15,61 \pm 10,7*	8,63 \pm 7,2*
IL-6 (E)	6,23 \pm 3,37	26,48 \pm 22,8*#	13,79 \pm 12,6*#

*p < 0,05 intragroup analysis; # p < 0,05 intergroup analysis.

Conclusion(s): (1) Significant postoperative cytokines release is seen in both groups. (2) Postoperative cytokines release is higher in epidural group than general group.

References:

- 1 Guirao X et al. *World J Surg* 1996;20:437–46.
- 2 Hogevoeld HE et al. *Cytokine* 2000;12:1156–9.
- 3 Helmy et al. *Anesthesia* 1999;54:733–8.

A-239

Efficiency of the AnaConDa (Anesthesia Conserving Device) with sevoflurane: in vitro study

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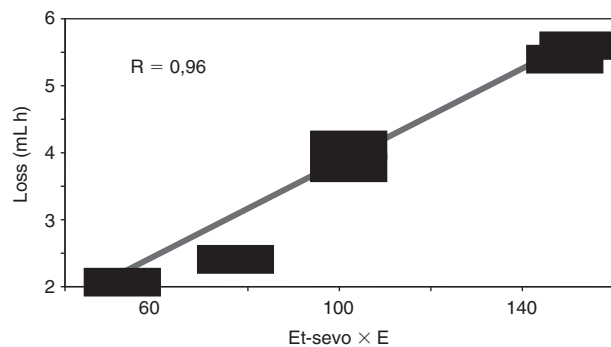
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Background and Goals: The Anesthetic Conserving Device (AnaConDa; Hudson RCI, Sweden) is a new device for anesthetic vapours delivery. A syringe pump delivers the volatile anesthetic in liquid status to the ACD where the anesthetic is vaporized (1). We evaluated the anesthetic loss from the ACD filter (efficiency) during 24 hours of use at different sevoflurane end-tidal concentrations and minute volume ventilation (VE).

Material and Methods: A latex bag of 2300 ml was connected to a Ergo ventilator (Temel, Spain) and mechanical ventilation was adjusted at 10 bpm. Infusion rates of liquid sevoflurane to the ACD filter were adjusted during the 24-hour study to obtain a constant end-tidal concentration of 1, 1.5 and 2%. Experiences were performed at VE of 5 and 10 L/min. Anesthetic concentrations were measured using a standard clinical monitor (Vamos, Dräger, Germany).

Results: The table shows the total losses in mL per hour, calculated from the difference of sevoflurane administered and retained in the bag (EtSevo times bag volume). Efficiency plot i.e. loss of sevoflurane through the filter (Y axis) related to the product of Et concentration times VE (X axis) is showed in the graph.

EtSevo – VE	1st h	2nd h	3th h	4–6 h	6–24 h	Mean	SD
1%–5	2.66	2.05	2.1	2.03	2.2	2.1	.05
1%–10	4.61	4.4	3.9	4.6	4.02	4.1	.49
1.5%–5	2.68	2.4	2.4	2.6	2.4	2.4	.11
1.5%–10	6.8	5.6	5.4	5.7	5.6	5.6	.13
2%–5	5.57	3.6	3.9	3.8	4.0	3.8	.19
2%–10	12.05	13.8	14.5	14.6	14.4	14.4	.32



Conclusions: Loss of anesthetic through the AnaConDa is directly related to the Et-concentration and the minute volume. Anesthetic loss was constant throughout the 24-hour period of study.

Reference:

- 1 *Anaesthesia* 2001; 56: 429–32.

A-241

Effects of dexmedetomidine on digital arterial inflow rate

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Background and Goals: Alpha-2 adrenoceptor agonists have peripherally mediated vasoconstrictive effects in human digits (1). Contribution of the arterial and venous vasculature to the total peripheral vasoconstriction has not been tested. The aim of this study was to determine the effect of dexmedetomidine, an alpha-2 agonist, on digital arterial inflow rate in healthy volunteers.

Materials and Methods: After Human Research Committee approval and written informed consent, we anesthetized 16 healthy volunteers using fentanyl, propofol and N₂O in O₂. Study subjects received a dexmedetomidine infusion in four consecutively increasing steps, targeting plasma concentrations of 0.15, 0.3, 0.6 and 1.2 ng/ml. Each infusion step was at least 15 minutes in duration. Rate of digital arterial inflow was measured by venous occlusion plethysmography before, during and after dexmedetomidine infusion. Arterial inflow rates were calculated as percent changes. Data were analyzed using ANOVA and paired t-test as appropriate, and are presented as means \pm SD.

Results: Induction of anesthesia increased digital arterial inflow rate by 330 \pm 462% (p < 0.01) compared to awake values. All four dexmedetomidine target concentrations reduced the rate of arterial inflow (p < 0.01). Compared to asleep baseline values the reductions were –30 \pm 31%, –28 \pm 65%, –36 \pm 53% and –45 \pm 44% for the 0.15, 0.3, 0.6 and 1.2 ng/ml target concentrations, respectively.

Conclusions: Dexmedetomidine reduced digital arterial inflow rate in anesthetized healthy volunteers. Our results demonstrate a significant arterial contribution to alpha-2 agonists induced peripheral vasoconstriction. The venous contribution to the total peripheral vasoconstriction is still unknown.

Reference:

- 1 Talke P. *Anesthesiology* 2003; 99(1): 65–70.

A-242

Dexmedetomidine: an agent for controlled hypotension in maxillo-facial surgery

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Background and Goal of Study: Dexmedetomidine (DXM) is a selective, short acting, central alpha2-adrenergic agonist. DXM is used in anesthesia and perioperative care for its sedative and sympatho-inhibitory properties (1). The aim of this study is to assess the efficacy of DXM in achieving controlled hypotension and in minimizing bleeding during maxillo-facial surgery.

Material and Methods: After institutional approval and informed consent, 20 consecutive ASA physical status I patients (pts), scheduled for maxillo-facial surgery, were included in this prospective study. Pts had general anesthesia with propofol 2.5 mg/kg, fentanyl 1 μ g/kg/h vecuronium 0.1 mg/kg, and isoflurane 1–1.5 MAC. After induction of anesthesia, pts received a DXM intravenous (IV) infusion of 0.1 μ g/kg/min for 10 min followed by 0.4 to 0.7 μ g/kg/h, with the objective of maintaining systolic arterial pressure (SAP) close to 80 mmHg. Intraoperative fluid and blood loss were adequately compensated. The infusion of DXM was stopped 20 min before the end of surgery. SAP, mean arterial pressure (MAP) and heart rate (HR) were continuously monitored. Bleeding in the surgical field was rated by the surgeon as being minimal, moderate or severe. Time interval between end of surgery and tracheal extubation (Text) was noted.

Results: Hemodynamic parameters recorded intra-operatively are presented as mean \pm SD in table. SAP was maintained between 80 and 90 mmHg. Highest recorded values of SAP were below 107 mmHg. Surgical bleeding was rated as minimal in 80% of pts and as moderate in 20% of pts. Text was 20 \pm 11 minutes.

Times	SAP	MAP	HR
Onset DXM	119 \pm 16	88 \pm 16	75 \pm 11
Incision	85 \pm 5	64 \pm 6	67 \pm 9
30 min	87 \pm 7	64 \pm 7	66 \pm 9
60 min	86 \pm 9	65 \pm 9	65 \pm 8
90 min	86 \pm 8	64 \pm 7	64 \pm 8
120 min	83 \pm 6	61 \pm 6	63 \pm 8
Offset DXM	81 \pm 5	62 \pm 5	63 \pm 9
Highest	100 \pm 7	78 \pm 8	72 \pm 9

Conclusion: Intraoperative IV infusion of DXM is effective in achieving controlled hypotension and in minimizing surgical bleeding during maxillo-facial procedures. The use of DXM in this context may delay postoperative tracheal extubation.

Reference:

- 1 Bhana N et al. *Drugs* 2000 Feb;59(2):263–8.

A-243

Effects of thoracic epidural anesthesia (TEA) on microvascular gastric mucosal oxygenation during physiological and compromised circulatory conditions in dogs

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Background and Goal of Study: The effects of thoracic epidural anesthesia (TEA) on gastric mucosal micro-vascular hemoglobin oxygenation (μHbO_2) are unknown, both under physiologic and compromised circulatory conditions. Furthermore, TEA may alter the relation between regional μHbO_2 and systemic O_2 -transport (DO_2).

Materials and Methods: Dogs (anesthetized, ventilated) randomly received TEA (lidocaine, $n = 6$) or epidural saline (controls, $n = 6$) and underwent physiological and com-promised circulatory conditions (PEEP, 10 cmH_2O) [1]. We measured μHbO_2 (spectrophotometry [2]) and DO_2 .

Results and Discussions: Under physiologic conditions, TEA preserved μHbO_2 (47 ± 3 and $49 \pm 5\%$, mean \pm SEM) despite significantly decreasing DO_2 . However, during compromised circulation, TEA aggravated the reduction in μHbO_2 (to $32 \pm 1\%$) and DO_2 , compared to controls. Herein, TEA preserved the $\mu\text{HbO}_2/\text{DO}_2$ -correlation.

Conclusions: TEA maintains mucosal μHbO_2 under physiologic conditions and preserves the correlation between regional (μHbO_2) and systemic (DO_2) oxy-genation, even under compromised circulatory conditions.

References:

- Scheeren TWL et al. Crit Care Med 2002; 30: 811–17.
- Kuchenreuther S et al. J Clin Mon 1996; 12: 211–24.

A-244

Influences of pneumoperitoneum on tissue oxygenation during laparoscopic abdominal surgery in normal weight and morbidly obese patients

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Background and Goal of Study: Morbid obesity is an important risk factor for surgical site infections. The incidence of wound infection is directly related to tissue perfusion and oxygenation [1]. Fat tissue mass expands without a concomitant increase in blood flow per cell which results in relative hypoperfusion and reduced subcutaneous oxygenation in obese patients [2]. We thus tested the hypothesis that peripheral perfusion and tissue oxygenation is reduced in obese patients during laparoscopic surgery.

Materials and Methods: After IRB approval and informed consent, patients (BMI > 35 $n = 15$, or < 25 $n = 11$) undergoing laparoscopic gastric banding or fundoplicatio were evaluated. Anesthesia technique was standardized. Fluid management was standardized per kg lean body mass. Subcutaneous tissue oxygen tension (PsqO_2) was measured in the upper arm with a Clark type electrode (LICOX[®], GMS Inc., Germany) during surgery. Groups were compared with unpaired, two-tailed t test. $P < 0.05$ was considered statistically significant. Values are presented as means \pm SDs.

Results and Discussions: Confounding factors such as fluid management, core temperature, intraarterial oxygen and carbon dioxide tensions, and hemodynamic responses did not differ significantly. BMI was 46 ± 7 kg/m^2 in obese patients and 24 ± 3 kg/m^2 in lean patients. Intraoperative PsqO_2 values were significantly lower in obese patients (Table 1).

Table 1. Intraoperative tissue oxygenation.

PaO_2 (mmHg) during pneu. peritoneum (Mean \pm SD)
Obese $41,7 \pm 10,1$; Lean $51,3 \pm 11,4$ ($p > 0,05$)

Conclusion(s): Tissue hypoxia is common in morbidly obese patients and is pronounced during laparoscopic surgery. Tissue oxygenation in obese patients is reduced to levels that are associated with a substantial increase in infection risk, perhaps explaining the high risk of infection in these patients.

References:

- Hopf H., Arch Surg 1997;132, p:997.
- DiGirolamo M., Am J Physiol 1971;220, p:932 Anesthesiology 2002; 96: A 190#.

A-245

Effects of oxygen delivery in a rabbit model of arterial thrombosis and bleeding

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Background and Goal of Study: Hypoxia can be associated with haemostasis troubles during some critical situations. No data are available in vivo. We have compared the effects of different levels of FiO_2 in an experimental model of arterial thrombosis and bleeding.

Materials and Methods: 44 New-Zealand rabbits were anaesthetised, ventilated and monitored for blood pressure, temperature and carotid flow. Sequentially an injury and a stenosis ($>60\%$) were carried out on the carotid artery, inducing thrombosis with cyclic flow reductions (CFR) recorded over a 20-min period. Afterwards, animals were randomised into 3 groups: *hyperoxic*: rabbits were ventilated with a high FiO_2 (0.8); *hypoxic*: rabbits were ventilated with air; *normoxic*: oxygen delivery was calibrated to obtain a PaO_2 between 80 and 120 mmHg. After every CFR period (CRF1: basal; CFR2: after FiO_2 change), blood samples (arterial blood gas, Ht, platelet count, prothrombin time, fibrinogen and platelet aggregation) and ear immersion bleeding time (BT) were performed. At the end of the experiment an hepato-splenic section was done and the amount of wound bleeding was recorded. Data were expressed as mean \pm SD except for CFR, BT and WB (median (range)). ANOVA.

Results and Discussions: Experimental conditions (weight, heart rate, blood pressure and temperature) were comparable in the three groups. There were no significant difference concerning pH and PaCO_2 between groups and periods. Prothrombin time, fibrinogen, platelet count and BT remained stable between groups and periods.

	Hyperoxic (n = 17)	Hypoxic (n = 17)	Normoxic (n = 10)
CFR1	8 (4–15)	7 (3–16)	6 (4–10)
CFR2	7 (0–14)	4 (0–12)*	4 (1–7)**

* $p < 0,05$ vs T1; ** $p < 0,05$ vs hyperoxic.

CFR (small reduction) and platelet aggregation (little increase in the slope, the maximum remained stable) were the only parameters modified when FiO_2 decreased. Bleeding time and wound bleeding were identical.

Conclusion(s): FiO_2 variations didn't seem to interfere clearly with haemostasis. The effects on thrombosis appeared to be limited in this model.

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The effect of halothane, isoflurane, sevoflurane and propofol infusion on renal function after coronary artery bypass surgery

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Background and Goal of study: Renal insufficiency after cardiac surgery is associated with increased mortality, morbidity, and length of intensive care unit stay. We investigated the effect of isoflurane, halothane, sevoflurane and propofol anesthesia on perioperative renal function after elective coronary artery surgery.

Materials and Methods: Medical records of 224 patients, who underwent cardiac surgery in our hospital in one year, were reviewed retrospectively. Chi-square and repeated measures ANOVA were used for statistical analysis.

Results and Discussion: Patient characteristics (diabetes mellitus, pre-operative ejection fraction), duration of operation, aortic cross clamping time, cardiopulmonary bypass time, usage of furosemide, intraoperative crystalloid, blood transfusion, urinary output, lowest central venous pressure, lowest blood pressure as well as preoperative and postoperative (after the operation, postoperative 6th hours and 24th hours) haematocrit, BUN levels were not different between the groups. Postoperative (postop.) fluid and blood transfusion, drainage, urinary output, diuretic usage were also similar between the four groups ($p > 0.05$). Data is given as number of patients (n) or mean \pm SD in the table below.

	Isoflurane (n = 65)	Halotane (n = 68)	Sevoflurane (n = 64)	Propofol (n = 27)	p
Age (yrs)	56 \pm 12	54 \pm 11	57 \pm 10	55 \pm 8	0.30
Female/Male (n)	17/48	15/53	19/45	6/21	0.94
Duration of anesthesia (min)	225 \pm 44	238 \pm 59	237 \pm 48	227 \pm 46	0.40
Preoperative creatinine	1,0 \pm 0,2	1,0 \pm 0,3	0,9 \pm 0,3	1,1 \pm 0,2	0,05
Postop. creatinine	0,9 \pm 0,3	1 \pm 0,2	0,8 \pm 0,3	1,0 \pm 0,3	0,05
Postop. 6 hr creatinine	0,9 \pm 0,2	1,0 \pm 0,3	1,1 \pm 0,4	1,1 \pm 0,3	0,05
Postop. 24 hr creatinine	1,0 \pm 0,3	1,0 \pm 0,3	1,1 \pm 0,3	1,0 \pm 0,2	0,05
Intraoperative dopamine (n)	8	10	11	9	0,03
Postop. dopamine (n)	8	9	16	7	0,03

Conclusion: We concluded that halotane, isoflurane, sevoflurane and propofol infusion do not affect early postoperative renal function after elective coronary artery bypass surgery.

A-249**Preconditioning effect of halothane on microcirculatory hemodynamics in muscle flap after experimental cardiac arrest**

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Background and Goal of Study: The purpose of this study was to investigate the preconditioning effect of halothane and isoflurane anesthesia on microcirculatory hemodynamics after cardiac arrest using cremaster muscle flap model for intravital microscopic study.

Materials and Methods: Twelve male Sprague-Dawley rats were studied in two experimental groups. Group I cardiac arrest under halothane anesthesia ($n = 6$): Following induction of anesthesia with pentobarbital (40 mg/kg ip.). The lungs were ventilated with 1 MAC of halothane and oxygen ($FiO_2 = 0.35$). Next, modified cardiac arrest was performed for 5 minutes and the animal were resuscitated. Group II cardiac arrest under isoflurane anesthesia ($n = 6$): The same experiment was performed under 1 MAC of isoflurane anesthesia. Vital parameters such as ECG, MAP, CVP, PaO_2 , $PaCO_2$, pH and esophageal temperature were measured. In both groups the cremaster muscle was isolated for intravital microscopy. The following peripheral microcirculatory parameters were measured for 4 hours after resuscitation: Vessel diameters and RBC velocities of A1, A2, A2-2, A3 arterioles, and functional capillary density.

Results and Discussions: Immediately after resuscitation a significantly higher decrease in arteriolar diameters was found in the isoflurane group A1 (16.6%), A2 (29.7%), A3 (42.4%) ($p < 0.01$) when compared to halothane group A1 (15.6%), A2 (19.3%), A3 (21.9%). At 4 hours after resuscitation RBC velocities increased by 27.6% in the halothane group and by 21.8% in the isoflurane group when compared with the baseline values. Following resuscitation 19.3% increase in capillary perfusion was found in the halothane group ($p < 0.01$).

Conclusion(s): In this study halothane anesthesia showed better recovery, as a preconditioning effect, of peripheral microcirculatory hemodynamics following cardiac arrest and resuscitation by increase in RBC velocities and functional capillary densities ($p < 0.01$). In contrast isoflurane showed impairment of flow in response to cardiac arrest.

Reference:

Anesthesiology; Vol. 85 No. 3A 574 Sep. 1996.

A-250**Isolated limb perfusion with cytostatics for recurrent melanoma: anaesthetic management, complications and outcome**

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Background and Goal of Study: Hypertermic isolated limb perfusion (ILP) with high doses of cytostatics is used to treat recurrent melanomas of the extremities (1). We present the experience of our institution in such procedure.

Materials and Methods: Patients with recurrent melanoma of the lower limb scheduled for ILP from 1997 to 2002 were included. All patients were under general anaesthesia and monitored with EKG, pulse oximetry, capnometry, invasive blood pressure, central venous pressure and transoesophageal doppler. Femoral vessels were cannulated and connected to an extracorporeal circuit (ECC). An inguinal tourniquete help to further isolate limb circulation. Skin limb was heated to 40°C and then melphalan and interferon were added and the limb perfused for one hour. Anaesthesia, haemodynamics, blood transfusion, ECC and procedure times, complications, remission of the disease and survival rate were evaluated.

Results and Discussions: We studied 24 patient (9 male, 15 female) from 32 to 83 years old. Patients were anaesthetized with fentanyl, propofol (TCI) and vecuronium. Antiemetic, antibiotic and antithrombotic prophylaxis was given. The duration of ECC and procedure was 72 ± 12 and 213 ± 42 minutes respectively. During ECC there was a trend to hypotension and low cardiac output in all patients, but only 5 need vasoactive drugs. One patient developed severe hypotension and anemia. Red blood cells were transfused in 64% of the patients. No alterations in pulse oxymetry was seen. Peritoneum was opened accidentally in two patients. Postoperative nausea/vomiting occurred in 5 patients. Late complications were: limb oedema in 11 (45.3%), cellulitis in 4 (16.6%), vein thrombosis, limb neuralgia and bone marrow depression in 2 (8.3%). Melanoma remission was: total in 6, partial in 8, no remission in 10. The Kaplan-Meier curve showed a survival rate of 41.7% at 5 years.

Conclusion(s): Treatment of recurrent melanomas with hypertermic ILP of cytostatics is a complex technique with potential severe complications and requires a strict perioperative monitoring. The procedure can be performed safely with a close collaboration between anesthesiologist, surgeon and perfusionist.

Reference:1 Klasee JM, Kroon BBR, Van Geel AN et al. *Br J Surg* 1993;80:1124-1126.**A-251****The effect of changes in end-tidal carbon dioxide on vascular reactivity of skin**

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Background and Goal of Study: The transient hyperaemic response (THR) of forearm skin has been validated as a measure of myogenic vascular reactivity (1,2). It is non-invasive and easily repeatable so may be a useful marker of vascular reactivity in critical illness or the peri-operative period. The effects of blood carbon dioxide tensions on vascular reactivity are unclear. We investigated the effect of changes in end tidal carbon dioxide tension on the transient hyperaemic response in healthy subjects.

Materials and Methods: We studied 15 healthy volunteers aged 20-33. Skin blood flow flux was measured using a laser Doppler flowmeter (DRT4, Moor, UK), with two probes attached to the volar aspect of the forearm. After a period of acclimatization baseline a series of THR tests was performed. Each test consisted of 20 seconds manual occlusion of the axillary artery and recording of the subsequent hyperaemic response. A THR ratio was calculated as the ratio of peak flux divided by baseline flux. Control measurements were taken with hyperventilation of 50% over baseline using inspired CO_2 to maintain normocapnia. Further pairs of THR tests at hypercapnia (+1 kPa) and hypocapnia (-1 kPa) were performed by adjusting inspired CO_2 . Data were analyzed using paired T-tests for the THR ratio, Wilcoxon for the baseline flow-flux.

Results and Discussions:

	Control	Hypercapnia	Hypocapnia
THR ratio	3.2 (1.1)	2.8 (0.9)	3.2 (0.9)*
Baseline flow-flux	4.4 (1.7-24)	4.3 (2.2-33)	2.8 (1.5-20)*

Data are given as mean (SD) for THR ratio (normally distributed) and median (range) for baseline. * $p < 0.05$ vs hypercapnia. The data suggest that hypocapnia augments vascular reactivity. This is consistent with a vasoconstrictive action of hypocapnia in skin.

Conclusion(s): Changes in end-tidal CO_2 are associated with altered myogenic vascular reactivity. This may be a cause of impaired vascular reactivity in critical illness.

References:

- 1 Brown H, Moppett IK, Mahajan RP. *Br J Anaesth* 2003; 90: 446-51.
- 2 Webster V, Mahajan RP. *Br J Anaesth* 2002; 89: 265-70.

Respiration**A-252****Tracheal tube impingement during nasotracheal fiberoptic intubation**

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Background and Goals: During nasal fiberoptic intubation (NFOI) endotracheal tube (ETT) insertion may be difficult due to its tip impinging on

laryngeal structures. It has been postulated that the impingement could occur at the arytenoids [1] or epiglottis [2]. Using a novel method of direct endoscopic visualisation we aimed to determine the exact location of the impingement during NFOI and to document ETT tip movement in response to rotation.

Materials and Methods: With ethical approval, we studied 43 ASA I-II adult patients undergoing dental procedures. Two fibrescopes, each connected to a CCTV were used for the study. With the patients anaesthetised and paralysed in the supine position, the first fibrescope was inserted through one

nostril and its tip positioned in the pharynx to monitor the view. The second fibrescope, loaded with an ETT, was inserted through the second nostril to intubate the trachea. We used 6.0/6.5/7.0 mm north polar preformed RAE tubes. If resistance was felt on tube insertion, the ETT was withdrawn 1 cm, rotated -90° and advanced again. If difficulty persisted, the manoeuvre was repeated with -180° , -270° and 360° rotation.

Results: We experienced 10 cases of impingement (23%). The site of the impingement was the right arytenoid in five cases. In two cases, the ETT migrated into the hypopharynx. Left arytenoid, left vocal cord and right piriform fossa were the site of impingement in one case each. Rotation was successful in all 10 cases (-90° in three cases, -180° in four and three cases requiring 360°). Despite these rotational manoeuvres at the proximal end of the ETT, we observed only partial rotation transferred to its distal tip in four cases. In six cases, the ETT tip only moved up and/or sideways.

Conclusions: During NFOI, impingement of ETT tip occurs at the lower areas of the laryngeal inlet (most commonly right arytenoid) rather than the epiglottis. Rotation of the ETT is a reliable solution, but it is of interest that proximal ETT rotation does not always result in rotation, but rather up or sideways movement of the distal ETT.

References:

- Hughes S, Smith JE. Nasotracheal tube placement over the fibreoptic laryngoscope. *Anaesthesia* 1996; 51:1026–8.
- Katsnelson et al. *Anesthesiology* 1992; 76:151–2.

A-253

Ventilatory effects of etomidate versus propofol for awake fiberoptic intubation – preliminary results

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Background and Goal of Study: The concept of 'awake' fiberoptic intubation (FI) is heavily influenced by local and personal preferences. The administration of etomidate (E) before advancing the tube is an established method (1) Propofol (P) is also frequently used for 'awake' FI. No data are available comparing induction of 'awake' FI with a single dose of E versus P. The aim of this study was to compare equipotential doses of E and P for 'awake' FI with focus on return of spontaneous ventilation.

Materials and Methods: After ethics approval and informed consent, 39 ASA 1–2 patients (age 15–50) were prospectively randomized to P ($n = 14$) or E ($n = 25$). Analgesia followed a standard procedure: 2 mcg kg^{-1} fentanyl, 0.5 ml cocaine 10% nasally and a transalaryngeal injection of 2 ml lidocaine 1% for topical anaesthesia of the upper airway. After preoxygenation the fiberoptic instrument was positioned into the proximal trachea. A bolus of E (0.2 mg kg^{-1}) or P (2.0 mg kg^{-1}) was administered. The tube was advanced after loss of consciousness. Times to loss of consciousness and return of spontaneous ventilation, defined as the first visible diaphragmatic movement or detection of the first ETCO₂-signal, were measured. Lowest bispectral-index-value (BIS) and time to reach the lowest BIS-value, as a descriptor of onset of drug effect, were recorded (2). We compared data using Mann-Whitney-U-test, $p < 0.05$ was considered significant.

Results and Discussions: Preliminary data (mean \pm SD).

	Etomidate	Propofol	p-value
Time to loss of consciousness (sec)	28 (6)	31 (6)	$p = 0.17$
Time to recovery of spontaneous ventilation (sec)	56 (39)	146 (91)	$p = 0.001$
Lowest BIS-value	49 (18)	45 (10)	$p = 0.58$
Time to lowest BIS-value (sec)	60 (15)	96 (44)	$p = 0.015$

Conclusion(s): Due to earlier return of spontaneous ventilation and faster onset, we recommend E for this technique of 'awake' FI.

References:

- Heidegger T et al. *Anaesthesia* 2003; 58:734–739.
- Minto CF et al. *Anesthesiology* 2003; 99:324–333.

A-254

Backward, upward and rightward pressure on the thyroid cartilage (BURP) improves laryngoscopic view of the glottis

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Background and Goal of Study: Even if a distinction should be made between difficult laryngoscopy and difficult intubation, many studies have shown a great relationship between bad visualization and difficult intubation

(1). In some cases of difficult laryngoscopy, displacement of the larynx by backward, upward and rightward pressure on the thyroid cartilage (BURP) may improve the view of the glottis (2,3). The aim of this study was to evaluate if BURP improved cord's vision in elective surgery.

Patients and Methods: 800 consecutive patients scheduled for general surgery were studied. Direct laryngoscopic visualization of the glottis was first classified from I to IV following Cormack and Lehane's (CL) classification (1) (Level I). If direct view of the glottis was not grade I we applied the BURP manoeuvre and patients were reclassified (Level II). A Wilcoxon signed ranks test was made to compare cord visualization before and after BURP manoeuvre.

Results: BURP manoeuvre after laryngoscopy allowed to reduce Grade III and IV in 70% of the patients and Grade II in 58%, thus increasing the incidence of best cord visualization in 55% of cases ($P < 0.01$).

	CL I	CL II	CL III	CL IV
Level I	416	243	104	37
Level II	657	101	31	11

Conclusions: BURP manoeuvre could be considered a potential simple aid in the management of difficult direct laryngoscopy. In our serie, it improved glottis visualization in 337 out of 800 patients.

References:

- Cormack RS, Lehane J. *Anesthesia* 1984; 39:1105–1111.
- Williams KN, Carli F, Cormack. *BJA* 1991; 66:38–44.
- Knill RL. *Can J Anaesth* 1993; 40:279–282.

A-255

Could Mallampati classification be evaluated in the lying position?

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Background and Goal of Study: Patient's position is important in describing Mallampati's classification (MC) for difficult intubation's prediction and some authors recommended the sitting position for better visualisation of the oropharyngeal area (1,2). Lying position seems worse than the sitting position, but some patients are unable to sit when preoperative evaluation is performed. The aim of the study was to compare both sitting and lying positions in evaluating MC.

Patients and Methods: 800 consecutive patients scheduled for general surgery were preoperatively assessed for MC both in sitting and lying positions. The incidence of difficult intubation (DI) defined as more than two trials by an expert anaesthesiologist was recorded. A Wilcoxon signed ranks test was made to compare MC in the lying and sitting position.

Results: Data (number of patients and %) is shown in the table. No differences were found between both sitting and lying positions in Mallampati's evaluation neither in the rate of DI.

	Patients		DI		% of DI	
	Sitting	Lying	Sitting	Lying	Sitting	Lying
MC I	282	327	6	8	15	20
MC II	343	270	10	9	25	22.5
MC III	135	159	14	14	35	35
MC IV	40	44	10	9	25	22.5
Total	800	800	40	40		

Conclusions: Despite sitting position is recommended for the evaluation of Mallampati's classification, we found the lying position as useful as the sitting position for prediction of DI.

References:

- Lewis M, Keramati S, Benumof JL et al. *Anesthesiology* 1994; 8: 69–75.
- Randell T. *Acta Anaesthesiol Scand* 1996; 40: 1016–1023.
- Samsoon GTL, Young JRB. *Anaesthesia* 1987; 42: 487–490.

A-256

Evaluation of a new cuff pressure release valve

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Background and Goal: Cuff hyperinflation due to N₂O can cause airway lesions, particularly in children (1). Automatic pressure release therefore is desirable. Aim of the present study was to evaluate a new release valve (CPRV; cuff pressure release valve, Imrler, Germany) intended to control pressure in paediatric cuffed tubes.

Methods and Materials: The CPRV consists of a spring-loaded pressure release valve which can be adjusted in steps of 5 cmH₂O from 10 to 25 cmH₂O. *In-vitro:* CPRV was set to 10, 15, 20, or 25 cmH₂O release pressure and connected to a cuffed tube (ID 7.5 mm, Microcuff, Weinheim, Germany) placed into a box flushed with 3 l min⁻¹ of 66% N₂O in O₂. Cuff pressure was monitored using a pressure transducer for 60 min. Experiments were performed four times using two exemplars of CPRV and tracheal tubes. *In-vivo:* With approval of the Hospital Ethics Committee CPRV was studied in 50 children (1–16 yrs.) undergoing general anaesthesia with tracheal intubation of at least 60 min. Anaesthesia technique and respirator settings were standardised including 66% N₂O. Patients were randomised in 2 groups (with and without CPRV). Cuff pressure was set to 20 cmH₂O and CPRV to 25 cmH₂O. Cuff pressure was electronically recorded and if it exceeded 25 cmH₂O it was released to 20 cmH₂O. The number of deflations was recorded. Results from both groups were compared by Mann-Whitney test ($P < 0.05$).

Results and Discussion: *In-vitro:* Cuff pressure exceeded 60 cmH₂O after 60 min without CPRV, but did not exceed settings with CPRV. *In-vivo:* There were no differences between groups in patient characteristics. There was no need for deflating the cuff in the CPRV group, but in every patient of the control group ($P < 0.0001$).

Conclusion: The CPRV allows reliable cuff pressure release at various pressure levels as required and reliably prevented cuff pressure increases caused by N₂O. CPRV provides a safety tool in addition to continuous cuff pressure monitoring which is mandatory when N₂O is used.

Reference:

1 Felten et al. *Anesth Analg* 2003; 97: 1612.

A-257

Insertion time and ease of insertion of the laryngeal tube and the laryngeal mask airway: a comparison

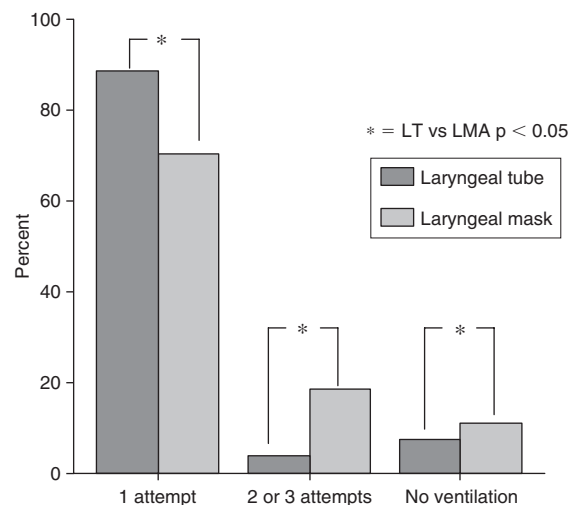
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Goal of Study: We compared the classical laryngeal mask airway (LMA, Intavent, UK) and the new laryngeal tube (LT, VBM, Germany) with respect to ease of insertion and time to achieve sufficient ventilation in a standardised clinical setting.

Methods: With institutional review board approval and written informed consent 107 patients scheduled for minor elective surgery were randomly allocated to receive either a LMA or the LT. Anaesthesia was induced and maintained with remifentanyl and propofol. No neuromuscular blocker was given. After completion of induction, loss of eyelash reflex and jaw relaxation, insertion of the LT or LMA was done as recommended by the manufacturer. 3 attempts for insertion of the airway device were allowed. The time between removal of the facemask for manual ventilation and sufficient ventilation either through LT or LMA was recorded. Ease of insertion was graded as easy (1 attempt), difficult (2 or 3 attempts) or impossible. Statistics: Mann-Whitney-U-test, data are mean \pm SD.

Results: The time for insertion was significantly shorter for the LT compared to the LMA (35.4 \pm 15.6 sec versus 54.0 \pm 41.5 sec, $p < 0.05$). Ease of insertion was significantly better with the LT compared with the LMA (easy 88.7% (LT) versus 70.4% (LMA), difficult 3.8% (LT) versus 18.5%, impossible 7.5% (LT) versus 11.1% respectively, $p < 0.05$).



Conclusion: Concerning rapidity and ease of insertion the new laryngeal tube is superior to the classic laryngeal mask airway.

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A comparison of the Laryngeal Mask ProSeal and the Combitube during routine surgical procedures

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Background and Goal of Study: For the management of the difficult airway several devices are available [1]. For the routine use in clinical practice, the device should have a high success rate and also an untrained user should become familiar with it after a short training period. In the present study we investigated whether the usage of the Laryngeal Mask ProSeal (LMPS) and the Combitube (CT) yield comparable results during routine surgical procedures.

Materials and Methods: After IRB approval and written informed consent, 61 ASA class I and II women scheduled for minor obstetric surgery were randomly allocated to the LMPS ($n = 30$) or CT ($n = 31$) group, respectively. Induction of anaesthesia was performed standardized with 2 mg kg⁻¹ propofol and 0.3 μ g kg⁻¹ sufentanil. Muscle relaxation was achieved with 0.6 mg kg⁻¹ rocuronium. Overall success rate, time required for the first adequate ventilation ($V_t > 500$ ml), cuff pressure and resulting leak pressure as well as the incidence of sore throat and hoarseness were determined. Data were analysed with Mann-Whitney U-Test and Fisher's Exact Test.

Results and Discussions: There were no significant differences between groups with regard to demographic data. The time required for the first adequate ventilation was significantly ($p < 0.001$) shorter in the LMPS (range 10–161 s, median 29 s; success rate 100%) compared to the CT group (35–183 s, 74 s; 90%). Cuff pressure was remarkably higher in the CT group (LMPS range 8–120 cm H₂O, median 60 cm H₂O; CT 160–250 cm H₂O, 237 cm H₂O), while leak pressure was comparable in both groups. Patients in the LMPS group complained significantly less about sore throat postoperatively ($p < 0.001$).

Conclusion(s): The results of our study suggest that the laryngeal mask ProSeal may be advantageous compared with the Combitube with respect to the time required for insertion of the device and patient comfort. The high cuff pressures in the CT group may be harmful for the oropharyngeal mucosa if applied for a longer period of time.

Reference:

1 *Ann Emerg Med* 1999; 33: 694–98.

A-260

Has the practice of airway management changed over the past decade?

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Background and Goal of Study: The modification of guidelines for management of the difficult airway and the introduction of new interventions mediate the re-evaluation of the current trends in the practice of airway management.

Materials and Methods: Following Ethics approval, information regarding preoperative evaluation and airway management was collected. Airway management, outcomes, and prediction of difficulties were compared in 530 patients undergoing surgery at Memorial Hermann Hospital during the years of 1999–2001 (Period 2). This sample was compared to a larger retrospective study that was conducted during the years of 1991–93 (Period 1) by the University of Toronto (1). Alternative techniques for intubation, including all methods other than direct laryngoscopy under general anesthesia (DL/GA), are noted below.

Results and Discussions: Data are shown in the table:

	Period 1	Period 2
Total (n)	22,542	530
DL/GA	80.1%	82.8%
Alternative technique	1.5%	0.8%
Regular mask	14.9%	4.3% [†]
LMA	2.8%	12.1% [†]
Other supraglottic devices	–	0.8%
Total \geq 3 laryngoscopies	1.4%	0.6%
Fiberoptic assist	0.1%	1.3%
Intubating stylets	0.03%	6.8% [†]
Predicted difficult airway	–	11.1%

[†] $p < 0.01$.

Conclusion(s): There was a significant decrease in the use of traditional mask ventilation correlating with a significant increase in the use of the laryngeal mask airway (LMA) ventilation. Furthermore, the use of airway adjunct devices (i.e. fiberoptic and intubating stylets) have become more extensively utilized. This data represents a preliminary analysis of an ongoing study. Continuation of this study is warranted in order to determine whether or not the practice of airway management is actually changing.

Reference:

1 Rose DK, Cohen MM. *Can J Anesth* 1997;44:A51.

A-261

Comparing Combitube, EasyTube and LTS to ventilation with tracheal tube in a bench model

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Background and Goal of Study: The oesophageal-tracheal Combitube (Kendall), the Easytube (Ruesch) and the Laryngeal Tube Suction LTS (VBM) are three similar looking airway devices with a large proximal (pharyngeal) cuff and a smaller distal cuff. The single use Combitube and EasyTube allow ventilation in oesophageal and tracheal position, the tip of the reusable LTS has to be placed in the oesophageal inlet. Ventilation with the three devices is compared with tracheal tube ventilation in a bench model.

Materials and Methods: 3-minute ventilation cycles (10 per device, total 60 cycles) were performed with tracheal tube (7.5), Combitube (37 Fr., tracheal and oesophageal position), Easytube (41 Fr., tracheal and oesophageal position) and LTS (#4) in a bench model consisting of a Ambu Megacode Station connected to a PC (Megacode software 2.23). Standardised ventilation (intermittent positive pressure ventilation, respiratory rate 12 per minute, tidal volume 750 ml) was performed with a Draeger Oxylog 3000 (Draeger medical). Cuff pressures were adjusted to 80 cmH₂O. Tidal volumes and peak airway pressures were measured. The t-test was used for statistical analysis of the data.

Results and Discussions: No gastric insufflation of air could be detected with any device. Tidal volumes (mean \pm SD) and peak airway pressures for the airway devices were 730 \pm 7 ml and 15.8 cmH₂O for tracheal tube, 733 \pm 6 (+0.4%) and 16.7*cmH₂O for Combitube in oesophageal position, 708* \pm 3 (-3.0%) and 17.6*cmH₂O for Combitube in tracheal position, 733 \pm 3 (+0.4%) and 17.0*cmH₂O for Easytube in oesophageal position, 742* \pm 2 (+1.6%) and 16.8*cmH₂O for Easytube in tracheal position, and 716* \pm 6 (-1.9%) and 15.0*cmH₂O for LTS (* = p < 0.01 compared to ventilation with tracheal tube).

Conclusion(s): In the bench model chosen, only small differences of tidal volumes are found for ventilation with Combitube, Easytube and LTS compared to ventilation with a tracheal tube. While some differences are significant, they may be of little clinical relevance considering the maximal deviation of 3%. Differences for ventilation in oesophageal and tracheal position may be caused by the variation of tube diameters.

Acknowledgements: Airway devices were provided by the respective manufacturers.

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LMA-Unique, SoftSeal, LTD and LaryVent: bench model comparison of 4 single-use supraglottic airway devices to facemask ventilation

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Background and Goal of Study: Different supraglottic single-use airway devices have been introduced in recent years for ventilation during elective surgical procedures. Main argument to refrain from using reusable devices is the possible transmission of infections via improperly sterilized masks and tubes (1,2). In a bench model, ventilation with LMA-Unique (LMA Company), SoftSeal (Smiths), LTD (VBM Medical) and LaryVent (B + P) is compared to facemask ventilation.

Materials and Methods: For all devices, standardised 3-minute ventilation cycles (IPPV, tidal volume 750 ml, respiratory rate 12/min) were performed with a Draeger Oxylog 3000 (Draeger medical). In a bench model consisting of a Ambu Megacode Station connected to a PC (Megacode software 2.23), 10 cycles each were performed with facemask, LMA-Unique, SoftSeal, LTD (all size 4) and LaryVent (size 9.0). Tidal volumes and peak airway pressures were measured with cuff pressures adjusted to 80 cm H₂O. Data were compared using the t-test.

Results and Discussions: Ventilation was possible with all airway devices without signs of gastric insufflation.

	Tidal volume	Peak airway pressure
Facemask	588 \pm 22 ml	13.4 cmH ₂ O
LMA-Unique	567* \pm 7 ml	12.9*cmH ₂ O
SoftSeal	649* \pm 4 ml	15.8*cmH ₂ O
LTD	725* \pm 3 ml	15.9*cmH ₂ O
LaryVent	672* \pm 22 ml	15.2*cmH ₂ O

Data are mean \pm SD (tidal volume) or mean (peak airway pressure); * = p < 0.01 when compared with facemask.

Difference of tidal volume compared to facemask ventilation was -3.6% for LMA-Unique, +10.4% for SoftSeal, +23.3% for LTD and +14.3% for LaryVent with the above settings.

Conclusion(s): All devices tested allow sufficient ventilation in the bench model chosen. Differences to the tidal volume set in the respirator and to the tidal volume reached with facemask ventilation vary, hinting at differences in the quality of airway seal with the single-use airway devices. Evaluation in clinical studies is warranted.

References:

1 Miller DM, *Anaesthesia* 2001;56:1069-1072.
2 Clerly G, *Anesth Analg* 2003;97:1189-1191.

Acknowledgements: Airway devices were provided by the respective manufacturers.

A-263

Upper airway management after cervical spine surgery

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Background and Goal of Study: Surgery for cervical spine is advisable in myelopathy associated by spondylosis and spinal hernia cases. Upper airway obstruction after surgery could lead different complications, such as hypoxia, neurological deficits and extreme bradycardia and patient's death (1) as a result of postoperative haematoma compressing soft tissues. The purpose of this study was to identify risk factors associated with airway obstruction following cervical spine surgery and to analyze the management of those patients.

Materials and Methods: A retrospective study was carried out in Vall d'Hebron Medical Center between January 1992 and December 2002, which included 766 patients (age range: 20-65 years old) with cervical spine surgery who presented airway obstruction and required reintubation or urgent tracheostomy.

Results and Discussions: Among the patients operated, 8 showed signs of upper airway obstruction due to haematoma. In all them, the pathology was degenerative. Time between airway obstruction signs and reintubation ranged 1-8 hours. Laryngoscopy showed to be a more efficient method for urgent reintubation than bronchoscopy. All the patients needed an urgent intervention for the compressing haematoma. There were no neurological sequelae. Airway obstruction was unrelated with patient age, myelopathy severity and ASA. As others studies also have demonstrated (2), there is a relationship between the surgeon experience, surgical time, blood pre- and postoperative losses, multilevel cervical procedures, and specially, corpectomy.

Conclusion(s): The comparison between pre- and postoperative lateral cervical RX prior extubation shows the cervical soft tissue dilatation due to haematoma (distance plate of arthrodesis/thyroid). In patients with multilevel cervical corpectomy, it is necessary to carry out laryngoscopy prior extubation, to evaluate upper airway obstruction, and requires patient intubation at least 24 hours post-surgery.

References:

1 Epstein NE et al. *J. Neurosurgery* 2001;94:185-8.
2 Sagi HC et al. *Spine* 2002;27(9):949-53.

A-264

Incidence of airway compromise in cardiac patients undergoing conscious sedation for implantable cardioverter defibrillator placement

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Background and Goal of Study: Implantable cardioverter-defibrillator (ICD) therapy is effective in primary and secondary prevention of sudden death in high-risk cardiac patients. Conscious sedation is being employed more frequently as the choice of anesthesia in patients undergoing ICD placement. However, the incidence of airway compromise in the forms of airway obstruction and apnea in these patients undergoing conscious sedation has not been studied systematically.

Materials and Methods: Institutional approved, prospective, observational trial. Patients (N = 17) with ASA Classification III (N = 9) and IV (N = 8) scheduled for prepectoral subfascial ICD placement were enrolled. Primary diagnoses included history of aborted sudden cardiac arrest, dilated cardiomyopathy, ischemic cardiomyopathy, heart failure, ventricular tachyarrhythmias, and coronary artery disease. All patients received local anesthesia and intravenous anesthesia including propofol, midazolam, and fentanyl. Monitoring of respiration was achieved by Microstream® capnometer and impedance respiratory plethysmography monitor.

Results and Discussions: Of the seventeen patients undergoing ICD placement (duration 1.67 ± 0.43 h [mean \pm SD]), 14 patients developed airway obstruction, 4 patients had apnea, and 2 patients did not have any evidence of respiratory compromise. Incidence of airway obstruction (total 32 periods) was higher than apnea (total 7 periods, $P < 0.05$). A total of 4 periods of arterial oxygen saturation (SpO_2) $< 90\%$ were seen. SpO_2 was significantly lower during periods of airway obstruction ($96.5 \pm 3.7\%$) and apnea ($95.6 \pm 4.0\%$) compared with normal breathing ($98.4 \pm 1.6\%$, $P < 0.05$). Early interventions including verbal stimulation, chin-lift and jaw-thrust maneuvers were effective in resolving all airway obstruction and apnea events.

Conclusion(s): In high-risk cardiac patients undergoing conscious sedation for ICD placement, airway obstruction occurred more frequently than apnea. Early detection and interventions can minimize any significant hypoxemia.

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Insertion of the classic Laryngeal Mask Airway by an Operating Department Practitioner with jaw thrust by anaesthetist

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Background and Goals: There are variety methods of insertion of Laryngeal Mask Airway (LMA) (1). We investigated a new way: insertion by an Operating Department Practitioner (ODP) with the jaw thrust by an anaesthetist.

Materials and Methods: All patients were given propofol 2.5–3 mg/kg and fentanyl 100 mcg and then ventilated with mask under Sevoflurane 8% with oxygen. When the patient's mouth become relax to be opened (30–45 seconds), anaesthetist provided the jaw thrust with both hands and ODP inserted LMA conforming the tip of LMA was pushed against the hard palate. Smooth chest movement was defined as successful insertion. The number of attempts and seal pressure (at which air leak is detected around the neck) were measured. The incidence of blood on LMA, sore throat and other complications were measured.

Results:

Table 1. Patient characteristics (n = 70) and insertion.

Age (yr) median (range)	49.4 (16–79)
BMI (kg/m) median (SD)	24.1 (4.9)
ASA I,II :n	54, 16
Mallampati class I,II :n	57, 13
Thyromental distance > 6.5 cm :n	65 (93%)
Mouth opening > 3 fingers :n	63 (90%)
Attempts 1, 2, > 2 :n	63, 5, 2
Fail: Anaesthetist took over :n	3 (0.04%)
Seal pressure (mmHg) :median (SD)	24.5 (5.1)
Tint of blood, clear blood on removed LMA :n	13, 2
Sore throat, laryngospasm, aspiration :n	2, 1, 0

The table shows high success insertion rate and, proper sealing pressure with low complications (2).

Conclusion: Insertion of LMA by ODA assisted by anaesthetist's jaw thrust provides successful method.

References:

- 1 Brimacombe & Brain. *The laryngeal mask* 1996.
- 2 Cook TM. *BJA* 2003;91:672–677.

A-266

Intracuff pressures after following the manufacturers instructions: a comparison between the laryngeal tube and the laryngeal mask airway

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Background and Goal of Study: Pharyngeal airway devices can exceed mucosal pressures greater than those considered safe for the pharyngeal mucosa [1]. We compared the intracuff pressures from either the laryngeal

tube (LT, VBM, Germany) and the classical laryngeal mask airway (LMA, Intavent, UK) after inflating the cuffs as recommended by the manufacturer.

Methods: With institutional review board approval and written informed consent 86 patients scheduled for minor elective surgery were randomly allocated to receive either a LMA or the LT. Anaesthesia was induced and maintained with remifentanyl and propofol. No neuromuscular blocker was given. The appropriate sizes of LT or LMA were chosen according to the manufacturers recommendations and after insertion the cuffs were inflated with air according to the manufacturers instructions (LT size 4 80 ml, LT size 5 90 ml, LMA size 3 20 ml, LMA size 4 30 ml, LMA size 5 40 ml). Cuff pressures were measured with a manometer and adjusted to an intracuff pressure of 60 cmH₂O, since this intra-cuff pressure was the pressure recommended by the manufacturer of each device. Statistics: Mann-Whitney-U-test, data are mean \pm SD.

Results: 47 patients received a LT (34 size 4, 13 size 5) and 39 patients received a LMA (1 size 3, 19 size 4, 18 size 5). The initial intracuff pressure was significantly higher using the LMA (107.8 ± 28.1 cmH₂O) compared with the LT (75.3 ± 15.9 cmH₂O) ($p < 0.001$).

Conclusion: Intracuff pressure after inflating the airway devices according to the manufacturers instructions often exceed 60 cmH₂O. Since high intracuff pressures may impair pharyngeal mucosal perfusion intracuff pressure should be always measured and adjusted to 60 cmH₂O if necessary what is the intracuff pressure that is recommended by the manufacturer of each device.

Reference:

Brimacombe J et al *Anesthesiology* 1999;91:1661–5.

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Submental Intubation with reinforced tube for intubating Laryngeal Mask Airway (LMA-Fastrach™ETT)

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Background and Goal of Study: In patients suffering from maxillofacial trauma, it is important to keep the airway secured and not interfering with the surgical intraoral manipulation and internal fixation. Submental endotracheal intubation, which was first described by Altermir in 1986, is pertinent to the airway management of patients suffering from maxillofacial trauma (1). It was suggested that the LMA-Fastrach™ETT could be useful intubating devices for submental intubation. This paper describes the experiences of using the LMA-Fastrach™ETT in submental endotracheal intubations for patients undergoing maxillofacial surgery.

Case 1: A 16-year-old male was scheduled for an open reduction and internal fixation of the panfacial fracture, consisting of a naso-orbital-ethmoidal (NOE) complex. After LMA-Fastrach™ETT was placed submentally in trachea, a bilateral auscultation and proper capnography confirmed the tube was in the correct position. Then it was reconnected to the tube connector and an anesthesia machine. The operation proceeded without any problem.

Case 2: A 19-yr-old male was scheduled for an open reduction and an internal fixation of a midfacial fracture, consisting of a NOE complex, via the bicoronal and transoral approach. After inducing anesthesia, an orotracheal intubation was performed successfully using the LMA-Fastrach™ETT. After confirming the correct position, the orotracheal intubation was converted into submental intubation. (Figure 1, 2) The operation finished without any complication related to airway management.

Conclusion(s): Submental intubation is a simple and less complicated. It does not interfere with the surgical field and procedure. It is believed that the appropriate device for a submental intubation must have a freely detachable connector and should be sufficiently flexible or angulated to retain patency despite the acute angle of the airway, particularly at the submental route (2). LMA-Fastrach™ETT does meet the needs for submental intubation in this kind of operation.

References:

- 1 Altermir FH. *J Maxillofac Surg* 1986; 14: 64–5.
- 2 Drolet P, Girard M, Poirier J, Grenier Y. *Anesth Analg* 2000; 90: 222–3.

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Percutaneous Dilation Tracheostomy (PDT) used for training in airway management for trainees in anaesthesiology

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Background and Goal: In the ICU of Hvidovre University Hospital we have used the PDT-technic since 1996. It is a general 6-bed intensive ward. In the

latest years PDT has increasingly been performed by a young anaesthesiologist supervised by a senior anaesthesiologist specialized in intensive care. The present study aims to evaluate if the rate of complications has increased with this policy.

Materials and Methods: This is a retrospective study of the clinical histories ICU patients undergoing PDT from January 1999 till September 2003 at Hvidovre University Hospital. They were found by extracting the computerized dismissal notes containing the code for tracheostomy. The clinical histories were evaluated for any complications and if the PDT were performed by an anaesthesiologist subspecialized in intensive care or not.

Results and Discussion:

Year	Specialist		Non-specialist	
	No. of PDT	No. of complication	No. of PDT	No. of complication
1999	7	1	5	0
2000	14	5	17	1
2001	9	1	8	0
2002	2	0	15	1
2003	3	0	13	0

Although the numbers are small, there is no sign of increasing complications with young anaesthesiologists performing PDT.

Conclusion: It is safe to use supervised PDT as training in airway management for young doctors to become anaesthesiologists.

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Does the experience of the anaesthetist influence tracheal tube cuff pressure?

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Background and Goal of Study: The tracheal tube cuff (TTC) protects the airway from acid gastric aspiration and prevents air leaks. A manual check of TTC pressure at the pilot balloon may be misleading¹. Over- or under-inflation can cause intraoperative problems: tracheal mucosa ischaemia, sore throat, rupture of the cuff or extubation. The aim of this study was to find out if an anaesthetist's degree of experience influences the tracheal tube cuff pressure.

Materials and Methods: TTC pressure was measured in 121 patients undergoing general anaesthesia for gynaecological or abdominal surgery. Tracheal tubes of low pressure high volume cuffs were used in all patients. The cuffs were filled with air by either a junior (group I, ≤ 4 years' experience) or a senior anaesthetist (group II, > 4 years' experience) and a blind observer measured the pressure with a Portex[®] manometer during first ten minutes after tracheal intubation. The recommended pressure range was 1.8–2.4 kPa². If the TTC pressure was out of range, it was adjusted to the right values. The results were analyzed according to the anaesthetists' experience. Differences were assessed with t-test and χ^2 tests.

Results and Discussion: Mean (SD) pressures are shown in the table.

Group	TTC pressure	Low pressure	Normal pressure	High pressure
I (N = 68)	2.87 (1.2) Kpa	N = 15 75.0%	N = 12 66.7%	N = 41 49.4%
II (N = 53)	4.01 (1.8) Kpa*	N = 5 25.0%	N = 6 33.3%	N = 42 50.6%

* $p = 0.002$.

Conclusions: (1) The experience of anaesthetist does not influence the establishment of correct tracheal tube cuff pressure. (2) Senior anaesthetists tend to over-inflate the TT cuff.

References:

- 1 Wujtewicz MA, Sawicka W, Bukowska A et al. *Eur J Anaesthesiol* 2003;20, Supl30:A252.
- 2 Vyas D, Inweregbu, Pittard A. *Anaesthesia* 2002;57:275–277.

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Comparison of LMA-Unique and SoftSeal for ventilation in patients undergoing short gynaecological interventions

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Background and Goal of Study: LMA-Unique (LMU, LMA Company) and SoftSeal (SS, Portex) are two single-use laryngeal mask airways that can be used for ventilation during elective interventions. The two devices are compared for ease of insertion and quality of airway seal in a prospective clinical trial.

Materials and Methods: After obtaining approval of the local ethics committee and patient consent, 30 women scheduled for elective short gynaecologic interventions, were randomized to be ventilated with either LMU or SS. After induction of general anaesthesia with fentanyl and propofol, airway devices were placed according to manufacturer's instructions. Number of attempts (maximum 2), insertion time, time until first tidal volume and intraoperative tidal volumes with an etCO_2 of 35 mmHg were recorded. Airway leak pressure was measured with cuff pressures set to 60 cmH₂O. After removal, devices were inspected for traces of blood and patients were questioned for hoarseness or soar throat.

Results and Discussions: 15 women were ventilated with LMU and 15 with SS. Demographic data as well as baseline heart rate, blood pressure and peripheral oxygen saturation were comparable for both groups, mean age was 33.7 (± 12) years for LMU and 41.1 (± 18) years for SS. Insertion was successful in all patients, a second attempt was necessary in 2 patients with LMU and 1 patient with SS. Insertion time and time until first tidal volume were 15.4 (± 5.7)/17.2 (± 13.1) and 21.8 (± 8.5)/27.1 (± 13.4) seconds for LMU/SS. Peak airway pressures were 16.0 and 17.1 cmH₂O with tidal volumes of 8.9 and 8.0 ml/kg for LMU and SS. Airway leak pressure with SS was higher than with LMU: 23.6 (± 4.4) vs. 20.9 (± 2.0) cmH₂O ($p = 0.025$). Anaesthesia time was 36.1 min for LMU and 41.7 min for SS. Traces of blood after removal were found in 1 SoftSeal patient. Mild complaints (2 on a ten point VAS scale) of trouble swallowing were stated in the recovery room and after 24 hours by one patient in the LMU group.

Conclusion(s): Both laryngeal mask airways allow sufficient ventilation in the patients studied. The airway leak pressure, serving as an estimate to judge quality of airway seal, is higher with the SoftSeal laryngeal mask.

Acknowledgements: LMA-Unique was provided by LMA Company and SoftSeal by Portex.

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Unexpected difficult intubation: four years of a systematic data collection

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Background and Goal of Study: Unexpected difficult intubation (UDI) is a risky situation in anaesthesia. In our department, we keep this event under systematic observation. The purpose of this study is to assess the incidence of UDI and to establish whether these difficult intubations (DI) were really unpredictable.

Materials and Methods: Since 01/1999, every anaesthesia has been described with the patient features, the anaesthetic technique and the occurrence of events (out of a list of 58), using a preformatted sheet, then recorded in a database. The exhaustiveness of the anaesthetic activity capture has been checked. DI is defined as a non achieved intubation after a 10 minute delay or 2 attempts by a senior anaesthesiologist without any special technique. The anaesthesia files of the declared cases have been analyzed by 2 independent people to precise the quality of the record filling regarding to the UDI risk for which our anaesthesia records comprise a checklist with 6 items, an intermediate conclusion to fill and a final abstract to write out. For coherent calculations, only general anaesthesia (GA) procedures with aimed intubation were analyzed.

Results and Discussions: 40 UDI have been identified out of 12217 procedures (incidence = 0,33%). 20% occurred in emergency. The trachea was successfully intubated in 90% of the cases, using a stylet half of the times, the other techniques being a fiberoptic or a trachlicht. For the rest of the patients (10%) a laryngeal mask (LMA) or a LMA-fastrach have been used. Surgery was never postponed. Only 3 patients had a SpO₂ below 95%. In 30% of the records, one or several predictive factors had been identified (sleep apnea syndrome: 1, Mallampati class III: 3, limited head extension: 7, short thyromental distance: 3). The checklist about intubation conditions was incomplete in 1 third of the cases. The final abstract mentioned the possibility of a DI in 4 cases. The causes that promote this insufficient taking into account are the record lack of legibility and above all, incomplete conclusions in the final abstract. The UDI incidence found in this study is close to those of the literature.

Conclusion: To lower the UDI risk, we must take into account more effectively the possible DI that are detected at the time of the preoperative assessment of the patient. We probably have to format more explicitly the conclusions of the anaesthesia consult.

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Proseal Laryngeal mask airway or Classic Laryngeal mask airway in spontaneous ventilation?

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Background and Goal of Study: The Proseal Laryngeal mask airway (PLM) is a new device with a modified cuff to improve the seal and a drainage tube to prevent aspiration. We compared both LMA devices in terms of ease of insertion, ventilation quality, airway seal efficacy and postoperative complication (sore throat).

Materials and Methods: 40 female patients ASA I–II undergoing elective breast surgery were randomly allocated in two groups (PLM group: $n = 20$, CLM group: $n = 20$). Anaesthesia was induced with propofol 2 mg kg^{-1} and fentanyl $1 \mu\text{g kg}^{-1}$. After the insertion of the LMA device the ventilation was manually assisted until the patients started breathing spontaneously. Anaesthesia was maintained with Sevoflurane 0.6–1.8 Vol%, a mixture of N_2O 70% in O_2 . The PLM was inserted without the aid of the introducer. Depth of anaesthesia was assessed with BIS; BIS was 50–60 during the insertion of both LMA devices and 80 the time of awaking. Number of attempts at insertion and success rate, adequacy of ventilation, tidal volume expiratory (TV_{EXP} : ml), peak airway pressure (P_{PEAK} : cmH_2O), seal pressure at $60 \text{ cmH}_2\text{O}$ intracuff pressure and postoperative complication (sore throat) were recorded. Statistical comparisons were performed by Unpaired t-test (Un. t-test) and Fisher's exact test as appropriate (statistical significance when $P < 0.05$).

Results: The groups were similar according to age, body mass index and the duration of surgical procedure. The table shows success and complication rate of PLM and CLM, as well as mean values \pm standard deviations.

	PLM	CLM	P
Success rate 1st/2nd attempt	17/3	20/0	NSS [§]
TV_{EXP}	400.25 ± 95.3	340 ± 88.3	0.043*
P_{PEAK}	11.9 ± 3.85	8.6 ± 3.33	0.006*
Seal pressure	30.5 ± 10.6	19.5 ± 2.95	$<0.002^*$
Sore throat: No/Yes	16/4 (20%)	19/1 (5%)	NSS [§]

[§]Fisher test; *Un. t-test; NSS[§] non statistical significance.

Conclusions: The PLM appears to be superior as a ventilatory device and provides higher seal pressure for spontaneously ventilation; BIS monitoring seems to contribute in quality of ventilation, quiet awaking and low incidence of sore throat for both LMA devices.

Reference:

1 Cook, T.M. et al. *Br. J. Anaesthesia* 2003; 88(4): 527–33.

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Pressure Support Ventilation versus Pressure Controlled Ventilation with the proseal laryngeal mask airway: a randomised comparative and prospective study of anesthetized adult patients

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Background and Goal of Study: During general anesthesia, Pressure Support Ventilation (PSV) could be an alternativesssss to conventional modes of mechanical ventilation. This ventilatory mode is not very used in operating theaters. Its advantages must be defined.

Materials and Methods: After ethical committee approval and informed consent, 30 patients scheduled for orthopedic surgery were included. Peripheral nerve block (PNB) and general anesthesia (GA) were used. GA was induced with sevoflurane (8%) during spontaneous breathing (SB) and sufentanyl ($10 \mu\text{g}$) and the proseal LMA was inserted. GA was maintained with sevoflurane expiratory fractions allowing BIS scores between 50 and 55 in $\text{O}_2/\text{N}_2\text{O}$ 50%. Patients were randomly allocated into 2 groups according to the perioperative ventilatory mode (Felix™, Taema, France): PSV ($n = 15$, inspiratory trigger = 0.1, expiratory trigger = 3 l/min, T_i max = 1.3 sec, minimal RR = 5/min) or CPV ($n = 15$, RR = 12/min, I/E = 1/2). PSV or CPV pressure levels were adapted to maintain a V_t at 6–8 ml/kg and EtCO_2 at 30–35 mm Hg. Inspiratory pressures, RR, V_t , VE, sevoflurane IF and EF, T_i/T_{tot} , EtCO_2 , BIS values, HR and BP at 1, 5 and 10 min, and then every 10 min were noted. At the end of the surgical procedure, sevoflurane was stopped and the patient was turned to an open circuit at FiO_2 1. We measured times to obtain SB, eyes opening (EO) and proseal removal by the patient himself.

Results and Discussions: There was no significant difference between both groups for patients characteristics, surgery durations, T_i/T_{tot} , VE, Inspiratory Pressure and BIS values. PetCO_2 values were significantly increased in PSV group for every times but stayed between 30 and 35 mm Hg in both group. The sevoflurane IF (at 10, 40 and 50 min) and EF (for every times) were significantly decreased in PSV group versus CPV ($p < 0.05$). Median values of time to obtain SB (50 vs 170 sec, $p < 0.001$, EO (4 min 15 vs 7 min 30, $p < 0.001$) and proseal removal (4 min 50 vs 7 min 50, $p < 0.001$) were significantly decreased in PSV group.

Conclusion(s): PSV can be used in operative rooms when PNB was associated to GA and leads to a faster recovery. This ventilatory mode allows a decrease in the sevoflurane EF and IF during GA for the same BIS level.

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Incidence of airway compromise in morbidly obese patients recovering from general anesthesia after laparoscopic gastric bypass surgery

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Background and Goal of Study: Morbidly obese patients especially those with obstructive sleep apnea (OSA) are at risk for respiratory events after general anesthesia. The incidence of airway obstruction and apnea immediately following surgery in the post-anesthesia care unit (PACU) has not been elucidated.

Materials and Methods: Patients ($N = 17$) with ASA Classification II ($N = 8$) and III ($N = 9$) scheduled for laparoscopic gastric bypass surgery were enrolled. Of the seven patients with OSA, 5 required continuous positive airway pressure (CPAP) at home. All patients received both inhalational and intravenous anesthesia. Monitoring of respiration in the PACU was achieved by Microstream® capnometer and impedance respiratory plethysmography monitor.

Results and Discussions: Of the seventeen patients monitored in the PACU (duration $1.17 \pm 0.16 \text{ h}$ [means \pm SD]), 4 patients had airway obstruction, 2 patients had apnea, and 12 patients did not have any evidence of respiratory compromise. A total of 8 periods of arterial oxygen saturation (SpO_2) $>90\%$ and $<95\%$ were seen in 3 patients. SpO_2 was not significantly different during periods of airway obstruction ($99.5 \pm 1.0\%$) and apnea ($98.5 \pm 2.1\%$) compared with normal breathing ($98.1 \pm 1.8\%$, $P > 0.05$). Impedance respiratory plethysmography falsely identified 14 episodes of apnea. Early intervention with verbal stimulation was sufficient in resolving all airway obstruction and apnea events. None of the patients on home CPAP required its use in the PACU.

Conclusion(s): Airway obstruction and apnea are infrequent in morbidly obese patients recovering from general anesthesia in the PACU, early detection and interventions can minimize any significant hypoxemia. Impedance respiratory plethysmography had a high rate of false apnea detection while capnography did not.

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Management of unexpected impossible tracheal intubation in Greece – A national survey

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Goal of Study: To record anaesthesiologists' management of unexpected impossible tracheal intubation (TI) by conventional laryngoscopy, in Greece.

Materials and Methods: A questionnaire was mailed to almost all specialist anaesthesiologists in Greece, in March 2001. Questions dealt with anaesthesiologists' demographics and the management of unexpected impossible TI with the use of conventional (Macintosh) laryngoscope. They were asked to choose from predefined answers concerning ventilation techniques they apply and alternative methods of TI they use, based on previous experience. They were also asked whether they opt for regional anaesthesia (RA) when applicable, if patient has to be awakened. Responses were received anonymously in pre-paid self-addressed envelopes.

Results and Discussions: The response rate was 360/849 (42%). 167 (46%) of the respondents achieve ventilation of the lungs via laryngeal mask (LM), 79 (22%) with intubating laryngeal mask (ILM), 64 (18%) with face mask (FM), 36 (10%) with cuffed oropharyngeal airway (COPA) and 14 (4%) with combitube (CT). Alternative TI is attempted with the use of flexible fiberoptic (FF) from 125 (35%) of the respondents, other rigid laryngoscopes from 80 (22%), ILM from 79 (22%) and tracheostomy (TS) from 51 (14%).

184 (51%) of the respondents will cancel cases where RA can be applied, when TI attempts have to be abandoned. Table summarises responders' choices that associate significantly with the duration of their clinical practice.

	Years of clinical practice				P-value*
	0–5 (45)	6–10 (81)	11–15 (76)	>15 (158)	
LMS	37 (82)	67 (83)	51 (67)	91 (58)	0.0001
FM	4 (9)	8 (10)	17 (22)	35 (22)	0.03
COPA	3 (7)	5 (6)	6 (8)	22 (14)	0.04
CT	1 (2)	1 (1)	2 (3)	10 (6)	0.04
TS	3 (7)	7 (9)	7 (9)	34 (21)	0.005

(): %, LMs: LM or ILM; *chi-square test.

Conclusions: Newer anaesthesiologists opt for LMs and are clearly less inclined for TS. Contrary, the usage of FM, COPA and CT increases with seniority. Moreover, familiarity with FF and the option to use RA is low irrespectively of respondents' years of practice.

A-276

Difficult airway and risk factors assessment. Correlation of Mallampati score to difficult endotracheal intubation

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Background and Goals: Difficult airway management is often responsible for respiratory-related adverse outcomes in anesthesia. There has been a heightened awareness and an increase in the amount of literature being published on the recognition and prediction of the difficult airway (1). During the preoperative evaluation of the airway, a thorough history and physical, specifically related to the airway, as well as various measurements of anatomic features and noninvasive clinical tests can be performed to enhance this assessment. The aim of this study was to correlate primarily the Mallampati modified score and other indexes with laryngoscopic view in order to show a relationship to the difficult airway.

Material and Methods: 1956 patients scheduled to receive general anesthesia requiring endotracheal intubation for elective surgery. The study was permitted by the Institutional Human Investigation Committee. Prior to surgery, each patient received a clinical physical evaluation with an emphasis on anatomical features of the mouth, face and neck that are known to affect both bag mask ventilation (BMV) and endotracheal intubation. Intraoperative assessment consisted of the Cormack Lehane (C-L) and a subjective operator endotracheal intubation difficulty scale (OIDS) scoring. Both of these scores were compared to airway characteristics noted in the preoperative evaluation. A linear correlation index (LCI) was calculated for Mallampati versus C-L as well as OIDS score.

Results: Mallampati vs. C-L LCI was 0.91. A Mallampati 3 correlated to C-L Grade 2 (0.94), whereas a Mallampati 4 mostly correlated to C-L Grade 3 (0.85) and a C-L Grade 4 (0.80). OIDS compared to C-L showed a LCI of 0.96.

Conclusions: There was no correlation between difficult mask ventilation and difficult intubation or difficult laryngoscopy and anatomical risk factors in this study. Although there is a correlation between oropharyngeal volume and difficult intubation, the Mallampati score, by itself, is not sufficient to predict difficult endotracheal intubation.

Reference:

1 El-Ganzouri AR, McCarthy RJ, Tuman KJ, et al. *Anesth. Analg.* 1997; 84:419–21.

A-277

Availability and familiarity with airway management equipment in Greece – A national survey

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Goal of Study: To record the availability of equipment for airway management (AM), and anaesthesiologists' familiarity with it, in Greece.

Materials and Methods: A questionnaire was mailed to almost all specialist anaesthesiologists in Greece, in March 2001. Anaesthesiologists were asked to tick from a predefined list of AM adjuncts (AMA) those that were available in their anaesthetic department (AD), and declare their expertise with them. Questions also dealt with the workload of ADs. Responses were received anonymously in pre-paid envelopes.

Results and Discussion: The overall response rate was 360/849 (42%). 323/360 (90%) respondents had direct access to a difficult AM cart, including: naso- and oropharyngeal airways (OPA) 318 (98%), facemasks 317 (98%),

Magill forceps 309 (96%), straight or McCoy laryngoscope blades 306 (95%), laryngeal masks (LM) 285 (88%), guiding stylets 278 (86%), flexible fibroscope (FF) 142 (44%), intubating LMs 139 (43%), cuffed OPAs (COPA) 122 (38%) and combitube (CTube) 65 (20%). 346/360 (96%) provided sufficient data to analyse their familiarity with certain AMAs. Table shows significant differences between the workload of ADs and respondents' access and experience (number of uses) with AMAs.

	No of GAs of AD per year			P-value*	
	<2 × 10 ³	2–5 × 10 ³	>5 × 10 ³		
Airway cart	n = 105	n = 111	n = 107		
ILM	35 (33)	52 (47)	52 (49)	0.05	
COPA	29 (28)	40 (36)	53 (50)	0.003	
FF	31 (29)	51 (46)	60 (56)	0.001	
COPA					
	No of uses	n = 112	n = 119	n = 115	
	1–20	20 (18)	35 (29)	46 (40)	0.05
	>20	14 (13)	10 (8)	13 (11)	0.05
LM					
	1–20	43 (38)	33 (28)	28 (24)	0.05
	21–100	19 (16)	25 (21)	24 (21)	0.05
	>100	33 (29)	51 (43)	53 (46)	0.05
ILM	1	45 (40)	67 (56)	61 (53)	0.04
CTube	1	13 (12)	25 (21)	27 (23)	0.05
FF	1	6 (5)	15 (13)	17 (15)	0.05

* χ^2 , GA: general anaesthesia; (): %.

Conclusions: LM is available in most ADs, but expertise is still lacking. For other modern AMAs, spreading and familiarity is yet poor, especially in smaller ADs. FF is moderately available, however its use is unsatisfactory.

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Conditions for insertion of the laryngeal mask airway: comparisons between propofol and etomidate using remifentanyl as a co-induction agent

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Background and Goal of Study: Insertion of laryngeal mask airway requires sufficient depth of anesthesia to relax the jaw and obtund airway reflexes. We designed a prospective, randomized study to compare the conditions during insertion of the LMA following propofol + remifentanyl vs etomidate + remifentanyl without muscle relaxant.

Materials and Methods: Thirty ASA I or II patients, aged 30–65 yr, undergoing peripheral vascular surgery were divided into two groups. After premedication with 0.02 mg kg⁻¹ midazolam, anaesthetic induction was achieved with 0.5 µg kg⁻¹ remifentanyl followed by either 2 mg kg⁻¹ propofol (group P), or 0.3 mg kg⁻¹ etomidate (group E). Anesthesia was maintained with remifentanyl 0.1 µg kg⁻¹ min⁻¹ infusion and volatile anesthetics in combination with air and oxygen. The LMA was inserted by the blinded anaesthetist who assessed and graded the jaw opening and ease of LMA insertion and noted any adverse responses such as inadequate jaw relaxation, gagging, coughing, limb or head movement, hiccough and larengospasm.

Results and Discussion: The two groups were demographically similar. Jaw relaxation and ease of LMA insertion were significantly better in group P (respectively p < 0.05, p < 0.05). Propofol group demonstrated significant decrease in arterial blood pressures which were still within clinically acceptable limits.

Conclusion: Co-administration of propofol-remifentanyl provided better insertion conditions than etomidate-remifentanyl.

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Videolaryngoscopy improves intubation in morbidly obese patients

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Background and Goal of Study: Tracheal intubation may be more difficult in morbidly obese patients than in non-obese (1). Videolaryngoscopy (video) may decrease the incidence of difficult intubation in this population.

Materials and Methods: 50 patients, ASA II–III, BMI > 35 kg/m², age 20–65 years, were randomly assigned either to video or control group. Morphologic data as mouth opening, Mallampati, thyro-mental distance, neck circumference,

BMI and significant comorbidities (sleep apnoea syndrome) were recorded. The grade of laryngoscopy was assessed with direct laryngoscopy and with video in each patient. The intubation was then done either with ($n = 25$) or without ($n = 25$) the help of the video. The duration of intubation was recorded. Paired and unpaired t-tests and simple linear correlation were used as appropriated.

Results and Discussions: Grade of laryngoscopy was significantly lower with video compared with direct vision ($P < 0.001$).

	Grade of laryngoscopy		
	1	2	3
Direct vision	30	12	8
Videolaryngoscopy	44	6	0

When the grade of laryngoscopy was >1 with direct vision it was systematically lower with video (Figure). Duration of intubation tended to be shorter with video compared with direct vision (69 ± 36 s vs. 95 ± 81 s; $P = 0.11$). Neck circumference was significantly correlated with the grade of laryngoscopy by direct vision.

Conclusion: In morbidly obese patients, the use of a videolaryngoscope improves significantly the grade of laryngoscopy. This grade of laryngoscopy is correlated with the neck circumference.

Reference:

1 Juvina P. *Anesth. Analg.* 2003;97:595–600.

A-280

Influence of endotracheal tube guides on ventilation parameters during percutaneous tracheostomy

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Background and Goal of Study: Withdrawal of the endotracheal tube (ETT) to free the cervical trachea during the percutaneous tracheostomy (PCT) procedure is crucial. Dislocation of the ETT from the larynx into the pharynx is undesirable. To prevent this, anesthetists use sometimes special guides. We tested the predictive values of several controllable variables including: flow, ratio between ETT diameter and guide diameter (RTGD), respiratory rate, tidal volume, and the pulmonary compliance on ventilation parameters. The dependent variables were the increase in mean intrapulmonary pressure (MIPP) and in the PEEP values that have been estimated using a simulated procedure.

Materials and Methods: At first, simulation experiment tests were done on a training/test lung (Model 56011, adult TTL, Michigan Instruments, Inc) using ETT of different sizes (9, 8, 7.5) and standard mechanical ventilator (Puritan Bennett 7200 series) with stable parameters and different lung compliance parameters. The second experiment tests included ventilation through the same ETT's. In addition, guides (20, 14 French) were inserted in the lumen of the ETT's. The increase in the integrated MIPP and PEEP value after stabilization of the system was determined by computing the area between the desired and the measured intrapulmonary pressure and PEEP. This area was calculated using an image analysis software (ImagePro 4.5). A multivariate regression method was applied and a predictive formula was computed using the regression coefficients of the statistically significant independent predictors of MIPP.

Results and Discussions: For each ETT, we estimated the permissible diameter of the guide that may be used for stabilization of the ETT, without disturbing the optimal ventilation parameters. The MIPP was best predicted by the respiratory rate and RTGD. The increase in the respiratory rate and the simultaneous decrease of the RTGD determined the rise of MIPP and PEEP values.

Conclusion(s): Our study describes a novel method of improving the airway management and facilitating the performance of PCT by rational choice of the guide diameter and ventilation parameters in relation to the patient's lung compliance and size of ETT.

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Evaluation of the PAXpress airway device with or without the presence of a nasogastric tube

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Background and Goal of Study: PAXpress™ (PAX) is a new supraglottic ventilatory device [1]. The aim of this study was to compare insertion

success rate and ventilatory capability of PAX, with or without the presence of a nasogastric tube (NGT).

Materials and Methods: After IRB approval, 100 ASA 1–2 consenting adult anesthetized paralyzed patients (M/F: 34/66) were included. Patients with anticipated difficult airway or at risk of regurgitation were excluded. Patients were randomly allocated in two groups, according to the presence (Group A), or not (Group B) of an NGT. NGT was placed before the insertion of PAX in patients of group A. The PAX was inserted with the patient's head in neutral position by a senior anaesthesiologist with prior experience with the PAX (>50 uses). Tidal volume (V_T) ≥ 7 ml/kg defined successful insertion. All patients underwent standardized manual positive pressure ventilation at three different cuff volume stages (40, 50 and 60 ml). Airway leak pressure (Pawleak) and maximum V_T (V_{Tmax}) were recorded at each stage. Statistical analysis was conducted with ANOVA, χ^2 and Fisher's exact test.

Results and Discussions: The groups had similar demographics (A: M/F 15/35, 56 ± 14 yr, 76 ± 12 kg; B: M/F 19/31, 53 ± 16 yr, 74 ± 13 kg) and insertion success rates (A: 49/50, 98%; B: 50/50, 100%). Table shows mean values (\pm SD) of ventilatory parameters achieved.

	Group	Cuff volume		
		40 ml	50 ml	60 ml
V_{Tmax} (ml/kg)	A	15.6 ± 5.5	17.3 ± 5.7	18.1 ± 5.5
	B	16.4 ± 5.7	17.6 ± 5.4	18.9 ± 5.6
P-value*		NSS	NSS	NSS
Pawleak (cmH ₂ O)	A	27.1 ± 4.0	29.6 ± 4.2	30.6 ± 4.2
	B	27.5 ± 6.4	30.3 ± 6.4	32.1 ± 5.3
P-value*		NSS	NSS	NSS

* χ^2 test; NSS: non statistically significant.

Pawleak increased significantly (ANOVA, $P < 0.0001$) and V_{Tmax} marginally (ANOVA, $P = 0.08$) with cuff inflation volume, in both groups.

Conclusion: PAX has a high insertion success rate and is equally effective ventilatory device, with or without the presence of a NGT.

Reference:

1 Dimitriou V et al. *Can J Anesth* 2003; 50: 495–500.

A-282

Nitrous oxide diffusion into tracheal tube cuffs

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Background and Goal of the Study: The new Microcuff tube with high-volume low-pressure polyurethane cuff (Microcuff, Germany) provides sealing at lower pressure than conventional cuffs (1). Aim of this study was to compare pressure changes during N_2O exposure in the Microcuff tube with a conventional PVC cuff.

Materials and Methods: With approval of the local ethical committee patients requiring tracheal intubation with tube sizes ID 4.0 mm, or ID 7.0 mm, were included. Patients were randomly divided in three groups: (A) Microcuff, cuff pressure baseline 20 cmH₂O, (B) Microcuff, baseline set to sealing pressure, and (C) Sheridan CF, cuff pressure baseline 20 cmH₂O. Anaesthesia technique and respirator settings were standardised. Cuff pressures were monitored by a pressure transducer. When cuff pressure increased to 25 cmH₂O, time was recorded and pressure reduced to baseline. The number of required deflations during the first hour was recorded. If no deflation was necessary, time was defined as 61 min (worst case scenario). Data are median (range). Groups were compared by Kruskal-Wallis test ($P < 0.05$).

Results: 30 patients were included. There were no differences between groups in patients characteristics. ID 4.0 mm: (A) first deflation after 7 min (4–15), deflation three times (2–6), (B) Baseline 10 cmH₂O (8–14): 48 min (11–61), deflation once (0–1), and (C) 13 min (8–46), deflation twice (1–4 times). ID 7.0 mm: (A) 9 min (5–24), deflation four times (2–5), (B) Baseline 10 cmH₂O (8–12): 60 min (47–61), deflation once (0–1), and (C) 6 min (4–8), deflation four times (2–5). Kruskal-Wallis test revealed significantly less need for cuff release in groups B ($p = 0.01$ for ID 4.0 mm, $p = 0.009$ for ID 7.0 mm).

Conclusion: N_2O increases cuff pressure in polyurethane cuffs in a similar fashion than with PVC cuffs. When inflated just to the sealing pressure, the Microcuff tube has the potential to increase the time span until upper limits are reached. Continuous cuff pressure monitoring and adjusting is mandatory when using N_2O .

Reference:

1 Dullenkopf et al. *Eur J Anesth* in press.

A-283

Preoperative airway evaluation in Greece – A national survey

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Goal of Study: To record anaesthesiologists' preoperative airway evaluation routine, in Greece.

Materials and Methods: A questionnaire was mailed to almost all specialist anaesthesiologists in Greece, in March 2001. They were asked to choose from predefined answers concerning risk factors of difficult airway they routinely use in preoperative assessment. They were also asked to clarify whether their evaluations are subjective estimates (S) or objective measurements (O). Questions also included anaesthesiologists' demographics. Responses were received anonymously in pre-paid self-addressed envelopes.

Results and Discussion: The response rate was 360/849 (42%). Among the indicators of difficult intubation the respondents evaluated micrognathia (MGN) (343, 95%; S: 52%, O: 43%), mouth opening (MO) (341, 94%; S: 72%, O: 22%), head/neck mobility (HNM) (331, 92%; S: 59%, O: 33%), obesity (331, 92%; S: 57%, O: 35%), Mallampa-ti class (264, 73%) and thyromental distance (TMD) (157, 43%). Mallampati classification was applied more frequently with the patient in the sitting position (187/264, 71%) and during phonation (191/264, 72%). Table summarises the predictors which show significant differences of frequencies when categorized according to respondents' years of clinical practice. MO and HNM frequencies did not differ with respondents' years of clinical practice.

n	Years of clinical practice			P-value†
	0–5 (45)	6–10 (81)	>10 (234)	
Mallampati	41 (91)	62 (77)	161 (69)	0.006
Obesity				
S	18 (40)	43 (53)	143 (61)	0.03
O*	22 (49)	31 (38)	74 (32)	
MGN				
S	12 (27)	44 (54)	130 (55)	0.002
O†	30 (66)	34 (42)	93 (40)	

(): %; *body weight or body mass index; †TMD; ‡ χ^2 test.

Conclusions: Preoperative airway assessment is carried out by the vast majority of respondents. Senior anaesthesiologists rely mostly on subjective impression. Contrary, anaesthesiologists of five or less years of clinical practice prefer objective indicators such as Mallampati classification and TMD, to evaluate the anticipated difficult airway.

A-284

Disposable laryngeal tube and laryngeal mask airway: a comparison during routine surgical procedures

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Background and Goal of Study: Both the laryngeal mask airway (LMA) and the laryngeal tube (LT) are established airway devices that were previously shown to be safe and efficient (1). For emergency airway management there was demand for a disposable alternative of both devices. The purpose of the present prospective, randomised, controlled trial was to assess both the LMA-D and LT-D in routine clinical practice.

Materials and Methods: After approval of our IRB and written informed consent was obtained, in 40 patients (ASA 1–2; 62 ± 10 years), undergoing minor routine gynaecologic surgery, standardised anaesthesia was induced (Alfentanil, Propofol). Patients were randomised to controlled ventilation (40% oxygen in air; VT, 7 ml kg^{-1} ; respiratory rate, 12 min^{-1}) with the LMA-D ($n = 20$) or the LT-D ($n = 20$). SpO₂ was recorded before induction of anaesthesia, and after administration of oxygen. After two and 10 minutes of ventilation with the LMA-D or LT-D, SpO₂, etCO₂, VT_{ex} and P_{aw} were recorded. Capillary blood gas samples were taken before induction of anaesthesia, and after 10 minutes of ventilation. Time of insertion and airway leak pressure of each device were measured.

Results and Discussions: Time of insertion was comparable with the LMA-D and LT-D (Median: 28 vs. 23 sec; Range: 13–57 vs. 12–50 sec; $P = \text{ns}$); Failures: LMA-D 3/20 vs. LT-D 1/20). Blood gas samples and ventilation variables revealed sufficient ventilation and oxygenation with either device ($P = \text{ns}$). Paw (LMA-D, $13 \pm 3 \text{ cmH}_2\text{O}$; LT-D, $16 \pm 5 \text{ cmH}_2\text{O}$) and airway leak

pressure (LMA-D, $16 \pm 7 \text{ cmH}_2\text{O}$; LT-D, $30 \pm 10 \text{ cmH}_2\text{O}$) were significantly ($P < .05$) higher with the LT-D compared to the LMA-D.

Conclusion(s): Employing the LMA-D and LT-D resulted in comparable ventilation and oxygenation variables. Both newly developed disposable devices may be a simple alternative to secure the airway.

Reference:

1 Anesth Analg 2002;95:1094–7.

A-285

Simulation vs. clinical practice – airway management with the laryngeal tube (LT)

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Background: Simulation training is becoming an important element in specialist education. It is especially useful during the evaluation and implementation of new equipment into clinical practice. However, it is difficult to foresee whether the conditions created during simulation are parallel to natural.

Study Aim: To assess how conditions obtained during manikin ventilation via LT resemble natural conditions (i.e. pts under general anaesthesia).

Material and Methods: 1st stage: (75 persons) – manikin (Laerdal) training in LT insertion and mechanical ventilation; 2nd stage: (30 persons) – short use of LT (up to 60 min) during general anaesthesia with muscles relaxants. Assessment: (1) difficulty level of tube insertion (3 steps); (2) tube placement (fiberoptic), (3) leakproof airway – assessed by leaks perceived during PPV (monitored sounds and airflow).

Results: (1) Difficulties found during insertion of the LT into the manikin and into patients: 1 and 2 (lack/negligible) – 100% vs. 74%; 3 (noticeable) 0% vs. 26%; difficulties were observed in obese patients (BMI > 30) and in 1 case of post-op. stiffening of cervical spine. (2) necessity for manual assistance: yes – 19% vs. 93%; no – 81% vs. 7% (3) Correct insertion of LT on first attempt: 93% vs. 47%. (4) Negligible leaks: 76% vs. 100%; leaks disabling ventilation 4% vs. 20%; stomach ventilation 0% vs. 33% ($1 - 4 = p < 0.05$) (5) ability to maintain artificial respiration 89% vs. 80% (NS). We believe that these differences arise from populace diversity – a factor which cannot be simulated

Conclusions: (1) LT insertion and leakproofness create significantly more problems in patients than during simulation training. (2) artificial ventilation is efficient in pts. and on manikin (3) continuous ALS training of doctors and nurses also demands training in natural conditions.

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Truview™ laryngoscope – A comparison with the macintosh blade

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Background and Goal of Study: Failure to intubate is a problem infrequently encountered, though with a potentially serious outcome. Consequently, numerous interventions have been developed to manage the problem. Laryngoscopes incorporating prisms have been designed to improve visualisation of the larynx [1, 2]. Truview™ is a standard Macintosh-shaped blade (size 3.5) with an optical viewing tube sited along the body of the blade. We performed a randomised crossover study to compare the Truview™ blade with a standard Penlon Macintosh size 3 blade (Mac3).

Materials and Methods: With ethical approval, 50 ASA I–III patients, undergoing elective surgical procedures were recruited. Patients were intubated with both the Truview™ and Mac3 blades in a randomised order, allowing 60s for each intubation. Laryngoscopic view obtained for each blade was assessed using the modified Cormack and Lehane classification [3]. Success of intubation, time taken and need for any adjuncts were noted. Statistical analyses used were Wilcoxon-sign and McNemar's test with $p < 0.05$ considered significant.

Results and Discussions: Laryngeal views were worse with the Truview™ compared with the Mac3 ($p = 0.026$). Time to intubation was significantly longer – mean 13 s – with the Truview™ ($p < 0.0001$). Failure rate was significantly higher with the Truview ($p = 0.02$) and the use of adjuncts was also more frequent ($p < 0.0005$).

Conclusion: The Truview™ provides no advantage over the Mac3 blade and can make intubation more difficult.

References:

- Bellhouse CP. *Anesthesiology* 1988; **69**: 126–9.
- Huffman J. *J Am A Nurse Anesthetists* 1988; **35**: 138–9.
- Yentis SM, Lee DJ. *Anaesthesia* 1998; **53**: 1041–4.

A-287

Predictive factors of perioperative mortality in lung transplant for emphysema

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Background and Goal of Study: Despite of the accrued experience, early perioperative mortality in patients with emphysema remains high. We analysed the relation between mortality and complications develop in the early postoperative period, during their stay in the intensive care unit (ICU), after Lung Transplant (LT) in patients with emphysema.

Materials and Methods: Retrospective study of 69 patient underwent LT for emphysema between 1994–2002. Variables from recipients (pre, intra and postoperative), related to the mortality, were analysed. Statistical significance was defined as a p value less than 0,05. Univariate analysis identified variables associated with the incidence of mortality in ICU. Variables with statistically significant associations were entered into multivariate analysis, using a logistic regression model to calculate odds ratio (OR) and 95% confidence intervals.

Results: A total of 65 patients were enrolled in this study. 17 patients received a single lung transplant (SLT) while 48 patients were bilateral lung transplant (BLT). The mean age was $50,09 \pm 8,5$ years. The intraoperative survival was 100%. In the early postoperative period the mortality rate was 16,9%. The main cause for death in ICU was sepsis (54,5%). The variables associated with a significant increase in mortality were: BLT (23%)*, cardiopulmonary bypass (35,7%)*, requirement of blood products (23,4%)*, primary graft failure (33,3%)*, rejection (71,4%**), reintervention (57,1%)*, haemorrhage postoperative (54,5%**), infection (29,7%**), length of intubation more than 48 hours (34,6%** and long-term stay in ICU* (* p < 0,05; **p < 0,01). Mortality was related to rejection (OR = 32), length of intubation more than 48 hours (OR = 11) and haemorrhage (OR = 6).

Conclusion: The mortality rate during the early postoperative period, in our series, was 16,9%. There were not any death in the operating room. Patients with SLT presented a greater survival during their stay in ICU. Rejection, time of tracheal intubation and haemorrhage postoperative were the variables analysed with greater predictive value for mortality in the early postoperative period.

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Effects of sevoflurane and propofol on oxygenation and lung perfusion during one-lung ventilation in an animal model

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Background and Goal of Study: Sevoflurane (SEV) depresses *in vitro* hypoxic pulmonary vasoconstriction (HPV), whereas propofol (PRO) does not. As HPV depression may alter lung perfusion, we compare *in vivo* the effects of SEV and PRO on lung perfusion and oxygenation during one-lung ventilation (OLV) in a pig model.

Materials and Methods: With approval of the local animal protection committee 12 premedicated female pigs (29 ± 7 kg) were anaesthetized, tracheally intubated and mechanically ventilated. After placement of femoral arterial and pulmonary artery catheters, the orotracheal tube was replaced under fiberoptic control by a double-lumen tube via tracheotomy. Then the pigs were positioned in the left decubitus position, OLV of the left lung was started and a right-sided thoracoscopy was performed to confirm lung collapse. Previous anaesthetics were discontinued, FiO_2 was set to 1.0 and each animal was anaesthetized in random order with 1 MAC SEV (2.7%) and PRO. The dose of PRO was adjusted to achieve mean arterial pressure and heart rate comparable to those during 1 MAC SEV. After equilibration times of at least 30 min, cardiopulmonary parameters were determined during OLV. Differential lung perfusion was measured with colored microspheres. Wilcoxon test was used for statistical analysis and $P < 0.05$ was considered significant.

Results and Discussion: Oxygenation and lung perfusion during OLV did not differ between SEV and PRO.

	PaO ₂ (mmHg)	CO (l/min)	Left lung perfusion (%)	SvO ₂ (%)	MAP (mmHg)
SEV	245 ± 92	3.6 ± 1.7	85 ± 6	68 ± 16	67 ± 13
PRO	257 ± 108	3.1 ± 1.2	82 ± 8	72 ± 16	69 ± 14

CO: Cardiac output; SvO₂: mixed venous saturation; MAP: mean arterial pressure.

Conclusion: In our animal model of OLV with SEV and PRO the potential advantageous *in vitro* effects of PRO could *in vivo* not be confirmed.

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Effects of sevoflurane and propofol on oxygenation during one-lung ventilation in humans

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Background and Goal of Study: During one-lung ventilation (OLV) oxygenation is of special concern to the anaesthetist. We compared the effects of Sevoflurane (SEVO) and Propofol (PROP) during OLV in patients undergoing thoracic surgery.

Materials and Methods: After approval of the local ethics committee and written informed consent of the patients, we studied 54 patients undergoing elective thoracic surgery. Anaesthesia was induced with remifentanyl and PROP. Cis-atracurium or rocuronium bromide were used to facilitate endotracheal intubation. The patients were intubated with a left- or right-sided double-lumen tube. The correct position was controlled repeatedly with bronchoscopy. Anaesthesia was maintained either with SEVO (1 MAC) or with PROP (3–6 mg/kg) following a randomisation protocol. Remifentanyl was dosed as clinically indicated. The FiO_2 was adjusted to 0.9. After placement of an arterial line baseline values of oxygenation were obtained in two-lung ventilation (TLV). Measurements in OLV were done 10, 20 and 30 minutes after beginning of OLV.

Results and Discussions: 28 patients were studied with sevoflurane and 26 with propofol. Patients characteristics, haemodynamic and respiratory parameters were comparable in both groups at all time points. Especially, there was no difference regarding the oxygenation between groups (Fig. 1).

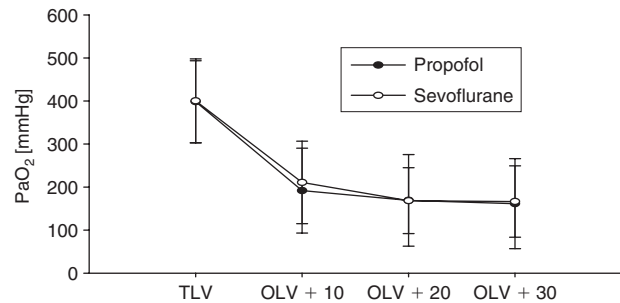


Figure 1. Oxygenation during the study phase with PROP and SEVO.

Conclusion: Our study suggests, that the decision for SEVO or PROP as anaesthetic agents during OLV could not depend on their effects on oxygenation, but on other factors like economics.

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Influence of graft ischemic time on early graft function after bilateral sequential lung transplantation

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Background and Goal of Study: Lung transplantation is currently limited by a donor shortage and the need for a short graft ischemic time (GIT). The possibility of extension of the traditionally accepted GIT of 6 hours has been recently suggested (1,2). The goal of this study was to assess the effect of GIT on early graft function after clinical bilateral sequential lung transplantation (BSLT) with our current graft preservation technique.

Materials and Methods: We studied 40 patients undergoing BSLT from January 1, 2002, to September 30, 2003. All organs were flushed with Perfadex® and stored in cold preservation solution in a mild inflated state. Ischemic time was measured from aortic crossclamping at organ procurement to reperfusion of the second graft. Ischemic times were divided into two groups: group I < 6 hours (n = 19), and group II > 6 hours (n = 21). Early graft function was assessed with the PO₂/FiO₂ ratio and the arterial to end tidal tension difference (Pa-etCO₂) 1 hour after reperfusion of the second graft. We also analyzed the incidence of severe graft dysfunction (PO₂/FiO₂ < 150) at the end of the procedure, and 30-day mortality. Statistical analysis was performed by Student t-test and significance was considered at p < 0.05.

Results: Data [mean (SD)] are shown in the table. Graft ischemic time of >6 hours didn't worsen early graft function.

	GIT < 6 hours	GIT > 6 hours	p
PO ₂ /FIO ₂	290.3 (136.45)	225.9 (119.31)	0.134
Pa-etCO ₂	13.1 (5.4)	15.6 (7.4)	0.247

PO₂/FIO₂ and Pa-etCO₂ in mmHg.

There was no significant difference neither in the incidence of severe graft dysfunction nor in 30-day mortality.

Conclusions: Prolonged graft ischemic time of more than 6 hours does not appear to have a significant impact on early graft function.

References:

- Ueno T, Snell GI, Williams TJ, et al. *Ann Thorac Surg* 1999; 67(6): 1577–1582.
- Fiser SM, Kron IL, Long SM, et al. *J Heart Lung Transplant* 2001; 20(12): 1291–1296.

A-291

Arterial oxygenation during one lung ventilation: a comparison of sevoflurane and propofol when combined with continuous positive airway pressure

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Background and Goals: Arterial hypoxaemia is a recognized problem during one-lung ventilation (OLV) (1). Effects of sevoflurane and propofol on arterial oxygenation when each is combined with continuous positive airway pressure (CPAP) in patients requiring OLV have not been compared. This prospective clinical study was designed to investigate the combination effects of anaesthetics with CPAP on oxygenation during OLV.

Materials and Methods: After obtaining Ethics Committee approval and informed consent, 40 patients (ASA I–III) undergoing noncardiac thoracic surgery and requiring OLV randomly received sevoflurane (S Group; n = 20, 1.5–2% end-tidal) or propofol (P Group; n = 20, 4–6 mg kg⁻¹ h⁻¹) with fentanyl for maintenance of anaesthesia. Volume controlled mode with a tidal volume of 10 mL kg⁻¹ and an I:E ratio of 1:2 was used. Fresh gas flow was set at 6 L min⁻¹. Ventilatory rate was adjusted to maintain end-tidal CO₂ between 30–40 mmHg. Blood gas values were obtained for 3 times in the lateral position while FIO₂ was 100%: (1) 15 min after two-lung ventilation, (2) 15 min after OLV, and (3) 15 min after the application of CPAP (5 cmH₂O) to the nondependent lung during OLV. Mann Whitney U, Friedman, Wilcoxon tests were used.

Results and Discussions: Patients' characteristics were similar between the groups. Data (mmHg, Mean ± SD) are shown in the Table (MAP; mean arterial pressure).

	PaO ₂ (1)	PaO ₂ (2)	PaO ₂ (3)	MAP ₁	MAP ₂	MAP ₃
S	415 ± 117	225 ± 116*	308 ± 134††	95 ± 10	94 ± 10	95 ± 11
P	423 ± 86	215 ± 94*	382 ± 74†	101 ± 8	100 ± 8	99 ± 11

*p = 0.000 vs. first; †p = 0.000 vs. second; ††p = 0.001 vs. first within groups, no significant difference between groups.

Increases in PaO₂ values after application of CPAP were 36% in sevoflurane group and 77% in propofol group.

Conclusion(s): Application of CPAP improved arterial oxygenation during both sevoflurane and propofol anaesthesia, but more during propofol maintenance anaesthesia. Propofol in combination with CPAP might be a better choice than sevoflurane with CPAP in patients at risk for arterial hypoxaemia during OLV.

Reference:

- Gothard J, Kelleher A, editors. *Essentials of cardiac & thoracic anaesthesia*. Oxford: Butterworth-Heinemann, 1999: 117–136.

A-292

Ventilation with PEEP activates the ACTH/cortisol-axis: effects of extended sympathicolysis

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Background and Goal of Study: PEEP may activate the endogenous stress-response system (SRS), e.g. by PEEP-induced impairment of haemodynamics [1]. The SRS comprises of two major components, i.e. the adrenocortical axis (mediated by ACTH/cortisol) and the sympatho-adrenomedullary system (mediated by spinal sympathetic fibres), both with complex amplifying and inhibiting interaction [2]. It is unclear, if PEEP activates the

ACTH/cortisol-axis and further, if inhibition of the alternative SRS, i.e. sympatho-adrenomedullary system, modifies a putative ACTH/cortisol response.

Materials and Methods: Six healthy dogs (permission of district government) were anaesthetized and mechanically ventilated. Intervention: Ventilation with 0 and 10 cmH₂O PEEP with and without intact sympathetic nervous system (extended epidural anaesthesia). Plasma ACTH and cortisol were measured at the end of each intervention. Statistics: t-test, p < 0.05. Means ± SEM.

Results and Discussions: In the controls PEEP doubled cortisol from 56 ± 14 to 110 ± 16 ng/ml within 15 min (correlation between ACTH and cortisol, r = 0.65), whereas after PEEP-release cortisol returned to 83 ± 19 ng/ml. MAP was maintained during PEEP (64 ± 2 vs. 65 ± 3 mmHg). Sympathicolysis per se did not increase cortisol, despite significant drop in MAP (from 66 ± 2 to 60 ± 3 mmHg). During sympathicolysis, PEEP again doubled cortisol from 71 ± 27 to 147 ± 21 ng/ml, and after PEEP release cortisol decreased to 118 ± 20 ng/ml. In this group, PEEP significantly depressed MAP (52 ± 4 vs. 65 ± 3 mmHg in controls).

Conclusion(s): We demonstrated that PEEP reversibly activates an endogenous stress-response. Interestingly, abolition of the alternative SRS (sympathetic nervous system) did not evoke a compensatory overshoot of ACTH/cortisol, but only maintained the “physiologic” increase in cortisol during PEEP (i.e. doubled cortisol levels). This finding surprises in view of the aggravated depression of MAP by PEEP during sympathicolysis, since hypotension appears a potent trigger of ACTH/cortisol [2].

References:

- Scheeren TWL et al. (2002) *Crit Care Med* 30: 881–7.
- Crozier TA (1995) in *Anaesthesiologie*. Springer, Berlin Heidelberg, 1186–1222.

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Lung volume changes by electric impedance tomography (EIT) during endotracheal suctioning

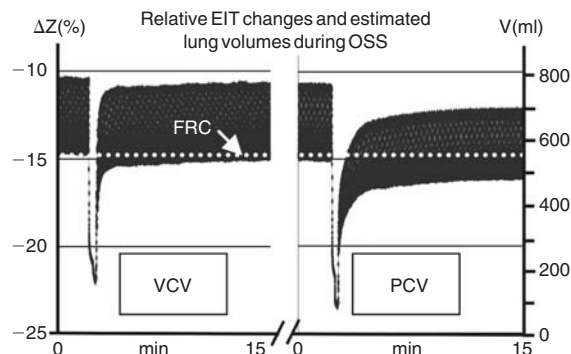
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Background and Goals: Closed system suctioning (CSS) has little efficacy and little side effects in contrast to open suctioning (OSS) (1). This study evaluates changes in lung volume using EIT during OSS and CSS.

Materials and Methods: In 7 anesthetised pigs, 25–30 kg b.w., ALI was induced by alveolar lavage. 16 electrodes were placed around the thorax and impedance changes, ΔZ (~aeration) monitored by 13 Hz (Dräger/GOE MFII, Univ of Göttingen) and calibrated against known lung volume changes with a super syringe. FRC was measured at baseline with a modified N₂ wash in/out technique (2). From these data an estimation of lung volumes was made. OSS and CSS were performed in random order during 10 s with a 14 Fr catheter in an 8 mm tube, in volume or pressure control ventilation (VCV, PCV) with equal tidal volumes at baseline and PEEP of 10 cmH₂O. Blood gases were measured continuously on line.

Results: OSS resulted in instant decruitment, –501 ± 55 ml, p < 0.001 and desaturation –19 ± 5 kPa, p < 0.001. After suctioning, VCV recruited lung more efficiently than PCV p < 0.001 (n = 7), see figure of typical experiment. During CSS loss of lung volume was minimal 37 ± 17 ml, p < 0.01. (Mean ± SD, Student's t-test, ANOVA).



Conclusions: EIT can be used to monitor rapid lung volume changes bedside. Following OSS, lost lung volume is recruited more efficiently with VCV than PCV as the tidal volume is preserved in spite of decreased compliance during suctioning.

References:

- Lindgren S et al *Intensive Care Med* 2001 (Suppl) 27: S241–248.
- Olegård C et al *Eur J Anaesth* 2003 (Suppl) 30: A-637.

A-294

Preoperative risk factors for the use of cardiopulmonary bypass in bilateral sequential lung transplantation in patients with obstructive lung disease

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Background and Goal of Study: Cardiopulmonary bypass (CPB) is required in some patients undergoing bilateral sequential lung transplantation (BSLT). However, it hasn't been found preoperative predictors for its use and it is generally instituted because of intraoperative cardiorespiratory instability (1, 2). The goal of this study was to evaluate preoperative risk factors for the need of CPB during BSLT in patients with obstructive lung disease.

Materials and Methods: We performed a retrospective analysis of 96 BSLT in patients with obstructive lung disease (emphysema, cystic fibrosis and bronchiectasis). We analyzed the patients characteristics (age, sex, body surface area and lung disease) and the preoperative tests of cardiopulmonary function (pulmonary function test, arterial gas analysis, right and left ventricular ejection fraction, and quantified perfusion of both lungs). We performed a multivariate logistic regression analysis to determine independent risk factors for the need of CPB in this group of patients.

Results: We didn't find any independent risk factor for the need of intraoperative CPB. The analysis showed that patients with cystic fibrosis had a 7-fold higher risk than emphysema patients (data in Table).

	OR	95% CI
Emphysema	1	-
Cystic fibrosis	7	2-22
Brochiectasis	1.5	0.4-4.8

OR: odds ratio; 95%CI: 95% confidence interval.

Conclusions: Our results show that patients with cystic fibrosis have higher risk for the need of CPB during BSLT than patients with other type of obstructive lung disease. We couldn't find any independent risk factor for preoperative prediction for the use of CPB.

References:

- 1 Anastasio N, Triantafyllou MK, Pasque CB, et al. *Ann Thorac Surg* 1994; 57: 1248-51.
- 2 De Hoyos A, Demajo W, Snell G, et al. *J Thorac Cardiovas Surg* 1993; 106: 787-96.

A-295

Validation of basic monitoring curves to estimate the neural inspiratory time

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Background and Goal: It is not possible to directly measure respiratory center's activity, and instead, it is defined in operational terms. Measurement of diaphragmatic electromyography (EMG) has been used to overcome this problem, but it cannot be standardized in any way. Because of it, neural inspiratory time (Tin) is usually estimated on indirect measurements. The last study displayed poor agreement between flow, esophageal and transdiaphragmatic pressure (Pdi) with the crural diaphragmatic EMG¹. We studied the concordance between diaphragmatic EMG and airway (Paw), Pdi and pleural (Ppl) pressures and flow.

Materials and Methods: Patients scheduled for coronary bypass were recruited. At the end of surgery two electrodes were placed in the left diaphragm and a pleural catheter in the left pleura. A nasogastric balloon catheter was used for Pdi (subtraction of Ppl from Pga). Paw and flow was recorded between the endotracheal tube and the Y piece. During weaning, we recorded 3 minutes with support pressure of 20, 15 and 10 cmH₂O. Signal processing and recording was made with the Biopac MP-100 system (Bionic Ibérica SA). We used descriptive statistics (frequencies, mean and standard deviation).

Results: We studied 6 patients (4 men and 2 women) average age 62 ± 9 years. During weaning, we analyzed 363 cycles. The table shows: (1) percentage of cycles in which the onset of Tin was recognized at the Paw and Ppl curves as so was its end at the Paw, Pdi and flow curves (recognized). (2) percentage of cycles in which the point recognized at the curve was coincident to EMG (coincidence). (3) time difference between the point detected on the curves and EMG, expressed in absolute figures (ms) and percentage of Tin (time).

	Recognized (%)	Coincidence (%)	Time (ms)	Time (%)
On set				
Paw	98.1	73.3	17 ± 56	0.9 ± 5
Ppl	98.6	74.9	2 ± 83	0.5 ± 9
End				
Paw	97	58.2	36 ± 109	2 ± 8.5
Flow	77.1	44.3	55 ± 160	8 ± 18
Pdi	98.3	71.7	13 ± 48	1 ± 5

Conclusion: Determined points at Paw, Ppl and Pdi curves provide a good estimation of Tin

Reference:

- 1 Parthasarathy A, Jubran A, Tobin. *MJ. Am J Respir Crit Care Med* 2000; 162: 546-52.

A-296

Effect of desflurane-gas mixtures density on airway resistance in a laboratory lung model

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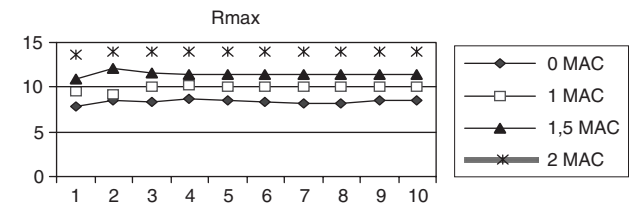
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Background and Goal of Study: It is well known that airway resistance does not depend only on airway's geometry but also on flow rate, and gas density and viscosity.^{1,2} The density of a desflurane gas mixture is markedly influenced by the high concentrations used to achieve 1.0 and 2.0 MACs.¹ To investigate the influence of desflurane's density on the measurements of airway resistance at different MAC values, the fixed airway resistance of an experimental lung model was used.

Materials and Methods: A two chamber fixed resistance test lung (Michigan Instruments, Grand Rapids, Mich, USA) was connected to an anaesthesia machine (Julian, Draeger) using the volume control mode of ventilation. A pneumotachograph and a pressure transducer were inserted between the tracheal tube and the Y piece of the respiratory circuit for the measurements of flow, tidal volume and inspiratory pressures (Ppeak, Pplateau, P_i). Pulmonary resistance was calculated at baseline (35% oxygen in air), and at 1.0, 1.5 and 2.0 MAC desflurane in the same mixture. The ANOVA test for repeated measures and probabilities for Post Hoc Tukey tests were used.

Results and Discussion: The administration of desflurane at 1.0 MAC did not affect R_{max}, while at 1.5 and 2.0 MACs there was a very significant increase (p = 0.00027 and p = 0.0003 respectively). This increase in R_{max} can be attributed to the high concentrations of the agent at 1.0, 1.5, 2.0 MACs that caused a 47.5% rise of the gas mixture density at the 2.0 MAC value.¹

Conclusion: The high density of the gas mixtures at high desflurane MAC concentrations caused a significant increase of the pulmonary resistance through alterations of the gas flow rate.



References:

- 1 Habre W, et al. Viscosity and density of common anesthetic gases: implications for flow measurements. *Br J Anaesth* 2001; 87:602-7.
- 2 Wood LD, et al. Effect of gas physical properties and flow on lower pulmonary resistance. *J Appl Physiol* 1976; 41:234-44.

A-297

High MAC concentrations of desflurane do not affect respiratory resistance

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Background and Goal of Study: The bronchodilatory properties of volatile anaesthetics are well established. However, is not clear the effect on respiratory resistance of desflurane at high concentrations in gas mixtures.^{1,2} The effect on total respiratory resistance of two different MAC concentrations of desflurane were investigated during general anaesthesia for operations not involving the thorax or abdomen.

Materials and Methods: Non-COPD patients undergoing total knee replacement under general anaesthesia were studied. All patients received a propofol,

remifentanyl, cis-atracurium induction and were ventilated in a volume control mode. Flow, tidal volume and inspiratory pressures (P_{peak}, P_{plateau}, P_i) were continuously recorded using a pneumotachograph and a pressure transducer near the tracheal tube. Anaesthesia was maintained with desflurane and remifentanyl infusion in 35% oxygen. Total respiratory resistance was calculated before (baseline) and after a steady state of 1.0 MAC desflurane every five minutes for thirty minutes, and when MAC decreased to 0.5 and 0 values (baseline) following discontinuation of desflurane. The same calculations were done at 1.5 MAC. The ANOVA test for repeated measures and probabilities for Post Hoc Tukey HSD tests were used.

Results and Discussion: The administration of desflurane at concentrations of 1.0 and 1.5 MAC for thirty minutes did not change significantly ($p < 0.3$) from baseline the total respiratory resistance. Also, there was no difference in the total airway resistance between 1.0 and 1.5 MAC desflurane concentrations. However, to assess the net effect of desflurane on respiratory resistance it should be taken into account the significant rise of the density of the gas mixture at high desflurane MAC concentrations, indicating a decrease of respiratory resistance.³

Conclusion: The present study did not demonstrate a change in respiratory resistance from baseline even at high MAC (1.0 and 1.5 MAC) concentrations of desflurane.

References:

- Mazeo AZ, et al. Differential effects of desflurane and halothane on peripheral airway smooth muscle. *Br J Anaesth* 1996; 76:841–6.
- Dikmen Y, et al. Pulmonary mechanics during isoflurane, sevoflurane and desflurane anaesthesia. *Anaesthesia* 2003; 58:745–8.
- Habre W, et al. Viscosity and density of common anesthetic gases: implications for flow measurements. *Br J Anaesth* 2001; 87:602–7.

A-298

PEEP and recruitment manoeuvres in anaesthetised obese patients – A CT study

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Background and Goal of Study: General anaesthesia promotes atelectasis formation. Obese patients experience more severe impairment of respiratory mechanics and gas exchange during anaesthesia than normal patients. The present study is performed to evaluate the formation of atelectasis in anaesthetised obese patients (Body Mass Index 40–50) and also to study the effect of a Vital Capacity Manoeuvre (VCM) + PEEP compared to PEEP alone.

Materials and Methods: 7 out of 16 patients scheduled for gastric bypass surgery have been studied. Before anaesthesia a spirometry, arterial blood gas and a transverse scan at end-expiration 1 cm above the diaphragm were performed. At 5 minutes after induction of anaesthesia (Propofol, Fentanyl, Rocuronium, oral intubation) a second CT + arterial bloodgas were recorded, with volume-cycled ventilation, 50% oxygen and zero end-expiratory pressure. In 4 patients an intervention with PEEP 10 cmH₂O was made, in 3 patients a VCM. (55 cmH₂O for 10 seconds) followed by PEEP 10 cmH₂O was performed. New CT's and bloodgases were recorded 5 and 20 minutes after intervention in all patients.

Results and Discussions: After induction of anaesthesia all patients had dorsal atelectasis. Application of PEEP did not reduce atelectasis or increase PaO₂ whereas VCM + PEEP abolished atelectasis in 2 out of 3 patients and reduced atelectasis in the third patient. VCM + PEEP also increased PaO₂ from 18,7 ± 2,8 kPa to 29,3 ± 8,4 kPa. PEEP did not cause any decrease in arterial blood pressure, but during VCM a mild, short lasting decrease in blood pressure was observed.

Conclusion(s): A single vital capacity manoeuvre followed by PEEP increases PaO₂ and reduces atelectasis in obese patients. PEEP alone did not have any significantly positive effects on atelectasis or oxygen gas exchange on the patients so far studied. Thus we conclude that intermittent VCM and PEEP should be considered for this group of patients. Further studies are needed to define an optimal recruitment manoeuvre.

Acknowledgements: Maquet Critical Care, Solna, Sweden for providing a Servo ventilator for this study.

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Lung mechanics after robotically enhanced MIDCAB: effects of HFPV versus OLV

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Background and Goal: Robotically enhanced minimally invasive direct coronary artery bypass (MIDCAB) comprises harvesting of 1 or 2 internal

mammary arteries (IMA) using a robotic system, and coronary anastomosis on a beating heart via mini-thoracotomy, during one lung ventilation (OLV). We have compared the effects of perioperative high-frequency percussive ventilation (HFPV) of the deflated left lung on postoperative lung mechanics with those after classic OLV.

Materials and Methods: After ethics committee approval and patient informed consent, 24 patients were randomised to either OLV (3 cm PEEP on the deflated left lung) (group A, n = 12), or to HFPV of the left lung (group B, n = 12) with a VDR 4 (Idaho, USA). The latter combines high frequency ventilation with conventional ventilation. Static lung compliance (C_L), airway resistance (Raw) and tidal volume (TV) of the left (LL), right (RL) and both lungs (TL) were measured before surgery and postoperatively every 30 minutes during 3 hours via a double lumen tube.

Results and Discussion: Mean OLV time was 205(58) in group A vs. 221(57) min in group B (NS). Postoperative LL C_L was 17(4), 17(5) and 17(5) at 60, 120 and 180 min after arrival in ICU vs. 25(6) ml/cmH₂O preoperatively ($P < 0.01$) in group A. Raw (LL) increased from 18(7) to 30(10), 32(12) and 32(13) cmH₂O/l.s at the same time points ($P < 0.05$). In group B there were no significant changes in C_L or Raw. Data on TV are shown below.

	Preop	60 min	120 min	180 min
Group A				
LL	322 (52)	260 (43)*	262 (53)*	272 (55)*
RL	345 (45)	401 (66)	405 (76)	403 (73)
Group B				
LL	289 (27)	284 (22)	284 (25)	284 (24)
RL	350 (60)	362 (47)	366 (49)	370 (47)

TV (ml) as mean (SD). *P < 0.05 vs. preop.

Conclusion: Prolonged OLV during robotically enhanced MIDCAB significantly changes postoperative C_L and Raw of the deflated lung and redistributes part of the tidal volume away from the deflated lung after classic OLV. These changes can be avoided when using perioperative HFPV on the deflated lung during OLV.

A-300

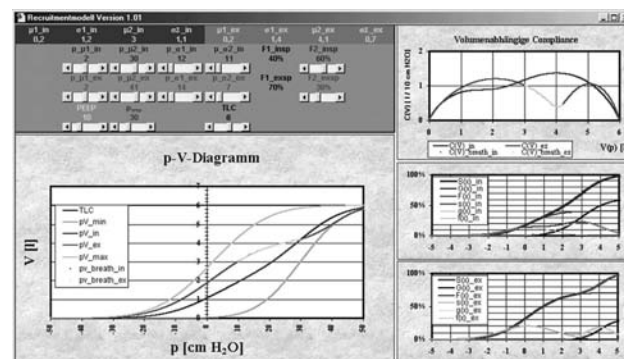
Nonlinearity of compliance within Tidal volume explained by a combination of recruitment functions – a mathematical model

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Background and Goal of Study: Volume-dependent compliance in surfactant-depleted piglets (1) and patients with ARDS (2) are characterized by a nonlinear behavior within V_T. Pressure-Volume curves obtained from patients with ARDS have a very excellent fit by a sigmoidal equation. This sigmoid can be thought as an integral of a normal distribution of alveolar opening pressures, so called recruitment functions (3).

Materials and Methods: In a mathematical model we defined the behavior of a pressure-volume curve as a combination of two recruitment functions. We presumed two populations of alveolar units with different mean opening pressures p_μ and different standard deviations p_σ. In a simulation program (EXCEL®) these parameters can be varied for each population separate in inflation and deflation.



Results and Discussions: P-V-Diagrams, distribution curves of open alveolar units and the volume dependent compliance are shown graphically simultaneously to variations.

Conclusion(s): Nonlinearity of compliance within V_T can be good explained by a recruitment/decrement model by a combination of different distribution functions, in accord with morphometric or visualizing studies of the last years.

References:

- Lichtwarck-Aschoff M, et al. *Am J Respir Crit Care Med* 2000; 162: 2125–2133.
- Mols G, et al. *Intensive Care Med* 1999; 25: 1084–1091.
- Harris RS, et al. *Am J Respir Crit Care Med* 2000; 161: 432–439.

A-301

Detection of post-operative obstructive apnoea (OA) among patient with desaturation risk

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Introduction: Obstructive apnoea (OA) is the main factor of desaturation after major surgery (1). In spite of several trials, monitoring of apnoea is not wide spread and SpO₂ is the standard monitoring in recovery room. The aim of this study was to evaluate the interest of nasal CO₂ monitoring in the detection of postoperative apnoea in recovery room.

Materials and Methods: 28 patients with obesity and/or history of respiratory disease, anaesthetised for abdominal, ENT or superficial surgery have been included. Induction were performed using propofol, remifentanyl and sevoflurane or desflurane. In recovery room, respiratory rate (RR), nasal end tidal CO₂ (etCO₂) and pulse oxymetry (SpO₂) were recorded using a Microstream® system (ORIDION®, Jerusalem, Israel), and analysed (PROFOX® software, Escondido, CA). Patients received O₂ 6 l mn⁻¹ when SpO₂ < 93% and morphine bolus IV then PCA to obtain a pain score lower than 40 using a visual analog scale of 100 mm. Apnoea was defined when RR was lower than 6 bpm; Hypopnoea when RR was between 6 and 10 bpm. Episodes of desaturation were defined when the time of low saturation (SpO₂ < 91% or between 91% and 95%) was longer than 1% of the total recording time.

Results: Demographics characteristics are: BMI: 29 ± 5 kg m⁻², age 62 ± 11 years, duration of anaesthesia: 235 ± 122 min. Apnoea episodes were identified in 10 patients and were responsible for desaturation in 7 patients, hypopnoea occurred in 11 patients and were responsible for desaturation in 2 patients. Low respiratory rate occurred without desaturation in 3 patients (Table1).

Table 1. Desaturation events in correlation with RR.

SpO ₂	<91%	91–95%	>95%
Apnoea (n = 10)	7	2	1
Hypopnoea (n = 11)	2	7	2
RR > 10 (n = 7)	0	6	1

Conclusion: Obstructive apnoea was not the only mechanism for post-operative O₂ desaturation. Nasal CO₂ monitoring allowed a good detection of apnoea and hypopnoea state even with oxygenotherapy.

Reference:

1 Catley DM Anesthesiology. 1985;63:20–8.

A-302

Preoxygenation in the morbidly obese patient: effect of the position on the apnoea tolerance

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Background and Goal of Study: Preoxygenation is an essential part of safe general anaesthesia. Preoxygenation technique with eight deep breaths within 60 seconds with an oxygen flow of 10 l/min (8DB/60) is effective in normal weight subjects¹. In morbidly obese patients, a decrease in the residual functional capacity exacerbated by supine position² might decrease the preoxygenation effectiveness, and the apnoea tolerance. The objective of the study is to compare the effect of position, sitting or supine in effectiveness of 8DB/60 preoxygenation technique, measured as the time of apnoea without desaturation (SpO₂ < 90%), in morbidly obese patients.

Materials and Methods: Thirtyfive morbidly obese patients (BMI > 35) scheduled for gastric bypass surgery were enrolled after informed consent. Patients with documented respiratory diseases were excluded. Patients were randomly assigned into two groups: Supine group (Sup) (n = 17) and Sitting group (Sit) (n = 18). All the patients were preoxygenated with 8DB/60 technique. Patients were intubated after rapid sequence induction and maintained disconnected from the anaesthesia circuit. Patients remained apnoeic until SpO₂ decreased to 90%. Time from the injection of thiopental until desaturation was noted. Arterial blood gas tension was measured prior to induction of anaesthesia (baseline) and immediately after preoxygenation. Values were expressed as Mean ± SD. Student's t-test was used for statistical comparisons.

Results and Discussions: There were no differences in demographic data between groups. Oxygen tension (mmHg) was similar between groups, at baseline (Sup 79 ± 8 vs Sit 69 ± 6) and after preoxygenation (Sup 329 ± 87 vs Sit 334 ± 51). However, the mean time to desaturation to 90% was significantly longer in the Sitting group (209 ± 30 s) than in the Supine group (162 ± 38 s) (p < 0.05).

Conclusion(s): Preoxygenation in sitting position significantly extends the apnoea tolerance in the morbidly obese patient.

References:

- Baraka AS, Taha SK, Aouad MT et al. Preoxygenation: comparison of maximal breathing and tidal volume techniques. Anesthesiology 1999; 91: 612–16.
- Hedenstierna G. Gas exchange during anaesthesia. Br. J. Anaesth. 1990; 64: 507–14.

A-303

Influence of obesity on lung function recovery after abdominal laparoscopy: role of volumetric capnography

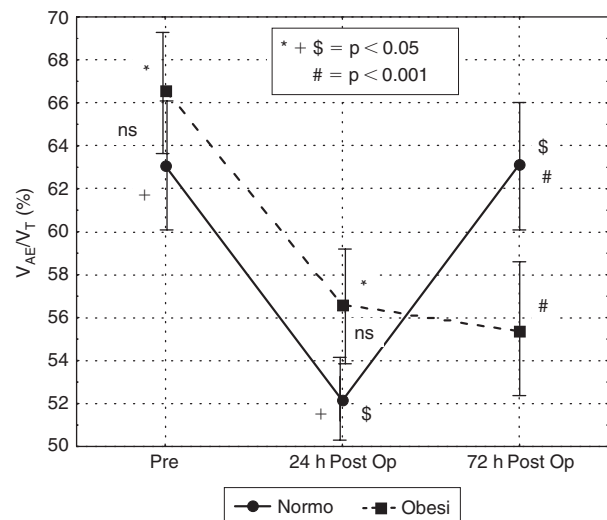
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Background and Goal of Study: The ratio between alveolar ejection volume and tidal volume (VAE/VT) is an index derived from volumetric capnography, able to detect lung inhomogeneities in ARF and ARDS patients (1). Obese patients have a reduction in functional residual capacity and an increased residual volume. The aim of this study was to evaluate post laparoscopy recovery of morbidly obese patients compared with normal weight patients by volumetric capnography.

Materials and Methods: 16 obese and 8 normal weight patients undergoing abdominal laparoscopy were studied (BMI = 44,33 ± 5,31 and 24,58 ± 3,27 respectively; mean ± SD, p < 0.001), with the same mean age, length of intervention and pneumoperitoneum mean pressure. VAE/VT was obtained in spontaneously breathing awake patients, in supine position, the day before anaesthesia (pre), on the first (24 h post) and on the third (72 h post) day after the operation by using Novamatrix CO₂SMO+.

Results and Discussions: Results of the ANOVA analysis between the two populations of VAE/VT are shown in the figure.



Conclusion(s): VAE/VT is a non invasive and useful index to differentiate lung function recovery of the studied populations in the postoperative period.

Reference:

1 Romero PV, Lucangelo U, Lopez J et al. Eur Respir J 1997. 10:1309–1315.

A-304

The phase of the respiratory variation in the photoplethysmographic signal is not affected by sympathetic tone

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Background and Goal of Study: Photoplethysmography (PPG) is a non-invasive optical technique used to follow variations in blood volume and flow. PPG is widely used in pulse oximetry. The respiratory synchronous part of the PPG signal varies with tidal volume, respiratory rate and volume status. Its physiological origin is not fully understood. Sympathetic activity varies with respiration. Anaesthesia reduces sympathetic tone. We hypothesised that sympathetic tone influences the respiratory synchronous part of the PPG signal.

Materials and Methods: We recorded PPG signals from 12 patients from a sensor positioned at the forearm, together with ABP and peripheral venous pressure (PVP) for 10 minutes of spontaneous breathing immediately before

anaesthesia and for 10 minutes of spontaneous breathing during anaesthesia. Respiratory variation in CVP served as reference. Squared coherence analysed the relationship between the signals (1). Phase differences between the signals was calculated and shown as time differences.

Results and Discussion: Median (quartile range) squared coherence values were high (>0.86 (0.35)). Time differences (seconds) for the respiratory synchronous variation in the signals compared with that in CVP are shown in the table.

	Awake		Anaesthetised
PVP	0.61 (0.56)	ns	0.63 (0.43)
ABP	-0.06 (1.11)	ns	0.31 (0.48)
PPG	0.76 (0.78)	ns	0.44 (0.73)

Conclusion: Sympathetic tone did not affect the phases of the respiratory synchronous part in the PPG signal, or in the macrocirculation as evaluated by ABP and PVP. PPG can be used in spontaneously breathing subjects to detect respiration, both in the awake and in the anaesthetised state.

Reference:

- 1 Bernardi L, Radaelli A, Solda PL et al. *Clin Sci* 1996;90:345–355.

A-305

Pulmonary function after sternotomy: comparison between S(+)-ketamine and remifentanyl

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Background and Goal of Study: Cardiac surgery is associated with a significant impairment of the pulmonary function which persists up to several months into the postoperative period¹. We investigated whether S(+)-ketamine would result in a less severe reduction of the lung function following sternotomy for cardiac surgery compared to remifentanyl.

Materials and Methods: Twenty-three patients were randomized to 2 groups and underwent open-heart surgery. The first group (11 patients) were induced with 2.5 mg kg⁻¹ S(+)-ketamine followed by a continuous infusion of 125 µg kg⁻¹ min⁻¹ until the end of the procedure. In the other group (12 patients) a target controlled infusion (TCI) of remifentanyl was infused to maintain a plasma level of 6–14 ng/ml. In both groups a TCI of propofol between 1 and 4 µg ml⁻¹ was administered. Pethidine was used for post-operative analgesia in all patients. The forced vital capacity (FVC), the forced expiratory volume in 1 second (FEV₁) and the forced expiratory flow between 25% and 75% of forced vital capacity (FEF_{25–75}) were determined preoperatively, 1 and 10 weeks after surgery. The change was calculated for each parameter and the Mann-Whitney U test used for statistical analysis.

Results and Discussions:

	S(+)-ketamine (n = 11)	Remifentanyl (n = 12)	p value
FVCw1-pre	-1.260 (0.463)	-1.280 (1.135)	0.90
FVCw10-pre	-0.175 (0.735)	-0.550 (0.555)	0.02
FEV ₁ w1-pre	-0.850 (0.655)	-1.060 (0.695)	0.83
FEV ₁ w10-pre	-0.110 (0.448)	-0.125 (0.335)	0.50
FEF _{25–75} w1-pre	-0.750 (1.345)	-0.735 (0.515)	0.98
FEF _{25–75} w10-pre	-0.030 (0.518)	0.110 (1.030)	0.98

Changes in FVC (L), FEV₁ (L) and FEF_{25–75} (L/sec) from before (pre) to 1 (w1) and 10 weeks (w10) after surgery. Data are presented as median (interquartile range).

Conclusion(s): S(+)-ketamine during cardiac surgery does not seem to be associated with better postoperative pulmonary function tests compared to remifentanyl, although the decline in FVC is less severe 10 weeks after surgery.

Reference:

- 1 Westerdahl E, Lindmark B, Bryngelsson et al. Pulmonary function 4 months after coronary bypass graft surgery. *Respir Med* 2003; 97: 317–22.

A-307

Alveolar hypoxia aggravates lipopolysaccharide-induced lung injury

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Background: The animal model of inflammatory response induced by intratracheal application of lipopolysaccharide includes many typical features of the acute respiratory distress syndrome. A number of experimental investigations have been performed to better characterize the nature of this injury (1, 2). In inflammation conditions, alveolar hypoxia occurs frequently before and in parallel with pulmonary pathological events. This study evaluates the impact of alveolar hypoxia in the endotoxin-induced lung injury.

Material and Methods: Lipopolysaccharide was instilled intratracheally into rat lungs, and thereafter animals were exposed to either normoxia or hypoxia (10% oxygen). Lungs were collected 2, 4, 6, and 8 hours later. Inflammatory response and tissue damage were evaluated by quantitative analysis of inflammatory cells and mediators, surfactant protein and vascular permeability.

Results: A significantly enhanced neutrophil recruitment was seen in lipopolysaccharide-animals exposed to hypoxia compared to lipopolysaccharide-animals under normoxia. This increased neutrophil accumulation was thoroughly triggered by tumor necrosis factor- α , secreted by alveolar macrophages. Determination of vascular permeability and surfactant protein-B showed enhanced concentrations in lipopolysaccharide-lungs exposed to hypoxia.

Conclusions: Our study demonstrates that alveolar hypoxia aggravates lipopolysaccharide injury and therefore has to be regarded as second hit injury. The additional inflammatory reaction seems to be predominantly orchestrated in the respiratory compartment, underlining the compartmentalized process.

References:

- 1 Beck-Schimmer B. *Am J Respir Cell Mol Biol* 1997; 17, 344–352.
- 2 Beck-Schimmer B. *Eur Respir J* 2002; 19(6), 1142–1150.

Acknowledgement: This study was supported by the Swiss National Science Foundation grant No. 31-55702.98, Gebert Ruff Foundation, Switzerland, the Hartmann-Müller Foundation, Switzerland and the Bonizzi-Theler Foundation, Switzerland.

A-308

Pulmonary immune effects of one-lung-ventilation in patients undergoing thoracic surgery

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Background and Goal of Study: Mechanical ventilation may induce intra-alveolar immune reactions including increased numbers of leukocytes, increased alveolar protein concentrations and expression of pro-inflammatory cytokines. One-lung ventilation (OLV) during thoracic surgery may aggravate these effects in the ventilated lung. In this prospective study, pulmonary immunological parameters were analysed prior to and after OLV.

Materials and Methods: 15 patients undergoing elective open thoracic surgery were included. After intubation with a double lumen tube the patients were mechanically ventilated (Two-lung ventilation (TLV) $V_T = 10$ ml/kg, $f = 10-12$ V_T/min adjusted to normal arterial pCO₂, FiO₂ = 0.35). During OLV, V_T was maintained at 10 ml/kg and FiO₂ was increased to 1.0. Fiberoptic, bronchoscopic guided, bronchoalveolar lavage of the ventilated lung was performed before, immediately after OLV and 2 hours postoperatively. In the BAL fluid, numbers of cells, protein concentrations, pro-inflammatory (TNF α , IL8) and anti-inflammatory cytokines (IL10) were determined. Data were analysed by Friedman and post-hoc Wilcoxon test.

Results and Discussions: Intra-alveolar protein concentrations and cell numbers increased over time as well as pro-inflammatory cytokines (IL8, TNF α). IL10 decreased significantly

Table

	TLV	After OLV	2 h postop.
Cells [Mio/ml]	0,06 ± 0,06	0,08 ± 0,05	0,28 ± 0,44*
Protein [µg/ml]	171 ± 140	193 ± 195	284 ± 277*
IL8 [ng/ml]	0,43 ± 0,7	1,28 ± 2,8	3,9 ± 6,1*
TNF α [pg/ml]	3,0 ± 3,3	46,7 ± 66,6*	56,8 ± 106*
IL10 [pg/ml]	16,2 ± 19,9	1,8 ± 3,5*	8,8 ± 19,6*

mean ± SD, * = p < 0.05.

Conclusions: Our results indicate that OLV with V_T = 10 ml/kg and FiO₂ = 1.0 initiates an epithelial damage and pro-inflammatory response in the alveolar compartment of the ventilated lung. Lung protective ventilatory approaches may be used to reduce lung damage during OLV in thoracic surgical patients.

A-309

Improvement of associated respiratory problems in morbid obesity patients after bariatric surgery

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Background and Goal of Study: Obstructive sleep apnea syndrome (OSAS) is present in 44% of patients scheduled for bariatric surgery. Associated

respiratory problems to OSAS are related to overlapping condition (COPD) and/or obesity hypoventilation syndrome (OHS). The aim of our study was to know the influence of long-term weight loss in the respiratory comorbidities associated to obesity.

Material and Methods: We have followed all patients scheduled for open Roux-Y gastric bypass plus gastroplasty with respiratory co-morbidity during a five-year period. Patients who were positive on polysomnographic studies and required CPAP treatment prior surgery were included. All patients were managed by the same anaesthetic and surgery protocols. One year after the procedure, we performed polysomnographic studies, arterial blood gases and pulmonary function tests to all patients.

Results and Discussion: From 209 patients scheduled for bariatric surgery during the study period, 105 patients had respiratory co-morbidity. Of them, 30 patients needed CPAP-BiPAP treatment before surgery, which were included in our study. Main results are expressed on the table.

	Before surgery (n = 30)	After surgery (n = 30)
Age median (range) years	44 (25–61)	47 (29–63)
BMI (Kg/m ²)	56.5 ± 8.4	32.1 ± 5.3*
Hospital stay (days) (median and range)	6.9 ± 1.7 (7; 4–11)	
pO ₂ arterial (mmHg)	73.8 ± 10.6	90.5 ± 11.5*
pCO ₂ arterial (mmHg)	44.5 ± 5.7	40.6 ± 4.9*
A-a O ₂ diff. (mmHg)	19.9 ± 7.4	10.4 ± 6.7*
FEV1 (%)	76.6 ± 11.9	101.7 ± 29.1*
FVC (%)	79.4 ± 11.4	111.9 ± 12.5*
FEV1/FVC (%)	85.1 ± 6.8	81.4 ± 8.0
Desaturation rate (/h)	47.8 ± 23.2	16.6 ± 10.6*
Time of sat <90% (%)	42 ± 22.6	3.3 ± 5.9*
CPAP treatment (%)	100	13.8 [#]

mean ± SD; *p < 0.05 t-Student; [#]p < 0.05 Chi-square.

Conclusions: The weight lost obtained after bariatric surgery improved arterial blood gases values, respiratory test and polysomnographic results. Therefore, we were able to retire CPAP treatment in most of patients.

A-310

Effects of low dose intrathecal morphine on pulmonary function after major abdominal surgery under remifentanyl/propofol TCI anaesthesia

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Background and Goal of Study: Respiratory function is markedly affected after major and painful abdominal surgery¹. We tested the hypothesis that under remifentanyl/propofol TCI anaesthesia, providing intense analgesia with preoperative intrathecal low dose morphine will decrease the effects on postoperative respiratory function, over a 120-h follow-up period compared to IV morphine exclusively.

Material and Methods: 32 patients were randomly allocated to receive in a double blind fashion either intrathecal hyperbaric bupivacaine (1 mg) alone (control group: CG) or intrathecal hyperbaric bupivacaine (1 mg) and morphine 0.3 mg (ITM). A TCI remifentanyl/propofol anaesthesia was used. 30 minutes before end of surgery the CG received IV morphine 0.2 mg/kg. Postoperative management was identical in the two groups-IV patient-controlled analgesia with morphine. During the first 24-h respiratory rate (RR) was assessed and arterial blood gases were sampled and analysed. Measurements of forced expiratory volume in 1 s (FEV1), vital capacity (VC), forced vital capacity (FVC), peak expiratory flow rate and pulse oxymetry were performed the day before surgery (baseline values) and postoperatively from day 1 until day 5. Morphine consumption was recorded. Postoperative pain was tested at rest and while breathing deeply using a visual analog scale (VAS). Statistical analysis was performed and P < 0.05 was regarded as significant.

Results and Discussions: No difference was found in the measurements of RR, PaCO₂, FEV1, VC, FVC and PEFr. In the ITM the PaO₂/FiO₂ ratio was lower compared to the CG (291.94 ± 86.39 versus 411.92 ± 120.15) during the first 4-h (p < 0.05). IV Morphine consumption was lower in the ITM (18.5 ± 17.94 mg) compared to the CG (35.56 ± 27.54 mg) on the first post-operative day only (p < 0.05). No difference was found in the VAS pain score.

Conclusions: Under remifentanyl/propofol TCI anaesthesia intrathecal morphine (0.3 mg) administered just before major abdominal surgery has no beneficial effects on postoperative respiratory function compared to a control group receiving only IV morphine. These results could be explained by the similar analgesia provided by both techniques.

Reference:

1 Sifakus NM Thorax 1999;54:458–465.

A-311

High-frequency percussive ventilation during one-lung ventilation for robotically enhanced MIDCAB

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Background and Goal: Robotically enhanced minimally invasive direct coronary artery bypass (MIDCAB) often requires prolonged one lung ventilation (OLV). We have compared the intra-operative effects on gas exchange and lung mechanics of high-frequency percussive ventilation (HFPV) on the deflated left lung with conventional OLV.

Material and Methods: After EC approval and patient informed consent, 24 patients were randomised to conventional OLV (flow 5 L/min, F_IO₂ 0.5, PEEP 3 cmH₂O) (group A) or HFPV (peak pressure 25 cmH₂O, F_IO₂ 0.5, PEEP 3 cmH₂O) of the left lung (LL) (group B) with a VDR 4 (Idaho, USA). Tidal volume (TV), compliance (C_L) and airway resistance (Raw) were recorded for both lungs together and for the left (LL) and right (RL) lung after induction of anaesthesia. During OLV F_IO₂ was 0.5 and respiratory rate 12/min in the right lung. In group A, RL TV volume was equal to that of both lungs, in group B it was kept identical to that measured during two lung ventilation. Arterial blood gas analysis and lung mechanics were assessed every 30 min during OLV and after the procedure, following an alveolar recruitment manoeuvre of the LL in both groups.

Results and Discussion: During OLV, PO₂ in group A was significantly lower vs baseline and group B (Figure 1). In both groups pH and PCO₂ were similar to baseline values. In group A postoperative LL C_L was lower vs baseline (15 ± 4 vs 25 ± 6 ml/cmH₂O, P < 0.001) and LL Raw was higher (29 ± 11 vs 18 ± 7 cmH₂O/l.s, P < 0.02). These parameters did not change in group B. In group A, postoperative LL and RL TV were different from baseline: 239 ± 56 vs 321 ± 52 ml (P < 0.002) and 431 ± 70 vs 345 ± 45 ml (P < 0.005), but did not significantly change in group B.

	TLV	T30	T60	T90	T120	T150
Gr A	169	86*†	90*†	96*†	103*§	109*§
Gr B	175	178	182	184	144	150

PO₂ in mmHg. TLV: two lung ventilation.

*P < 0.01 vs TLV; †P < 0.0001; §P < 0.03 vs Group B.

Conclusion: HFPV of the deflated lung during OLV preserves arterial PO₂ significantly better than conventional OLV. Furthermore it prevents changes in TV, C_L and Raw, noticed after conventional OLV.

A-312

Incidence and risk factors of nosocomial pneumonia in neurosurgical intensive care unit

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Background and Goals: Nosocomial pneumonia (NP) is a common problem in neurosurgical intensive care unit (NSICU) (1). The aim of this study was to determine the risk factors (RF) and the incidence of NP in patients admitted in NSICU for aneurysmal subarachnoid hemorrhage (ASH).

Materials and Methods: The present study used data collected prospectively by the local nosocomial infection surveillance system. Were included patients over 16 years admitted to the NSICU in a university hospital for ASH between January 1998 and January 2002 and who stayed more than 48 h. NP was defined according to the Center for Disease Control and Prevention (CDC) criteria (2). RF that were significant in univariate analysis were tested using multivariate analysis and logistic regression. Significance level P < 0.05.

Results: 495 patients met inclusion criteria. 302 received mechanical ventilation for longer than 24 h. 137 NP were identified in 112 patients (incidence 27.7%). Thus the most frequent nosocomial infection (NI) was NP (34.2% of NI), followed by tracheal infections (30.2%) and urinary tract infections (23.2%). Factors independently associated with NP are shown in the table:

	Initial model		Final model		
	aOR	p	aOR	[CI 95%]	p
WFNS	1.14	0.41			
Male sex	2.45	0.001	2.49	[1.44–4.30]	0.001
Age	1.0005	0.96			
Hospital stay	1.06	<10 ⁻⁴	1.06	[1.04–1.08]	<10 ⁻⁴
IGS	1.01	0.48	1.007	[0.98–1.03]	0.56
GCS < 9	2.22	0.08	1.72	[0.91–3.26]	0.095
MV > 1d	14.51	0.0005	13.76	[3.06–61.73]	0.0006

Conclusions: NP is a common infection in NSICU. The main RF for NP is mechanical ventilation. If classical RF have been identified in our study, the male gender is not usually associated with NP. These RF could be used to constitute a predictive risk index for NP.

References:

- Berrouane Y, Daudenthum I, Riegel B, et al. *J Hosp Infect* 1998;40(4): 275–80.
- Garner JS, Jarvis WR, Emori TG, et al. *JM. Am J Infect Control* 1988;16: 128–40.

A-314

Comparison of two types of ventilatory circuit (double-limb vs single-limb) on airway climate during low-flow anesthesia in patients undergoing short-duration peripheral procedures

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Background and Goal of Study: Single-limb ventilatory circuits are suggested to be more thermally efficient than conventional two-limb circuits (1). The aim of this study was to compare the effect on the airway climate of these two types of circuit in patients undergoing short peripheral surgery under low-flow anesthesia.

Materials and Methods: After IRB approval and informed consent, 24 ASA I/II patients undergoing thyroidectomy or rhinoseptoplasty were prospectively included (50 ± 16 yr, 62 ± 16 kg) and randomized into 2 groups: double-limb (Europe Medical®) and single-limb circuit (Vital Signs®). The mean inspiratory values of the temperature, relative (RH) and absolute (AH) humidities were measured between the breathing filter (Clear-Guard Mid, Intersurgical®) and the catheter mount. Data were obtained using the Gibeck Humidity Sensor System (Gibeck®) inserted between the filter and the catheter mount. An oesophageal probe was inserted to assess the central core temperature of each patient. The circuit was closed immediately after tracheal intubation (T0) (Fresh gas flow: 1 L/min, 50% air/50% oxygen mixture, RR: 12 cycles/min, PEEP: 0 cmH₂O). The tidal volume was adjusted to maintain ETCO₂ at 35 mmHg. Sevoflurane (0.8 MAC) and remifentanyl (0.15–0.20 µg/kg/min) were used for maintenance of anaesthesia. Data were obtained at T0, T5 and then every 15 minutes until the end of the procedure.

Results and Discussions:

	Double-limb	Single-limb	P
OR T°	22.2 ± 0.4	22.3 ± 0.5	0.98
Patient T° at arrival	36.7 ± 0.2	36.5 ± 0.3	0.17
Mean insp. T°	27.8 ± 0.6	29.3 ± 0.32	<0.001
AH (mg/L)	25.9 ± 1.4	25.5 ± 2.0	0.63
RH (%)	95.9 ± 2.6	88.4 ± 3.1	<0.001
Delta (end-start) T°	0.63 ± 0.26	0.16 ± 0.3	<0.001
Duration (min)	90 ± 29	113 ± 10	0.12

Mean ± SD; T° expressed in °C.

Conclusion(s): Single limb circuits allowed higher inspiratory temperatures and reduced the patient temperature drop during anaesthesia.

Reference:

- Branson RD, Campbell RS, Davis K et al. *Anesth. Intensive Care* 1998;26:178–183.

A-315

Does body mass index influence on PaCO₂ level during anaesthesia with HFJV for the laser microsurgery on the larynx?

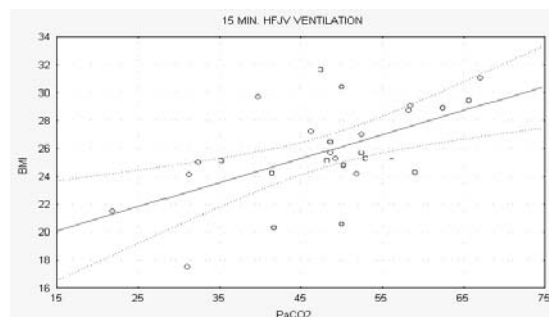
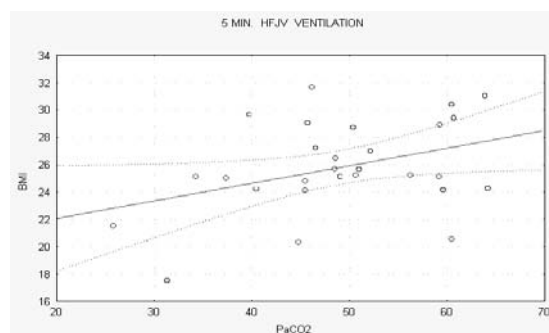
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The Goal of the Study: During our earlier experience with anaesthesia with high frequency jet ventilation we observed problems with elimination CO₂ especially in obese patients. The goal of this study was to investigate the correlation between the body mass index (BMI) and PaCO₂ in ENT patients during anaesthesia for the laser microsurgery on the larynx.

Material and Method: After obtaining an approval of the local Ethics Committee, 27 ASA I–III patients were included in the study. One hour prior to anaesthetic all patients received midazolam (0.2 mg/kg p.o.) as a premed. General anaesthesia was induced with alfentanil (30 mcg/kg), propofol (2 mg/kg) and mivacurium (0.15 mg/kg), next the tip of the Hunsaker teflon jet catheter was placed about 2 cm above carina. The HFJV was then commenced with the same parameters for each patient (f – 150/min, FiO₂ – 0.4, insp. time – 40% and driving pressure – 2 bars). The arterial blood gas samples were taken for PaCO₂, PaO₂, SaO₂ and pH analysis prior to the start of HFJV, at 5 and 15 min. during jet ventilation and laser microsurgery.

Results and Discussion: There was no significant correlations between BMI and PaCO₂ before the start of HFJV, however patients with increased BMI had shown CO₂ retention during the course of anaesthesia. We have demonstrated significant positive correlation at 5 min. and 15 min. after start of jet ventilation (r-Pearson 0,3833, p < 0,044 and r-Pearson 0,5487, p < 0,003) respectively.



Conclusion: Calculated BMI must be taken into account adjusting parameters of ventilation for patients undergoing high frequency jet ventilation for laser microsurgery of the larynx. If BMI is greater than 25 (normal BMI range 18.5 to 25) it is necessary to increase parameters of HFJV (driving pressure, frequency or inspiration time) to maintain normocapnia.

References:

- Bourgain JL, et al. *Br. J. Anaesth.* 1990; 64: 327–330.
- Biro P, et al. *Br. J. Anaesth.* 2000; 84: 635–637.

A-316

Does prone position during spine surgery affect respiratory mechanics?

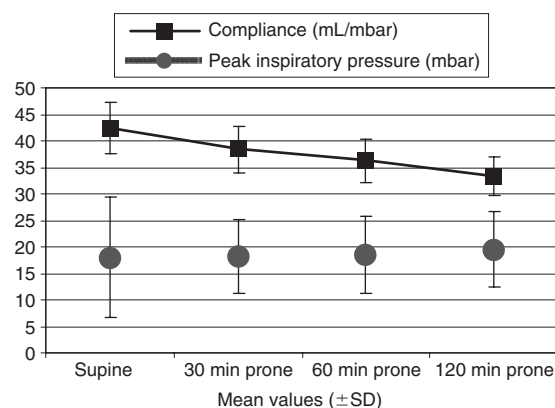
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Background and Goal of the Study: The goal of surgical positioning is to facilitate the surgeon's technical approach while balancing risk factors. The goal of this study was to assess the effect of prone position on respiratory mechanics during spine surgery.

Materials and Methods: Thirty one ASA I–III patients, scheduled for lumbar spine surgery in prone position, were studied. The anaesthetic was standardized and pulmonary ventilation was adjusted to maintain PETCO₂ around 32 mmHg. The following parameters were recorded: peak inspiratory pressure and pulmonary compliance while the patient was supine (about 15 min after intubation) and 30, 60 and 120 min after he was turned in prone position. Statistical analysis was performed with paired t-test and one-way ANOVA.

Results: Peak inspiratory pressure increased with time but this increase was not statistically significant. Pulmonary compliance decreased significantly with time (34 mL/bar after 120 min in prone position versus 42 mL/mbar in supine position) (p < 0.01).



Conclusion: Prone position decreases pulmonary compliance and this decrease is time-dependent. If longer operations are planned, this finding must be taken into consideration.

A-317

Effect of PEEP on pulmonary compliance and functional residual capacity in cardiac surgery patients during the postoperative period

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Background and Goal of Study: Pulmonary compliance, resistance and functional residual capacity (FRC) are useful parameters helping to follow the effect of Positive end-expiratory pressure (PEEP) in ventilated patients. FRC can also be used to estimate recruited volume with PEEP. We measured the effect of PEEP on compliance, resistance and FRC in 9 ventilated patients after cardiac surgery at 0, 4 and 8 cmH₂O PEEP.

Materials and Methods: Compliance was estimated by a multi-linear regression model (1), FRC was estimated with the N₂ dilution method by abruptly changing the F_iO₂ from 50% to 100% using 2 ventilators. Recruited volume was estimated by the evolution of FRC at the 3 level of PEEP. Airway pressure, flow, inspiratory and expiratory partial pressures in O₂ and CO₂ were measured by a Datex MCOVX-S5 module. Blood gas was measured at each level of PEEP. Stata 7 was used for data analysis and computation of pulmonary model using the following equation: $V_i = a + b \cdot P_a + c \cdot P_a^2 + d \cdot \text{flow}^2 + e \cdot P_a \cdot T_i$ where V_i is insufflated volume, P_a airway pressure, flow inspiratory flow and T_i time from the beginning of inspiration. One way analysis of variance with Bonferroni correction was used to compare coefficients at the 3 level of PEEP.

Results: (1) coefficients of the pulmonary model

Coefficient	PEEP 0	PEEP 4	PEEP 8	p
b	30.05 ± 9.34	39.13 ± 11.32	45.16 ± 12.99	0.0307*
c	0.61 ± 0.24	0.32 ± 28	0.14 ± 31	0.0068*
d	-0.24 ± 0.09	-0.18 ± 0.04	-0.18 ± 0.05	ns
e	1.77 ± 1.2	0.57 ± 0.54	0.81 ± 0.68	ns

*Only PEEP 8 compared to PEEP 0 are significant.

(2) change in FRC

	PEEP 4	PEEP 8
Δ FRC	188 ml	435 ml

Conclusions: In our small group of postoperative cardiac patients only PEEP 8 cmH₂O significantly increased compliance. The estimated recruited volume was however small.

Reference:

1 Ranieri VM *Am J Respir Crit Care Med* 1994;149:19-27.

A-318

Comparison of valve and blower based ventilators in different modes of non-invasive ventilation

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Background and Goal of Study: Zeus® is a new anesthesia work station with a closed breathing circuit that allows augmentation of spontaneous breathing. Ventilatory pressures are build up by a blower. We asked whether there are differences in breathing comfort between ventilators using blowers or else valves for flow generation.

Methods: 11 healthy, awake volunteers (6 f, 5 m; 35 ± 6 yrs) supplied with fixed standard nose masks (Respironics) were connected to 7 different ventilators. 3 were blower based: BiPAP Vision® (Respironics), LTV 1000® (Pulmonetic Systems), Zeus® (Dräger Medical); 4 were valve based: Evita 2® (Dräger Medical), Bennett 840® and Bennett 7200® (Nellcor Puritan), Veolar® (Hamilton Medical). 4 ventilatory modes were used: CPAP (PEEP 3 mbar), pressure support (ΔPS 5 mbar, PEEP 3 mbar), pressure-controlled SIMV

(PC: 10 bpm, ΔP_{insp} 10 mbar, ΔPS 5 mbar, PEEP 3 mbar), and volume-controlled SIMV (VC: 10 bpm, VT 6 ml/kg, ΔPS 5 mbar, PEEP 3 mbar). Volunteers were instructed to breathe freely for a few minutes. 16 questions concerning cycling and breathing effort during in- and expiration had to be answered on a scale from 1 (very good, extremely comfortable) to 5 (very poor, extremely uncomfortable). The 2 final questions asked to evaluate breathing comfort during in- (I) and expiration (E) as a whole. SPSS® 11.0; ANOVA, p < .05.

Results: Breathing comfort differed significantly between the ventilatory modes (all ventilators; mean ± SD; P < .001):

	CPAP	PS	PC	VC
I	1.9 ± 0.7	2.0 ± 0.9	2.9 ± 0.9	4.1 ± 0.9
E	2.4 ± 1.0	2.5 ± 1.0	3.5 ± 0.9	4.0 ± 1.2

To compare ventilators, PC and VC were excluded, as Bipap vision is not capable delivering these modes. We found no difference between ventilators during I. During E blower based ventilators were scored better than valve based ventilators (2.2 ± 1.0 versus 2.6 ± 0.9; P = .007).

Conclusions: Awake volunteers experience pressure and volume controlled ventilatory modes – although synchronized and with supported spontaneous breaths – as extremely unpleasant. Differences between ventilators are far less, but during expiration blower based ventilators scored better than valve based ventilators. It is remarkable that Zeus, despite its totally closed breathing circuit, belonged to the 'more comfortable' group of ventilators.

A-319

Evaluation of pulmonary air distribution by Electrical Impedance Tomography (EIT) during single lung ventilation

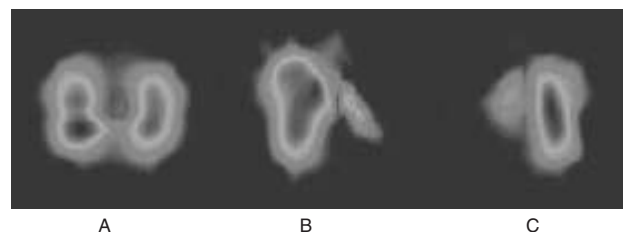
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Background and Goal of Study: Electrical impedance tomography (EIT)¹ is a promising novel technique to assess continuously respiratory function with high temporal resolution. Changes in thoracic gas volume lead to correspondent changes in thoracic impedance. The aim of this study was to evaluate EIT during single-lung ventilation.

Materials and Methods: Eight adult patients undergoing elective thoracic surgery with single lung ventilation using a standard double lumen tube were included. Data were collected during ventilation of both lungs (tidal volume = 800 ml), the left lung (tidal volume = 400 ml), and the right lung (tidal volume = 400 ml), respectively. Correct placement of double lumen tube was confirmed by bronchoscopy. The EIT measurement was performed by using 16 electrodes placed around the thorax at xyphoid level. Electrical current (5 mA, 50 kHz) was injected sequentially, and the potential differences were measured at the remaining electrodes.

Results and Discussions: Single lung ventilation was successful in all patients. The functional EIT images (Figure) clearly demonstrate the difference in pulmonary air distribution when comparing ventilation of both lungs (A), single right lung (B), and single left lung (C).



Figure

Conclusion: EIT seems to be a sensitive non invasive methode for "on time monitoring" of distribution of ventilation. Further studies are needed to demonstrate the usefulness of this novel technique, especially in patients with acute or chronic lung failure.

Reference:

1 Fredrichs et al. Non-invasive radiation-free monitoring of regional lung ventilation in critically ill infants. *Intensive Care Med* 2001; 27.

Transfusion and Haemostasis

A-321

Partial success of recombinant activated factor VIIa (rFVIIa) in severe hemorrhage in acquired von Willebrand disease

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Background and Goal of Study: Acquired von Willebrand (vWa) disease is an extremely rare disease (0.04–0.13%). It is usually associated with auto-immune or lymphoproliferative disease. It is caused by vWF antibody formation. Hemorrhage in this case is difficult to treat and mortality is high. We report the management of a patient with this disease where all treatment resources were used including recombinant activated factor VII (rFVIIa).

Materials and Methods: A 72 years male patient with severe vWa associated with Waldenstrom macroglobulinemia presented with severe hemorrhagic cystitis secondary to treatment by cyclophosphamide. Blood tests revealed F VIII = 15%, W Ag = 15%, W activity < 1% with a particularly high-titer inhibitors (collagen binding assay) > 150 Bethesda unit.

Results and Discussions: Several cystoscopic hemostatic procedures were done during the next days with regular factor VIII and vWF, platelet, tranexamic acid and even Immunoglobulins administration resulting in normalization of FVIII and vWF levels, but with a persistent low vW activity because of high-titer antibodies. Hematuria remained severe necessitating 43 packed red cells (PRC). Radiological embolisation of the bladder was unsuccessful. Finally, administration of rFVIIa (60 µg/kg/3 hours) allowed a relative control of bleeding and total hemostatic cystectomy was done. On the first postoperative day 22 PRC were needed and rFVIIa was continued for 7 days. Bleeding continued moderately necessitating 1–2 PRC daily. Prednisone was then tried (120 mg daily) and allowed on the third day (20th postoperative day) achievement of adequate hemostasis.

Conclusion: rFVIIa helps to ameliorate hemostasis in acquired vWa although its effect is not complete. It allows bypassing the role of FVIII and stimulating thrombin generation. However defective platelet adhesion to collagen persists maintaining a defective platelet plug. Prednisone had probably helped by reducing the effect of circulating vWF inhibitors.

A-322

Monitoring platelet function following GP-IIb/IIIa-receptor inhibition and heparin administration: in-vitro comparison of Sonoclot analyzer and platelet aggregometry

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Background: An increasing number of emergency cardiac surgery procedures is performed on patients following GP-IIb/IIIa-inhibition. Reliable bedside monitoring of platelet function during perioperative heparin therapy is therefore gaining importance¹. The aim of this in-vitro study was to assess platelet function after various doses of tirofiban with and without heparin administration using the Sonoclot analyzer² and to compare the results with ADP activated platelet poor plasma aggregometry (AGG)³.

Methods: With institutional approval and informed consent citrated blood samples were drawn from 20 healthy volunteers. Samples were analyzed after recalcification and addition of tirofiban (0, 0.125, 0.25, 0.5, 1 µg ml⁻¹) with/without heparin (1 U ml⁻¹) using Sonoclots' glass bead activated cuvettes with heparinase (hGB), standard glass bead activated cuvettes (GB), and AGG. Sonoclots' platelet function (PF) and % AGG were recorded as mean of duplicate measurements. Statistical analysis was done using Bland-Altman Analysis, linear correlation and ANOVA with post-hoc Bonferroni-Dunn correction. P < 0.05 was considered significant.

Results: After tirofiban alone hGB-PF, GB-PF and %AGG showed a comparable, significant gradual decrease (tirofiban 0–1 µg ml⁻¹). For hGB-PF vs. GB-PF mean bias ± 2SD was 0.3 ± 1.0 and correlation coefficient (r²) was 0.83; for hGB-PF vs. %AGG r² = 0.80 and for GB-PF vs. %AGG r² = 0.74 was found. After tirofiban plus heparin hGB-PF and %AGG decreased again gradually (tirofiban 0–1 µg ml⁻¹), GB showed a nearly complete loss of PF (hGB-PF vs. GB-PF: 1.4 ± 2.1, r² = 0.23; hGB-PF vs. %AGG: r² = 0.78; GB-PF vs. %AGG: r² = 0.35).

Conclusion: These data indicate that GP-IIb/IIIa inhibition in the presence of heparin is accurately reflected by the Sonoclot analyzer using hGB cuvettes. Standard GB however, is reliable in assessing platelet function only in situations, where no heparin is used.

References:

- 1 *Cardiology* 1999; 92: 240–7.
- 2 *Anesth Analg* 1998; 87: 1228–33.
- 3 *Platelets* 2003; 14: 351–4.

A-323

Screening for deep venous thrombosis in children undergoing scoliosis surgery

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Background and Goals: The incidence of deep venous thrombosis (DVT) in paediatric population has been reported to be lower than in adults (1, 2). The contribution of congenital prothrombotic disorders remains uncertain. The effectiveness of ultra sound and Doppler study in detecting DVT has not been established. We therefore undertook a prospective study to define the incidence of DVT in children operated for scoliosis.

Material and Methods: Patients included in the study were younger than 18 years and scheduled for posterior arthrodesis. Ultra sound examination and Doppler study and laboratory screening were performed a day before surgery and at 3rd, and 15th postoperative days. Laboratory tests included: haemoglobin level, fibrinogen level, platelet count, prothrombin time, activated cephalin time, antithrombin III, total protein C, total protein S, F1 F2 (fragment 1 and 2 of thrombin) and thrombin–antithrombin complex (TAT). Available results were compared with normal values derived in our laboratory.

Results: The preliminary results were obtained in 20 teenagers: 11 girls and 9 boys aged 14.8 ± 2.5 years. No patient developed clinical symptom of venous thrombosis. Preoperative Doppler and ultra sound exam were normal in all patients. A partial thrombosis of deep femoral vein was observed in 2 patients on 3rd day with normal coagulation tests and no risk factors. These pictures were missed on, and 15th days control without a specific therapy. There was no correlation between results of coagulation tests and clinical exam and Doppler and ultra sound findings for all the patients. Children have been seen 1, 6 and 12 months after without any thromboembolic complications.

Conclusions: Routine screening for DVT in children undergoing scoliosis surgery seems not be recommended. In our study, DVT was rare and neither ultra sound exam and Doppler nor coagulation tests were correlated with clinical findings and evolution.

References:

- 1 Van Ommen HC. *J of Pediat* 2001; 138:676–81.
- 2 Andrew M. *Blood* 1994; 83:1251–7.

A-324

Effect of moderate hypothermia on coagulation and fibrinolysis – Experimental study

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Background and Goals: Aim of this study was to investigate the effect of moderate hypothermia on natural inhibitors of coagulation: antithrombin III (ATIII), and protein C (PC) and factors of fibrinolytic system: plasminogen (PLG) and α₂-antiplasmin (α₂-APL).

Material and Methods: Ten male New Zealand rabbits were subjected to moderate hypothermia of 32°C. They were anaesthetized and a tracheotomy was performed for continuous mechanical ventilation under general anaesthesia. Cooling was achieved by applying icepacks directly to the skin. The animals were kept at a steady core temperature (oesophageal thermometer) of 32°C for 60 minutes. After that period, blood samples were obtained. ATIII, PC, PLG and α₂-APL were determined by chromogenic assay methods and compared to normothermic samples obtained from the same animal a few days before. Paired t-test was used for the statistical analysis of ATIII, PC and PLG and Wilcoxon Signed Ranks Test was used for the statistical analysis of α₂-APL. P < 0,05 was considered statistically significant.

Results: ATIII, PC and α₂-APL were significantly reduced, while PLG was significantly increased.

	Normothermia	Hypothermia	Statistical significance
ATIII (%)	103,4 ± 12,54	82,7 ± 20,78	P < 0,05
PC (%)	70,1 ± 7,51	53,1 ± 7,34	P < 0,01
PLG (%)	14,5 ± 0,52	17,3 ± 2,45	P < 0,01
α ₂ -APL (%)	97 ± 9,63	83,7 ± 13,94	P < 0,05

Conclusions: This study suggests that even though the hypothermia period was relatively short, haemostatic mechanism was impaired. Our data indicate an increased thrombotic and fibrinolytic tendency. Major trauma and abdominal surgery are related to hypothermia, usually of a duration longer than 60 minutes. Coagulation defects are relatively early effects of hypothermia; they should be either prevented or corrected promptly, well before standard laboratory tests or clinical signs indicate the disorder.

A-325

Clinical events after hip fracture surgery: the ESCORTE study

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Background and Goal of Study: Snapshot on hip fracture to measure the incidence and the predictive risk factors for clinical venous thromboembolic events (VTE), to describe the use of antithrombotic prophylaxis and to measure mortality and its predictive risk factors after 6 months.

Materials and Methods: Prospective, multicenter (n = 525) epidemiological study. Inclusion of operated hip fracture patients between October 1st and November 30, 2002. VTE were assessed by a critical events committee. Risk factors were isolated using a logistic regression. Odds Ratio – CI 95%.

Results and Discussions: 7019 patients were included among which 6860 (97.7%) were analysed: age 81 ± 12 (76% women, 63% > 80 yr), history of cardio-vascular disease 63%, history of deep vein thrombosis (DVT) or pulmonary embolism (PE) 6.4%. Surgery was performed with general anaesthesia 56%, (among which regional + general 7%) and regional 44%. A low molecular weight heparin (LMWH) treatment was initiated pre-operatively in 51% of the patients. The median prophylaxis duration was 6 weeks. At 3 months, 75 symptomatic and confirmed DVTs and 15 PEs were reported in 85 patients (global rate 1.3% (CI 1.1%–1.6%). Fatal PE rate was 0.3%. Positive predictive risk factors: history of DVT or PE (OR 2.5 (1.6–4.0)), interval between the induction of anaesthesia and arrival in the recovery room greater than 2 hrs (OR 2.2 (1.4–3.4)). The LMWH treatment was beneficial (OR 0.3 (0.1–0.8)). After 6 months, 1066 patients died (14,7%) among which 366 died during the first month. The main causes were cardiac (31%), neurological (20%) pulmonary infections (8%), other causes (38%) and 49 (4.1%) deaths were declared as possible or definite PE. Major bleeding occurred in 86 (1.2%) patients (16 deaths). The main mortality predictive risk factors were: age, gender, reduced preoperative autonomy and cognitive functions, and complications requiring a re-hospitalisation. The use of regional anaesthesia (peripheral blocks 99%) combined with general anaesthesia was beneficial (OR 0.6 (0.4–0.9)).

Conclusion(s): This very large study demonstrates that LMWH prophylaxis is applied widely after hip fracture in France and provides a high level of efficacy and safety. However the high death rate should lead to a major change in the care of these patients.

A-326

Role of thromboelastograph in open heart surgery after cardiopulmonary bypass

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Background and Goal of Study: Non surgical bleeding after cardiac surgery still remains an unpredictable and troublesome problem that frequently complicates perioperative period. Thromboelastography (TEG) has been shown to be a better predictor of postoperative bleeding than routine coagulation studies. The aim of the study is to evaluate the efficacy of TEG in the reduction of bleeding, transfusion requirements and the rate of reexplorations postsurgery.

Materials and Methods: We report a retrospective study. We compare the results of two groups of patients, all of them undergoing CPB. In group A

(n = 177) none of them went through TEG study. In group B (n = 167) patients with high risk were scheduled to TEG study. The time of the data collection were 8 months. The measurements were performed at the end of the surgery. Data: demographic, intra and postoperative transfusion requirements, postoperative bleeding and the reason for it.

Results and Discussions: We did not find demographic differences. 33 patients of the group B were scheduled for TEG study. Transfusion requirements during the first day were (mean ± SD) group A: erythrocyte concentrates = 2,57 ± 3,2, fresh frozen plasma = 1,1 ± 2,5, platelets: 0.3 ± 0,7. group B: erythrocyte concentrates = 2,57 ± 3,2, fresh frozen plasma = 1,1 ± 2,5, platelets: 0.3 ± 0,7 and the total transfusion: group A = 3,5 ± 6, group B = 2,83 ± -4,78.

	Group A	Group B
N° patients	177	167
Incidence of reexploration	12,42% (n = 22)*	5,38% (n = 9)*
Surgical bleeding	27,27% (n = 6)*	66,6% (n = 6)*
Bleeding of coagulopathy	72,73% (n = 16)*	33,3% (n = 3)*

*p > 0,05.

Conclusions: Since the use of TEG in cardiac surgery in our Hospital the rate of incidence of reexploration has been reduced. TEG helps considerably in management of post/perioperative coagulopathies and contributes to its early diagnosis. 3. TEG reduces the transfusion requirements after cardiac surgery.

References:

- 1 D. Royston, Reduced haemostatic factor transfusion using heparinase-modified thromboelastography during cardiopulmonary bypass. *Br J Anaesth* 2001;86:575–78.
- 2 Vig S, Thromboelastography: a reliable test? *Blood Coagul Fibrinolysis* 2002 Sept; 13(6):575.

A-327

Effect of sampling site on thromboelastogram in cardiac surgery

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Background and Goal of Study: Thromboelastography (TEG) has been shown to reduce transfusions in cardiac surgery. We have evaluated the effect of heparin coated central venous catheters and heparin flushed arterial lines on thromboelastography analysis, in order to determine which reference sample could be used as a control for perioperative haemostatic monitoring in cardiac surgery.

Material and Methods: After EC approval and patient informed consent, in 15 adult patients (group A) scheduled for cardiac surgery, a blood sample for TEG analysis and activated clotting time (ACT) was simultaneously drawn from a heparin coated central venous catheter (CC) and a heparinised saline flushed arterial catheter (AC). Prior to analysis a 10 ml waste sample was aspirated. In 15 other patients (group B) waste sample was 20 ml and only CC was sampled. TEG and ACT samples were analysed in standard and heparinase cuvettes. Patients on aspirin <7 days prior to surgery or on anti-coagulants, were excluded.

Results and Discussion: TEG analysis in group A revealed that R-time, angle and maximal amplitude (MA) were significantly different in standard vs heparinase TEG from the CC, but not from the AC (Table 1). This suggests heparin leaching from the CC. However, ACT was not capable to demonstrate this difference. At the end of the procedure, after protamine administration, no differences in TEG could be demonstrated.

Table 1.

Group A	R	Angle	MA
Standard (CC)	11.2 (6) [†]	46.3 (17.8) [†]	57.9 (7.5) [*]
Heparinase (CC)	5.7 (2.9)	59.4 (10.3)	61.6 (6.4)
Standard (AC)	6.3 (3.8)	57.2 (10.8)	60.2 (7.3)
Heparinase (AC)	5.6 (2.9)	60.6 (8.7)	63.1 (5.9)

*P < 0.01 vs Heparinase CC; [†]P < 0.05 vs Standard AC.

In group B standard TEG showed significant differences in R-time, angle and MA (P < 0.01) vs heparinase TEG.

Conclusion: These data suggest that sampling from heparin coated catheters influences TEG, both with 10 and 20 ml waste samples. Therefore

baseline measurements for haemostatic monitoring can be performed with standard TEG for arterial samples, but heparinase TEG should be used for samples from heparin coated catheters.

Reference:

L. Shore-Lesserson et al. *Anesth Analg* 1999; 88:312–319.

A-331

6% Hydroxyethyl starch 130/0.4 versus 3% modified fluid gelatin for volume replacement in patients undergoing on pump cardiac surgery

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Background and Goal of Study: Synthetic colloids are used to maintain adequate circulating blood volume during major surgery. The choice between the different solutions not only depends on the fluid replacing properties, but also on the incidence of side effects, in particular on hemostasis. This prospective randomized single blinded study compared 6% HES 130/0.4 (VOLUVEN®) versus 3% modified fluid gelatin (GELOPLASMA®) in terms of hemodynamic efficacy and hemostatic effects in patients undergoing elective cardiac surgery with cardiopulmonary bypass (CPB).

Materials and Methods: After institutional Ethic Committee approval and informed consent, 132 patients were randomized to receive either 6% HES 130/0.4 (HES) or 3% modified fluid gelatin (GEL) for perioperative volume management (including CPB priming) from induction of anesthesia until 20 hr after the end of surgery. Efficacy was evaluated by comparing the amount of fluid infused to achieve adequate cardiac filling pressures and cardiac output. Hemostatic effects were evaluated by comparing perioperative blood loss and the need for transfusion of allogeneic blood products. Perioperative blood losses were measured but also calculated from the pre and perioperative estimated blood volume and hematocrit using the formula of Samama et al. (1). Data between groups were compared using unpaired t-test and Fisher exact test. Statistical significance was accepted at $p < 0.05$. Data are expressed as mean \pm standard deviation.

Results and Discussions: Demographic data were similar in both groups. There was no difference in the amount of colloids administered (HES 49 ± 17 mL/kg; GEL 49 ± 15 mL/kg). Measured blood loss (HES 19 ± 12 mL/kg; GEL 19 ± 15 mL/kg) and calculated net RBC loss (HES 544 ± 305 mL; GEL 504 ± 327 mL) did not differ significantly. Need for transfusion of allogeneic blood products was similar in both groups. There was no difference in any of the measured hemodynamic parameters.

Conclusion: In the conditions of this study, HES 130/0.4 exhibited similar hemodynamic efficacy as 3% modified fluid gelatin and comparable hemostatic effects as evaluated by perioperative blood losses and transfusion needs.

Reference:

1 Samama CM et al. *Anesth Analg* 2002; 95: 287–293.

A-332

Comparison of Hextend versus Hextend-free intravenous fluid therapy on renal function in living donated kidneys

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Background and Goal of Study: The effect of hydroxyl ethyl starch (HES) preparations on renal function is subject to controversy (1). Hextend® is a colloid in a balanced salt solution used for volume expansion. Kidney graft outcome after Hextend infusion is assessed in patients after living related donor transplantation.

Materials and Methods: After ethical approval all living related donors and the matched recipient of the respective kidneys between May 2000 and January 2003 were identified. Living donor and recipient pairs given intravenous Hextend for volume replacement therapy during transplantation surgery were assigned to the HEX group ($n = 29$). HEX-free group is a comparison group where neither donor or recipient received intravenous Hextend ($n = 30$). The anaesthetic was standardized and immunosuppressive therapy given as per protocol. Data was collected from electronic records, discharge summaries and follow up transplant clinic notes Demographics (age, weight, gender, ASA status), iv fluids, creatinine (Cr) (baseline, day 1 and 3 months). Dialysis requirement in the first week and graft survival at 3 months (3m) are compared. Data was analyzed with ANOVA and Fisher Exact tests.

Results: Mean \pm SD, $p < 0.05$ considered significant.

	HEX	HEX free	P value
Urine output (ml)	812 \pm 1010	252 \pm 347	0.009
Hextend (ml)	1046 \pm 468	na	
L. Ringers (ml)	428 \pm 928	161 \pm 525	ns
N. Saline (ml)	2649 \pm 1477	2554 \pm 1425	ns
Cr baseline (mmol/l)	9.05 \pm 3.05	9.46 \pm 2.98	ns
Cr (Day 1) (mmol/l)	7.3 \pm 2.87	7.67 \pm 3.32	ns
Cr (3 m) (mmol/l)	1.33 \pm 0.29	1.31 \pm 0.29	ns
Dialysis (1 week)	3/29	2/30	ns
Graft Survival 3 m	29/29	30/30	ns

Conclusion: Kidney graft function at 3 months is not affected by the type of intraoperative fluid administered. Patients receiving Hextend, however, have a higher intraoperative urine output.

Reference:

1 Cittanova ML *Lancet* 1996; 348:1620–2.

A-333

Effects of ketamine on the coagulation response during and after cardiopulmonary bypass: a prospective, randomized, double-blind controlled study

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Background and Goal of Study: Inflammatory response after cardiopulmonary bypass (CPB) may result in uncontrolled platelet aggregation, thrombin activation, and disseminated intravascular coagulation. Many anesthetics possess immunomodulatory effects but their clinical effects during CPB remain unknown (1). We studied effects of ketamine on the coagulation response during and after CPB.

Materials and Methods: In the preliminary prospective study report, we randomized 25 patients underwent coronary artery bypass graft surgery in two groups: K-group ($n = 11$), which received 0.25 mg/kg ketamine, and P-group ($n = 14$), which received placebo. Serum samples were collected before operation (T0), after aorta clamp releasing (T1), 2 (T2), 12 (T3), and 48 hours (T4) after weaning from CPB.

Results and Discussions: Data (mean \pm SD) were shown by variance analysis.

Data		Measurements				
		T0	T1	T2	T3	T4
CRP (mg/dl)	K	3.6 \pm 2.9	2.0 \pm 1.6	2.6 \pm 2.1	33.2 \pm 17.0	122.2 \pm 53.3
	P	5.0 \pm 5.6	4.1 \pm 5.6	4.5 \pm 6.9	36.3 \pm 18.3	121.2 \pm 52.3
WBC ($\times 10^9$)	K	4.7 \pm 1.4 [†]	8.3 \pm 3.1	11.4 \pm 3.1	10.1 \pm 2.7	10.9 \pm 4.5
	P	7.0 \pm 3.1	8.9 \pm 4.7	12.3 \pm 3.3	10.1 \pm 3.0	8.7 \pm 3.5
PMN ($\times 10^9$)	K	3.1 \pm 1.4	5.9 \pm 2.8	9.3 \pm 2.7	9.2 \pm 3.1	9.1 \pm 4.1
	P	4.5 \pm 2.0	6.1 \pm 3.1	10.0 \pm 2.4	8.4 \pm 2.1	10.2 \pm 8.7
Htc (%)	K	0.35 \pm 0.1	0.21 \pm 0.0	0.32 \pm 0.2	0.34 \pm 0.2	0.29 \pm 0.3
	P	0.40 \pm 0.0	0.22 \pm 0.0	0.32 \pm 0.3	0.32 \pm 0.3	0.30 \pm 0.1
AT III (%)	K	80.0 \pm 9.5	50.9 \pm 5.4	57.4 \pm 9.7	66.5 \pm 9.0	67.9 \pm 7.9
	P	86.6 \pm 14.8	57.3 \pm 9.3	71.3 \pm 15.6	75.0 \pm 9.3	72.7 \pm 11.9
Fibrin (g/L)	K	3.3 \pm 0.7	1.9 \pm 0.3	2.2 \pm 0.3	2.7 \pm 0.5	4.3 \pm 1.5
	P	3.3 \pm 0.9	2.0 \pm 0.4	2.4 \pm 0.4	3.0 \pm 0.5	5.3 \pm 1.3
D-dim (μ g/mL)	K	0.3 \pm 0.1	1.8 \pm 1.3	2.8 \pm 1.7	2.1 \pm 1.3	0.7 \pm 0.2
	P	0.5 \pm 0.6	1.8 \pm 1.5	2.9 \pm 2.3	1.6 \pm 0.9	1.1 \pm 0.9

* $p < 0.05$ between groups; † $p < 0.05$ within groups (CRP = C reactive protein; WBC = white blood cell; PMN = polymorphonuclears; Htc = hematocrit; AT III = antithrombin; fibrin = fibrinogen; D-dim = D dimers).

Conclusion(s): In this preliminary study, results did not show any effect of small doses of ketamine on the coagulation response during and after CPB.

Reference:

1 Zilberstein G. *Anesth Analg* 2002; 95: 531–536.

A-334

Effects of high molecular weight hydroxyethyl starch solutions on platelets

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Background and Goal of Study: Hydroxyethyl starch (HES) solutions are known to impair platelet function by reducing the availability of the functional

receptor for fibrinogen on the platelet surface depending on their physico-chemical characteristics (1,2). The goal of the present experiments was test the effect of novel high molecular weight HES solutions on platelets.

Materials and Methods: After IRB approval and informed consent, citrated whole blood from 8 healthy volunteers was hemodiluted *in vitro* (0%, 20%) with either HES 550 (Hextend[®], Biotime[®]-Inc. Berkely, CA, USA), HES 600 (6%Hetastarch-Baxter[®], Deerfield, IL, USA), HES 200 (Elohäst[®], Fresenius Kabi Austria GmbH, Graz, Austria), or the solvents of Hextend[®] in its commercially available solution. An undiluted sample served as a control. Expression of platelet fibrinogen receptor (GP IIb-IIIa) and P-selectin were analyzed with and without agonist-stimulation using thrombin receptor activator peptide 6 (20 µM). After incubation with monoclonal antibodies (PAC-1, anti-CD62P), fixed aliquots were subjected to whole blood flow cytometric analysis using FACSCalibur[™] and CellQuestPro[™] software (Becton Dickinson Immunocytometry Systems, San Jose, USA). Statistics: one-way ANOVA ($P < 0,05$).

Results and Discussions: Platelet reactivity increased significantly after hemodilution with Hextend[®] and its solvents. This study shows that Hextend[®] does not inhibit platelet function as anticipated by its high molecular weight and degree of substitution. The platelet inhibiting effect of high molecular weight HES 600 (6%Hetastarch-Baxter[®]) was not significantly different from that of medium molecular weight HES 200.

Conclusion(s): The unexpected platelet stimulating effect of Hextend[®] is unique among the currently available HES preparations and may be, at least in part, be induced by its solvents containing calcium. Further studies are warranted to evaluate the clinical relevance of the platelet-activating effect of Hextend[®] on outcome variables such as blood loss.

References:

- 1 Stöggermüller B, Stark J, Felfernig M, et al. *Anesth Analg* 2000; 91:823-7.
- 2 Franz A, Bräunlich P, Gamsjäger T, et al. *Anesth Analg* 2001; 92:1402-7.

A-335

Is aprotinin useful to reduce blood loss in scoliosis surgery in children with Werdnig-Hoffmann (WH) disease?

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Background and Goal of Study: Aprotinin, an antifibrinolytic drug has been used successfully in major orthopaedic surgery in adults (1), but his usefulness in children is still controversial (2). We studied the usefulness of aprotinin in reducing blood losses during surgical instrumentation of major scoliosis (D2-Sacrum) in children with W-H disease.

Materials and Methods: We reviewed the chart of the 55 children operated in our hospital between the January 1st 1995 and the January 1st 2003. The surgery was done by the same surgeon and the same team of anaesthesiologists. The sex, age, weight, duration of surgery, blood loss (measured by the cell saver), amount of autologous and homologous transfusions during surgery, the haemoglobin before and immediately after the procedure, the amount of crystalloids, colloids and HES instilled were studied. Group 1 received 7 500 IKU/kg (international kallikrein unit) at incision followed by an infusion of 5 000 IKU/kg until the end of surgery. Group 2 did not receive any antifibrinolytic drug. The comparison was done with the t-test. Children with a hereditary bleeding disorder and those who received an other drug in attempt to reduce blood loss ($n = 3$) were excluded.

Results and Discussion:

	Group 1 (n = 41)	Group 2 (n = 11)	Prob level
Bleeding (ml)	1223	1528	0.27
HES (ml)	800	1050	0.20
Homol. RBC (ml)	351	397	0.59
Autol. RBC (ml)	340	488	0.10
Pre-operative Hb (g/dl)	12.2	10.7	0.06
Post-operative Hb (g/dl)	9.5	8.9	0.23

The two groups were similar in term of weight, age, duration of surgery and preoperative haemoglobin. There was no statistically significant difference in term of bleeding, amount of transfusion, post-operative haemoglobin.

Conclusion: In this retrospective observational study, we haven't found any benefit in using aprotinin to reduce blood loss during major spine surgery in children with W-H disease. Alternative methods should be investigated in this indication.

References:

- 1 Samama CM et al. *Anesth Analg*. 2002 Aug; 95(2): 287-93.
- 2 Cole JW et al. *Spine*. 2003 Nov; 28(21): 2482-5.

A-336

Hyperoxic ventilation reduces six-hour mortality after partial fluid resuscitation from hemorrhagic shock

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Background and Goal of Study: Administration of 100% oxygen (hyperoxic ventilation, HV) enables survival in extreme normovolemic anemia (1), but fails to improve survival in severe hemorrhagic shock (2). The aim of the present study was to investigate whether HV as a supplement to fluid infusion therapy could restore adequate tissue oxygenation and prevent death in a lethal shock model.

Material and Methods: In 14 anesthetized domestic pigs (bw 32.4 ± 6.0 kg) ventilated on room air (FiO₂ 0.21) hemorrhagic shock was induced by controlled withdrawal of blood (target: MAP 35-40 mmHg) and maintained for one hour. Subsequently the animals were fluid-resuscitated with either hydroxyethyl starch (6% HES, 200 000/0.5) alone (G 0.21) or with HES supplemented by HV (G 1.0). After completion of fluid resuscitation all animals were followed up for the next 6 hours. Tissue oxygenation was assessed polarographically by means of an eight-wire platinum surface electrode (MDO, Eschweiler) on the rectus abdominal muscle (tissue oxygen partial pressure; tpO₂).

Results: Despite adequate fluid resuscitation 5 of 7 animals of G 0.21 died within the 6 hours observation period (i.e. 6 hours mortality 71%). In contrast all animals of G 1.0 survived (G 0.21 vs. G 1.0; $p < 0.05$). Muscle tpO₂ was significantly higher in G 1.0 than in G 0.21 (G 0.21: 20 ± 9 mmHg vs G 0.21: 42 ± 19 mmHg; $p < 0.05$), indicating superior tissue oxygenation.

Conclusion: In anesthetized pigs experiencing lethal hemorrhagic shock the supplementation of conventional fluid resuscitation with HV improved tissue oxygenation and outcome. Therefore fluid resuscitation should be combined with HV for resuscitation from hemorrhagic shock.

References:

- 1 Meier J. *Anesthesiology* 2004; 100: 70-76.
- 2 Takasu A. *Crit Care Med* 1999; 27: 1557-1564.

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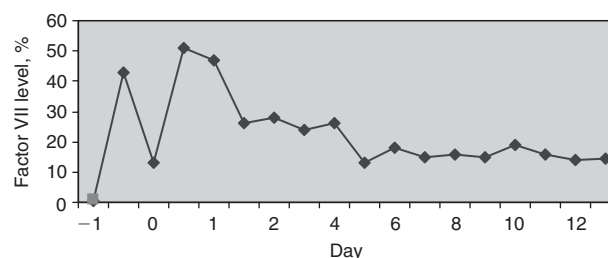
Factor VII deficiency and cardiac surgery

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Background and Goal of Study: Few cases of cardiac surgery with extracorporeal circulation (ECC) in patients with a congenital FVII deficiency have been reported over the years. We present a regimen of intra- and pre-operative substitution therapy.

Case Report: A 21-year old man with a known inherited factor VII deficiency was admitted for a curative surgical therapy of a congenital cardiopathy (double-outlet right ventricle with interventricular communication). He had minor bleeding symptoms, consisting in gingival bleedings. Preoperative coagulation tests showed a prothrombin time inferior to 5%, a FVII level of 0,6%. Partial thromboplastin time was slightly prolonged at 44 seconds. No inhibitor of FVII was present. Kinetics of the factor VII were studied by infusing a single dose of 40 U/kg of a factor VII concentrate. Half-life of the product, measured in our patient was 220 minutes. On the operation day, one dose of 40 U/kg of FVII was administered before incision. As usual, a dose of 4 mg/kg of heparin was given just before ECC, another 300 mg were given in fractionated doses in the time it lasted (179 minutes). A second dose of 40 U/kg was given at the end of ECC and continuous infusion at a calculated rate of 3,2 U/kg/h was initiated in the Intensive Care Unit. It was adapted to maintain FVII level above 25% during the first five days, then reduced to maintain FVII levels above 15% for 8 days.



Neither bleeding nor thrombo-embolic complication occurred during his hospitalisation. No acquired FVII inhibitor was found after substitution therapy. **Conclusions:** The regimen of intra- and post-operative substitution therapy applied to our patient was thus effective in preventing bleeding. No adverse effect was documented.

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Reinfusion of shed blood as an alternative to allogeneic blood transfusion in patients undergoing total knee replacement

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Aim of the Study: To evaluate the safety and efficacy of postoperative reinfusion of shed blood as an alternative to allogeneic blood transfusion (ALBT) in patients undergoing total knee replacement (1).

Patients and Methods: The study included 127 patients assigned to two groups. Group A (control group, $n = 51$) involved patients with ALBT as required, and group B ($n = 76$) patients to receive autologous shed blood using conservation blood system (AUBT) (ConstaVac or Bellovac A.B.T). Drainage was collected for five hours or until 500 ml had accumulated, at which reinfusion took place. The blood loss, the volume of both homologous and autologous transfusion was measured in all patients. The patient's hematological status was assessed before surgery, on first and fifth post-operative day. Blood sample was taken from the collection device before the infusion of the shed blood to the patient in order to determine the characteristics of the shed blood. Postoperatively, any adverse reactions or complications were recorded. Statistical analysis included the chi-squared and t-test.

Results: Demographic data of patients were similar. In group B, 6/77 patients were excluded from the study due to technical reasons. Data (Mean \pm SE) are shown in the table:

	Group A	Group B	P
Blood loss (ml)	992 \pm 60.0	1024 \pm 64.1	NSS
Patients with ALBT	40/51	28/70	<0.001
Units/patient ALBT	1.63 \pm 0.28	0.61 \pm 0.17	<0.001
Preop-Ht (%)	40.6 \pm 1.0	40.8 \pm 0.9	NSS
Postop-Ht (%)	34.2 \pm 1.1	35.9 \pm 0.8	NSS
Volume (ml) AUBT	–	497 \pm 71.8	
Units/patient AUBT	–	1.65 \pm 0.24	
Postop fever	5/51	3/70	NSS

NSS: No statistical significance.

The mean Hb value of shed blood was 12 (± 2.2) gr/dl.

Conclusion: Postoperative reinfusion of shed blood seems to be a safe and effective alternative to allogeneic blood transfusion in patients undergoing total knee replacement. The saving of allogeneic blood was 62.3%.

Reference:

- 1 Jensen CM et al. *J Arthroplasty* 1999;14:3:312–18.

A-340

Superoxide anion production and aggregation capacity by platelets in surgical trauma under general anaesthesia

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Background and Goals: An altered equilibrium between the generation of reactive oxygen species and scavenger machinery occurs in surgical trauma with general anaesthesia. Such a disbalance affects overall cell functions including platelet activity. In this study we have investigated on production of superoxide anion (O_2^-) and aggregation capacity of platelets from patients undergoing surgery under general anaesthesia.

Materials and Methods: Blood samples were drawn from nineteen patients which underwent surgery with general anaesthesia at preoperative time (t_0) as well as at the end of operation (t_1) and 24 hours following surgery (t_2). After platelet preparation release of O_2^- was measured by means of chemiluminescence (CL) lucigenin method (1) using a Bio-Orbit 1251 luminometer; Platelet aggregation was evaluated according to Born (2) in a four-sample aggregometer II Menarini (Florence, Italy) at 37°C using silicized glass cuvetts under continuous stirring at 1,000 rpm. Among materials, collagen, type I, was from Semmelweis (Mascia Brunelli, Milan, Italy).

Results: We found that both unstimulated and collagen-treated platelets released a significantly increased amount of O_2^- at the end of operation (t_2)

compared to t_1 and t_3 times ($p < 0.05$). At the same t_2 time, aggregation capacity was reduced in comparison with preoperative period (t_1) or 24 hours following surgery (t_3) ($p < 0.05$).

Conclusions: Immediately after surgical trauma and general anaesthesia an exaggerated production of O_2^- occurs in platelets. This phenomenon could account for the paralleling loss of the aggregation ability. Since compromised platelet function may directly impair hemostasis, the administration of antioxidant agents during the early postoperative period is worth further exploring.

References:

- 1 Liochev ST, Fridovich I. Lucigenin (bio-N-methylacridinium) as a mediator of superoxide anion production. *Arch Biochem Biophys* 1997; 337: 115–120.
- 2 Born GVR. The aggregation of blood platelets by adenosine diphosphate and its reversal. *Nature* 1962; 194: 927–932.

A-341

Effect of intraoperative cell salvage on leukocyte-endothelial interactions

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Background and Goal of Study: Intraoperatively salvaged blood contains considerable numbers of activated white blood cells (WBC) which have been suspected to contribute to inflammatory reactions and organ dysfunction. Therefore, we studied the role of activated WBC in salvaged blood for subsequent leukocyte-endothelial interactions.

Materials and Methods: After approval of the local ethics committee, two samples of heparinized blood (venous sample VB, salvaged wound blood SWB) were taken from $n = 25$ patients undergoing major orthopaedic surgery. Expression of L-Selectin (CD62L) and beta-integrins (CD11b, CD18) was measured by flow cytometry. Adhesion to TNF-activated endothelial cells (HUVEC) was examined by videomicroscopy of Calcein-stained blood that was perfused over HUVEC at postcapillary shear rates of 50–300 s^{-1} . To ensure comparable conditions, all samples were diluted to a hematocrit of 30%. Paired t-test and analysis of covariance were used in the statistical analysis. Results are given as means and 95% confidence intervals.

Results and Discussions: Compared to VB, CD62L decreased and CD11b increased on WBC derived from the SWB samples ($p < 0.05$). The mean WBC count in VB was 3941/ μ l and 2162/ μ l in SWB respectively. Therefore, adhesion was calculated as a normalized adhesion after correction for the different WBC count. WBC from SWB displayed a 65% reduction in firm adhesion at all shear rates when compared to VB. Rolling of WBC from SWB decreased by 45% only at high shear rates of 300 s^{-1} ($p < 0.01$). In contrast to VB, no decrease in rolling velocity could be observed during shear rate reduction in SWB-HUVEC cocultures. Increasing shear rates up to 1600 s^{-1} resulted in a significantly increased detachment of adherent cells from SWB compared to VB ($p < 0.01$).

Conclusion(s): Although salvaged blood from intraoperative autotransfusion contains activated WBC, these WBC are functionally impaired. The changes in rolling fraction, rolling velocity and cell detachment indicate that the impairment is due to a decreased affinity of the integrin bonds. Therefore, intraoperative autotransfusion does not increase leukocyte accumulation, but impairs leukocyte recruitment to inflamed tissue.

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The effects of acute normovolemic haemodilution with gelofusine on tissue oxygenation, haemodynamic parameters and coagulation

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Background and Goal of Study: Acute normovolemic haemodilution (ANH) is an autologous blood donation technique (1). The aim of this randomised study was to evaluate the effects of ANH on tissue oxygenation, haemodynamic parameters and blood coagulation and to compare it with allogeneic transfusion in patients undergoing radical prostatectomy.

Materials and Methods: 20 ASA I–II patients undergoing radical prostatectomy with haematocrit values between 36–45% were randomised to two groups. In Group ANH ($n = 10$) acute normovolemic haemodilution was performed with gelofusine and in Group K ($n = 10$) allogeneic blood transfusion was done. Anaesthesia was induced with sodium thiopental, fentanyl and vecuronium; maintained with desflurane in O_2-N_2O mixture. Plasma haemoglobin concentration, haematocrit, fibrinogen, platelet count, prothrombin time (PT), partial thromboplastin time (PTT) were measured preoperatively, before and after ANH, before and after transfusion and on the 1st and 7th postoperative days. Heart rate, mean arterial pressure, central venous

pressure, mean pulmonary arterial pressure, pulmonary capillary pressure, cardiac output, cardiac index, systemic vascular resistance, pulmonary vascular resistance, oxygen delivery and mixed venous oxygen saturation were measured at the same measurement intervals. Kruskal Wallis One-Way ANOVA, Mann-Whitney-U and Chi-Square tests were used and $p < 0.05$ was considered as significant.

Results and Discussions: Patients characteristics and demographic data were similar among groups. Blood loss during surgery was significantly higher in Group ANH. In Group ANH, PT and PTT were significantly increased and fibrinogen was decreased. There was no significant difference between groups in terms of haemodynamic variables, tissue oxygenation parameters and postoperative allogenic blood transfusion requirements.

Conclusion: ANH is an alternative method to allogenic blood transfusion, without any effect on tissue oxygenation. Besides; its effects on coagulation makes invasive monitoring of tissue oxygenation and haemodynamic parameters essential.

Reference:

- 1 Monk TR et al. *Anesthesiology* 1999; 91: 24–33.

A-343

Epinephrine augmented hypotensive epidural anesthesia in total knee replacement

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Background and Goal of Study: Investigation of blood loss using hypotensive epidural anesthesia in combination with a continuous intravenous infusion of epinephrine (EAHEA) is well described in total hip arthroplasty, but poorly described total knee replacements (TKR). A tourniquet is often used to reduce intraoperative blood loss in Total Knee Replacement despite various side effects. The goal of this study was to determine perioperative blood loss in Total Knee Replacement using Epinephrine Augmented Hypotensive Epidural Anesthesia (EAHEA) without a tourniquet compared with normotensive epidural anesthesia and the use of a tourniquet.

Materials and Methods: 100 patients undergoing total knee replacement were included in this prospective observer-blinded controlled randomised study. 49 patients received Epinephrine Augmented Hypotensive Epidural Anesthesia without tourniquet use (group A), 51 patients received normotensive epidural anesthesia and a tourniquet was used (group B). Postoperative hemoglobin, hematocrit and transfusion requirements were determined. Postoperative management was identically in both groups.

Results and Discussions: Despite lower transfusion requirements statistically significantly higher postoperative hemoglobin values were determined in group A.

Conclusion(s): It can be concluded that Epinephrine Augmented Hypotensive Epidural Anesthesia without the use of a tourniquet is an adequate technique to reduce perioperative blood loss in Total Knee Replacement.

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Eurocode blood labeling system – uniform identification and classification of blood products improves transfusion security

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Background and Goal of Study: In the last years numerous attempts have been made to improve the safety of blood products. The new EU directive relating to blood donation management to make demands on a unique number and a system for haemovigilance (1).

Materials and Methods: A various code systems with unique bag number, product codes, blood group codes and other relevant informations have been developed by the “Eurocode International Blood Labelling System e.V.” in cooperation with the DGTI (German Transfusion Association) (2).

Results and Discussions: The standardization as an German Industry Norm (DIN) is in process. In addition, the PEI (German regulatory authority) has assured that the product specification offered by the Eurocode product code fulfils the registration duties and, in addition, that it offers the opportunity of acquiring consumption data and data of adverse drug effects in accordance with the German Transfusion Law (3). For users, who have already obtained Eurocode blood bags and are able to read in the data in their internal EDP systems and to perform statistical evaluations, this is certainly a great relief compared to the handling of many different product

designations on different manufacturer labels. By use the system the exchange of blood products and the registry of the transfusion is more simply and safely. Users of the Eurocode at the moment are Blood donation centres of the Red Cross and the Bundeswehr (Army) in Germany.

Conclusion(s): The presentation will deal with the new requirements as well as the structure and possibilities of the Eurocode-system. In the interest of product safety it can only be hoped that other blood donation services will soon be using the system as well.

References:

- 1 Directive 2002/98/EC of the European Parliament and of the Council. *Official Journal L033* 2003;0030–0040.
- 2 Knels R, Roos D, Boecker W et al. *Infus Ther Transfus Med* 2002; 29:226–231.
- 3 Gesetz zur Regelung des Transfusionswesens (German Transfusion Law). *Bundesgesundheitsblatt* 1998; 42:1752–1760.

A-345

Differences between knowledge of the principles of safe and effective blood transfusion practice between anaesthetists, surgeons and nurses in adult cardiac surgery units

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Background and Goal of Study: The aim of this study was to determine A if there was any difference in knowledge of blood transfusion principals and practice between nurses, surgeons and anaesthetists working in postoperative cardiac surgery units and B if the establishment of transfusion nurses improved knowledge in transfusion practice and safety.

Materials and Methods: Critical care medical and nursing staff at 18 adult cardiac surgical units were invited to anonymously complete a questionnaire containing 35 questions related to the theory and practice of transfusion medicine. These questionnaires were first sent in Autumn of 2001 and again in Spring of 2003. Data were analysed by speciality (surgeon, anaesthetist or nurse) and whether the hospital had employed a transfusion nurse specialist between the two audit periods.

Results and Discussions: Complete questionnaires were obtained from 671 nurses, 106 anaesthetists and 97 surgeons. There was a wide variability between the proportion of correct, incorrect and did not know answers by subject. For example only 66% of those questioned knew it was inappropriate to add calcium to transfused blood. This proportion did not differ significantly based on professional group ($p = 0.58$). In contrast nearly 100% of responders correctly answered questions relate to patient safety. Anaesthetists had significantly more correct answers to questions related to clinical management of a patient who was bleeding ($p < 0.001$) and with laboratory evidence of coagulopathy ($p = 0.0019$) than surgeons and nurses. The presence of a transfusion nurse had no impact on the overall knowledge of the participants in the study.

Conclusion(s): These data suggest that (A) anaesthetists will conduct control over haemostatic management in the early period after cardiac surgery most appropriately compared to surgeons or nurses and (B) transfusion nurse specialists did not improve overall knowledge of transfusion practice and safety.

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Effectiveness of the postoperative blood salvage after total knee arthroplasty

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Background and Goal of Study: Patients undergoing total knee arthroplasty (TKA) usually suffer important bleeding in the postoperative (PO) period and may require blood transfusion. One classic method to avoid allogeneic transfusions is the PO blood salvage, but its used is still discussed¹. We evaluate the effect of PO blood salvage on the need for allogeneic transfusion following TKA.

Materials and Methods: We studied 20 consecutive patients scheduled for TKA, alleatorily allocated within two groups: C, control ($n = 10$); S, blood salvage ($n = 10$). We checked the levels of haemoglobin preoperatively, 8 and 24 hours postoperatively (g/dl), the bleeding in the first 5 and 24 hours (ml) and the need for allogeneic transfusion. In the group with PO blood salvage, drainage over 300 ml during the first 5 hours set the indication for autotransfusion. We used descriptive statistics and, to compare the means, the independent-samples T test, with a confidence interval of 95%.

Results and Discussions: We resumed the results in the table (mean \pm SD).

	Male/ Female	Age	Weight	Drain 0–5 h	Drain 5–24 h	Autotransfusion
C	3/7	70 \pm 7	78 \pm 13	315 \pm 267	143 \pm 126	–
S	2/8	70 \pm 4	78 \pm 0	585 \pm 270	162 \pm 135	412 \pm 281

Group	Hb pre	Hb 8	Hb 24
C	13'1 \pm 1'6	11'4 \pm 1'5	10'3 \pm 1'8
S	13'6 \pm 1'3	12 \pm 1	11 \pm 1'5

No patient needed allogeneic transfusion. The only point favouring the use of the blood salvage was the greater level of haemoglobin at 24 hours postoperative, though it was not significant ($p = 0.3$).

Conclusions: In our study, the use of the PO blood salvage is not effective as a blood-saving method. Because of the drop in the haemoglobin level at 24 hours postoperatively, the blood salvage may be useful in patients with a preoperative haemoglobin under 12 g/dl.

Reference:

1 Thomas D, Warchman K, Cohen D, Hutchings H. *Br. J. Anaesth.* 2001; 86 (5): 669–73.

A-347

ICG-densitometry investigation of liver function during hepatic resection

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Background and Goal of Study: The assessment of the global liver function has a very important prognostic value in patients undergoing hepatic resection.

ICG densitometry was introduced to measure the hepatic elimination of indocyanine-green.

Materials and Methods: In the present study the liver function of 20 patients (age: 60.1 \pm 10.5, male: 12, female: 8) was investigated. The patients were admitted with the plan of hepatic resection because of primer hepatocellular carcinoma ($n = 7$), colorectal liver metastases ($n = 12$) and intrahepatic bile duct cancer ($n = 1$). Pulsion LiMON PC 5000 ICG-densitometry (equipment) was used. We assessed the hepatic function with the measurement of PDR (plasma disappearance rate—normal value: 18–25%/min) and R15 (retention extrapolated to 15 minutes – normal value: 0–10%). We planned three examinations for every patient, first: after the induction of the anesthesia, before surgery; second: after the clamping-procedures of v. portae and a. hepatica (which were clamped during the resection); and the third: within 4 hours after surgery. If there was no resection only the first examination was taken, if there was no vessel clamping we only did the first and the third measurements.

Results and Discussions: During our investigations we did three measurements in 4 cases, two measurements in 6 cases, and one measurement in 10 cases. Our first examinations showed pathologic liver function in the 75% of patients, while the indicational value of the traditional laboratory tests were poorer. (Serum bilirubin was pathologic in 20%, prothrombine in 5%, ALAT 15%, ASAT 30% of the patients.) The mean PDR of the first measurement was 14.19%/min in all the patients, and it was 13.9%/min in patients who were undergoing resection, while the postoperative value was 19.6%/min in these patients.

Conclusion(s): In contradiction to traditional laboratory tests – which are indicating of the impairment of liver function late or in the case of a huge amount of liver cell damage – ICG densitometry is quick, immediate and sensitive method for investigating the hepatic function. Due to serious apprehension, like the postoperative liver failure, the ICG densitometry could be a very important step in the perioperative routine.

Neurosciences

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Differential susceptibility of synaptic GABA_A receptors to anesthetics vs. non-immobilizers at amnestic concentrations

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Background and Goal of Study: Non-immobilizers (formerly termed non-anesthetics) are drugs with physicochemical properties similar to those of anesthetics, but they do not produce immobility at concentrations predicted to do so. They are of interest because they may help to discriminate between relevant and irrelevant cellular and molecular targets of general anesthetics (1). Because the GABA_A receptor is of pivotal importance for the mechanism of action of numerous general anesthetics, we have investigated the effects of the prototypical drug 1,2-dichlorohexafluorocyclobutane (F6 or 2N) on hippocampal GABA_A receptors at concentrations that induce amnesia *in vivo* (2) and compared these to the effects of isoflurane at amnestic concentrations.

Materials and Methods: We used the whole-cell mode of the patch clamp technique to record from hippocampal pyramidal cells in brain slices prepared from young Sprague-Dawley rats (14–22 days of age). Miniature GABA_A receptor-mediated IPSCs (mIPSCs) were isolated using glutamate receptor antagonists and tetrodotoxin.

Results and Discussions: Neither F6 nor isoflurane at amnestic concentrations (0.003–0.01 mM and 0.04–0.1 mM, respectively) altered the frequency or amplitude of mIPSCs. The decay time constant, however, was differentially affected: isoflurane slowed mIPSC decay even at the lowest concentration tested, but F6 had no effect even at the highest concentration.

Conclusion(s): Synaptic GABA_A receptors sharply discriminate between anesthetics and non-immobilizers. Thus, non-immobilizers should be useful in elucidating molecular mechanisms of receptor modulation. By contrast, whereas effects on synaptic GABA_A receptors may underlie the amnestic effects of volatile anesthetics (3), non-immobilizers may cause amnesia via different mechanisms. If so, the value of non-immobilizers for the understanding this aspect of anesthetic mechanisms may be more limited than previously thought.

References:

- 1 Koblin, D.D. et al. *Anesth Analg* 1994; 79: 1043–1048.
- 2 Kandel, L. et al. *Anesth Analg* 1996; 82: 321–326.
- 3 Simon, W. et al. *Anesthesiol* 2001; 94: 1058–1065.

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The non-immobilizer 1,2-dichlorohexafluorocyclobutane (F6 or 2N) suppresses hippocampal theta oscillations at amnestic concentrations

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Background and Goal of Study: Non-immobilizers are anesthetic-like compounds that do not induce the full spectrum of anesthetic-like effects. They are used as tools in the elucidation of anesthetic mechanisms. Though F6 does not alter GABA_A receptor-mediated inhibition (1), it does induce amnesia at concentrations well below MAC_{pred}, so the mechanism by which this effect is produced is of interest. Since the hippocampal theta rhythm is postulated to be important for memory processes (2), we tested the effect of F6 on theta oscillations *in vivo* by recording hippocampal field potentials in awake behaving rats.

Materials and Methods: With the approval from the IRB, electrical activity was recorded from 4 adult (400 g) male Sprague Dawley rats using 4-channel linear micro-electrode arrays implanted into the hippocampus, and 3 dural-surface EEG leads. An occipital bone screw served as the reference lead. After 10–14 days of recovery from surgery, an unrestrained rat was connected to an EEG recording apparatus, placed into a novel environment, and allowed to explore. EEG activity was recorded during a 30-minute baseline period, a 30-minute exposure to F6 (gas-phase concentrations confirmed by gas chromatography), and a 30-minute recovery period. The animal was then anesthetized, sacrificed, and electrode placement was confirmed by histological analysis.

Results and Discussions: Animals exposed to amnestic but subconvulsive concentrations of F6 (1–3%) remained alert and responsive. During F6

exposure we observed a generalized depression in the theta, beta and gamma frequency ranges, with power in the theta band (5–12 Hz) reduced most strongly, by up to 80%.

Conclusion(s): At amnesic concentrations, F6 has profound effects on the electrical activity patterns in the hippocampus. Depression of the power in the theta band may have a causal relationship to its amnesic effects.

References:

- 1 Perouansky, M. et al. *Anesthesiol.* (2004), in press.
- 2 Buzsaki, G. *Neuron* (2002) 33: 325–340.

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The effects of sevoflurane and ischemic preconditioning on neurologic injury and DNA fragmentation after transient spinal ischemia in the rat

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Background and Goal of Study: Spinal cord injury remains a devastating complication after aortic surgery. Anesthetic¹⁾ and ischemic^{2,3)} preconditioning have been known to prevent ischemic injury. The purpose of this study was to elucidate the effects of sevoflurane and ischemic preconditioning (IPC) on neurologic outcome and DNA fragmentation after transient spinal ischemia in the rat.

Materials and Methods: Rats were anesthetized with enflurane (Enflurane group) or sevoflurane (other 4 groups), divided by 5 groups: Sevoflurane group, Enflurane group (13 minutes of ischemia), Control group (no IPC, 15 minutes of ischemia), Rapid group (5 minutes IPC, 30 minutes recovery, and 15 minutes of ischemia), Delayed group (5 minutes IPC, 48 hours recovery, and 15 minutes of ischemia). Spinal ischemia was produced by both induced hypotension and thoracic aortic cross clamping. After spinal ischemia, neurologic scores were assessed after 1, 2, 3, 24 hours. After 24 hours, rats were euthanized and spinal cords were removed for the assay of DNA fragmentation.

Results and Discussions: The neurologic injury and DNA fragmentation of sevoflurane group were significantly lesser than enflurane group after 13 minutes of aortic cross clamping. The significant neurologic injury occurred after 15 minutes of aortic cross clamping under sevoflurane anesthesia. There were no significant changes in neurologic injury and DNA fragmentation between control group, rapid group, and delayed group.

Conclusion(s): Sevoflurane was effective in preventing neurologic injury after 13 minutes of transient spinal ischemia. However, rapid and delayed ischemic preconditioning did not potentiated neuroprotective action of sevoflurane during 15 minutes of spinal ischemia.

References:

- 1 *J Neurosurg Anesthesiol* 2003; 15: 193–9.
- 2 *Ann Thorac Surg* 1999; 68: 874–80.
- 3 *Stroke* 2003; 34: 1803–8.

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Estimation of permeability of the blood-cerebro-spinal barrier in rabbits with induced arterial hypertension – comparison of two experimental methods

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Background and Goal of Study: The brain injury leads to increased permeability for water, molecules and drugs from blood into the cerebro-spinal fluid (CSF) and to the brain. For the evaluation of the integrity of the blood-cerebro-spinal fluid barrier (BCSFB) Gentamycin (Gent) or marked Albumin (Alb) and IgG are used. This permeability markers has different molecule size to enable qualification of injury condition. The aim of study was to compare two quantitative methods during induced arterial hypertension (AH).

Materials and Methods: The 40 mixed race rabbits randomised into 4 groups (Gr). In two groups AH was induced with Metaraminol (Gr I and Gr II) and there were two control Gr without AH (Gr III and Gr IV). Concentration of Gent (Gr I and Gr II) or Alb and IgG (Gr III and Gr IV) were measured in plasma (Sg, S_A, S_{IgG}) and in CSF (CSFg, CSF_A, CSF_{IgG}) in: S – start point, before AH induction, M – middle point, E – end point. The relative permeability index for Gent ($Q_g = \text{CSF}_g/\text{S}_g$), Alb (Q_A), IgG (Q_{IgG}) was calculated. Statistical analysis included Shapiro-Wilk test and U-Mann-Whitney test. Statistical significance was set at $P < 0,05$ and are marked with (*).

Results and Discussions: Data (Mean \pm SD) are shown in the Tables 1 and 2.

Table 1.

	Point	S	M	E
Gr III	Qg	0,55 \pm 0,06	0,25 \pm 0,04	0,22 \pm 0,04
Gr I	Qg	0,23 \pm 0,04	0,32 \pm 0,05	0,54 \pm 0,06

Table 2. The results are the mean values from measurements in S, M, E points and SD.

	Q _A	Q _{IgG}
Gr IV	1,39 \pm 0,05	1,40 \pm 0,06
Gr II	7,43 \pm 0,25*	4,15 \pm 0,16*

Conclusion: Estimation of BCSFB injury in induced AH with albumin and IgG is the better, more detailed method and also enables the evaluation of the molecule's size which occurred in CSF.

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The protective effect of ischemic and hypoxic preconditioning on hypoxic-ischemic brain injury in a neonatal rat: ¹H magnetic resonance spectroscopic study

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Background and Goal of Study: A brief episode of cerebral ischemia confers transient ischemic tolerance to a subsequent ischemic challenge that is otherwise lethal to them. This study was purposed to evaluate the effect of ischemic and hypoxic preconditioning on hypoxic-ischemic brain injury in a neonatal rat.

Materials and Methods: Seven-day-old Sprague-Dawley rat pups were used. The rats were divided into three groups; control group (CG, n = 53), ischemic preconditioning group (IG, n = 51), and hypoxic preconditioning group (HG, n = 48). For preconditioning, right common carotid artery was temporarily occluded for ten minutes in IG. Rats in HG underwent hypoxia (8% oxygen) for four hours. Twenty-four hours after the preconditioning, rats from all groups were exposed to right common carotid artery ligation followed by 2.5 hour hypoxia. Lipid/N-acetyl aspartate (Lip/NAA) and lipid/creatine (Lip/Cr) ratios of the ¹H magnetic resonance spectroscopy and terminal deoxynucleotidyltransferase-mediated dUTP-biotin nick end-labeling (TUNEL) reaction were evaluated as apoptotic markers on the 1st day and the 7th day after hypoxic-ischemic injury. All the rats were sacrificed 2 weeks after hypoxic-ischemic brain injury and the brains were examined for morphologic study.

Results and Discussions: In IG and HG, the Lip/NAA and Lip/Cr ratios were lower than those of CG on the 1st day and the 7th day after hypoxic-ischemic injury ($P < 0.05$). The numbers of TUNEL positive cells in IG and HG were also smaller than those of CG on the 1st day and the 7th day after hypoxic-ischemic injury. The degree of morphologic changes of the brain on the 14th day after hypoxic-ischemic injury was lower in the preconditioning groups ($P < 0.05$).

Conclusion(s): The results suggested that ischemic and hypoxic preconditioning attenuate the apoptosis that is caused by the hypoxic-ischemic brain injury in a neonatal rat.

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The effects of sevoflurane and desflurane in CA1 after incomplete cerebral ischemia in rats

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Background and Goals: Volatile anaesthetics can reduce the ischemic cerebral injury (1–3). We aimed to compare the effects of sevoflurane and desflurane in a model of incomplete cerebral ischemia in rats.

Methods: Thirty male Sprague-Dawley rats were randomly assigned to three groups; control, sevoflurane and desflurane. The rats were anaesthetized with 5% isoflurane, intubated and mechanically ventilated, then received 2% isoflurane in 70% nitrous oxide and 30% O₂ up to the end of the ischemia. Femoral artery was cannulated for invasive blood pressure and blood samples. Five minutes before ischemia and at the end of ischemia plasma glucose, hematocrit and arterial blood gases were analysed. When mean arterial pressure was 35 mmHg with haemorrhagic hypotension both common carotid arteries were clamped for ten minutes. Then they were unclamped and the rats in Control Group were extubated. After carotid

arteries were unclamped, the rats in Sevoflurane and Desflurane Group received 2% sevoflurane and 6% desflurane, respectively, in 70% nitrous oxide and 30% O₂ for 30 minutes. Five days later the rats were sacrificed, histological scores in CA1 was graded on a scale 0 to 3 according to frequency of ischemic neurons. ANOVA was used for physiologic variables, Chi-Square test was used for histological scores.

Results: The physiologic data did not differ among the groups ($p > 0.05$). Histological scores are: Grade 0; no rats in control, three rats in sevoflurane and four rats in desflurane, Grade 1; one rat in control, five rats in sevoflurane and four rats in desflurane, Grade 2; four rats in control, one rat in sevoflurane and two rats in desflurane, Grade 3; five rats in control, one rat in sevoflurane and no rats in desflurane. There were no differences between Sevoflurane and Desflurane, but there were differences between Sevoflurane and Control ($p < 0.05$), and Desflurane and Control ($p < 0.01$).

Conclusion: Sevoflurane and desflurane have cerebral protective effects in area CA1 of rat hippocampus after incomplete cerebral ischemia.

References:

- David S. Warner, Paula S. Ludwig, Robert Pearstein, et al. *Anesthesiology* 1995; 82: 1237–1245.
- Baughman VL, Hofman WE, Thomas C, et al. *Anesthesiology* 1990; 72: 85–92.
- Miura Y, Grocott HP, Bart RD, et al. *Anesthesiology* 1998; 89: 391–400.

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Interaction of synthetic opioids and clonidine on alpha 2-adrenoceptor subtypes in mouse brain

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Background and Goal of Study: Clonidine and opioids like pethidine share clinical similarities. It has been shown that certain opioids interact specifically with cerebral α_2 -adrenoceptors (α_2 -AR) in rat brain (1). Furthermore experiments with α_{2A} , α_{2B} - and α_{2C} -knock-out (KO) mice indicate that most clinical effects of α_2 -AR-agonists are mediated subtype-specifically (2). Because it is still unknown whether or not this interaction of opioids and α_2 -AR may be specific for a single α_2 -AR-subtype, we studied the effect of three opioids on autoradiographically detected α_2 -AR binding of [¹²⁵J]-paraliodoclonidine ([¹²⁵J]-PIC) in α_{2A} , α_{2B} - and α_{2C} -KO mice brain.

Materials and Methods: With approval of the local animal care committee α_{2A} , α_{2B} - and α_{2C} -AR-KO mice were sacrificed, brains removed and rapidly frozen to -70°C . Parasagittal brain sections of 15 μm were prepared using a cryostat. Total binding was determined by incubation of brain slices with 1 nM [¹²⁵J]-PIC. Unspecific binding was determined by addition of unlabeled clonidine at 200 μM and subtracted after autoradiography. Displacement of [¹²⁵J]-PIC from receptor binding was performed by incubation of brain slices in the presence of increasing concentrations of pethidine, tramadol or morphine. After removal of unbound radioactivity slices were attached to an autoradiography film (Kodak Biomax MRTM) for 3 days. Resulting autoradiograms were analysed densitometrically.

Results and Discussions: Tramadol, pethidine and morphine provoked dose depend displacement of specifically bound [¹²⁵J]-PIC from α_2 -AR in all sites of the mouse brain. In contrast to pethidine and tramadol, the displacement of [¹²⁵J]-PIC by morphine was not complete. According to the dominant role of α_{2A} -AR, α_{2A} -AR-KO-mice showed a strongly reduced signal intensity of specifically bound [¹²⁵J]-PIC but its displacement by opioids was similar to α_{2B} - and α_{2C} -KO mice.

Conclusions: Our results suggest that pethidine, tramadol and morphine interact with all subtypes of α_2 -AR in the central nervous system. This may indicate that clinical effects of these opioids could be mediated by all AR-subtypes though α_{2A} -AR seem to play a dominant role.

References:

- Krause T, Tonner PH, Scholz J, et al. *Anesthesiology* 1999; 91: A388.
- Kable JW, Murrin LC, Bylund DB. *Pharmacol.* 2000; 293: 1–7.

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Morphological evidence that xenon prevents N-methyl-DL-aspartic acid-induced injury in rat arcuate nucleus

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Background and Goals: Excitotoxicity induced by NMDA receptor activation mediates neuronal injury in acute processes such as stroke and head trauma. Many NMDA receptor antagonists proposed as neuroprotectants display severe side effects, while the anaesthetic gas xenon revealed a safer agent (1). This study provides morphological evidence that xenon exerts

neuroprotection in a model of neuronal injury induced by N-methyl-DL-aspartic acid (NMA) in the rat arcuate nucleus (AN).

Material and Methods: Female Sprague-Dawley rats (180–200 g bw) were used. Animal procedures were approved by the Institutional Animal Care Committee. Rats ($n = 5$ for each group) were randomly assigned to four groups (control, xenon, NMA, xenon plus NMA) and morphological evaluation was performed by light (LM) or transmission electron microscopy (TEM). NMA (100 mg/kg) was administered subcutaneously 15 min after xenon exposure. Air or a gas mixture of xenon 70%–oxygen 30% was delivered into the experimental cage for 3 hrs. Animals were then euthanized by pentobarbital overdose. The brain was removed and frozen in isopentane at -80°C for LM. Cryocut sections of AN were obtained and processed for cresyl violet, haematoxylin/eosin staining, and for the novel Fluoro Jade-B technique (FJB) Rats assigned to TEM were perfused with paraformaldehyde 4%, the brain was removed and AN samples were processed as routine.

Results: In NMA group 27% of neuronal loss was assessed with an intense positivity to FJB, indicating the presence of degenerating neurons. Ultrastructural alterations, including chromatin margination, nuclear shrinkage, mitochondria with matrix dilution, dilated endoplasmic cisternae and electron-dense cytoplasm were detected, whereas blood vessels appeared undamaged. Xenon alone did not induce morphological changes under both LM and TEM, but significantly prevented the NMA-induced damage: only 8% of neurons were lost and a less intense fluorescence was evidenced.

Conclusions: NMA is able to induce a severe neuronal loss in the rat AN. Xenon can provide a significant neuroprotection against NMA-induced injury.

Reference:

- Ma D, Wilhelm S, Maze M, et al. *Br. J. Anaesth.* 2002;89:739–46.

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Bupivacaine inhibits GABA_A-receptor currents in hippocampal neurons from mammalian brain

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Background and Goal of Study: Inhibition of GABA_A-receptors has been suggested to underlie local anesthetic induced seizure (1). However, there is only limited information available on the interaction of bupivacaine with GABA_A-receptors in mammalian brain. It is furthermore unknown if the anti-convulsant and GABA_A-agonist thiopental antagonizes the effects of bupivacaine on GABA_A-receptors. The aim of the present study, therefore, was to establish the effects on and the interaction of bupivacaine and thiopental at GABA_A-receptors in murine hippocampal neurons.

Materials and Methods: The whole cell patch-clamp method (2) was used to record synaptic GABA_A-receptor currents in acutely isolated hippocampal CA1 neurons from neonatal mice. Data is given as mean \pm SD, $n =$ the number of experiments.

Results and Discussions: Bupivacaine inhibited GABA_A-receptor currents in a concentration-dependent and reversible manner. At concentrations of 1 μM , 3 μM , and 10 μM the currents were reduced by $58 \pm 15\%$ ($n = 3$), $84 \pm 20\%$ ($n = 5$), and $98 \pm 4\%$ ($n = 4$), respectively. Thiopental stimulated the charge crossing the membrane through GABA_A-receptors by slowing macroscopic current decline in a concentration-dependent and reversible manner. The time constant of current decline increased from 32 ± 8 ms at control conditions ($n = 16$), to 77 ± 15 ms at 10 μM ($n = 5$), to 202 ± 32 ms at 30 μM ($n = 5$), and to 436 ± 55 ms at 100 μM ($n = 5$). Co-application of bupivacaine (3 μM) and thiopental (30 μM) revealed that thiopental only partially antagonized inhibition of GABA_A-receptor currents.

Conclusion(s): Bupivacaine at neurotoxic concentrations (3) inhibited synaptic GABA_A-receptor currents in mammalian brain. As thiopental only partially antagonized this effect additional molecular mechanisms may contribute to local anaesthetic induced seizure.

References:

- Hamill OP, Marty A, Neher E et al. *Pflugers Arch* 1981; 391: 85–100.
- Sugimoto M, Uchida I, Fukami S et al. *Eur J Pharmacol* 2000; 401: 329–37.
- Tucker GT. *Br J Anaesth* 1986; 58: 717–31.

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Neuroprotective effects of α_2 adrenoceptors may be mediated via APLP1

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Background and Goal of Study: Alpha₂-adrenoceptor (α_2 -AR) agonists exert potent analgesic and sedative/hypnotic effects. In addition, they have

been shown to be neuroprotective (1), but the mechanisms of these actions are still poorly defined. The identification of proteins involved in the signal transduction cascades of α_2 -ARs is a crucial step in understanding the molecular mechanisms underlying these effects. In this study, we identified the amyloid precursor-like protein 1 (APLP1) as a binding partner of α_2 -ARs.

Materials and Methods: The intracellular domain IV of the α_{2A} -AR was utilized as bait in a BacterioMatch two hybrid system to screen a human brain cDNA for protein–protein interactions. Positive clones were isolated by growth on selective agar plates and evaluated by a colorimetric test. Protein–protein interactions were confirmed by GST pull down assays and co-immunoprecipitation.

Results and Discussions: A total of 5×10^7 clones were screened. 20 positive clones were isolated and sequence information was subsequently obtained. Screening of the EMBL/GenBank database revealed that 2 clones were 100% homologous to the gene encoding APLP1. GST pull down assays and co-immunoprecipitation results also confirmed the specificity of this interaction.

Conclusions: This is a first report of an interaction of α_2 -ARs with APLP1. This gene belongs to a larger gene family that includes also the amyloid precursor protein involved in Alzheimer's disease (2). Furthermore, the c-terminal domains of these genes have been reported to possess neuroprotective effects in native cells (3). Therefore, this interaction may present one of the mechanisms that contribute to the neuroprotective effects of α_2 -AR agonists.

References:

- 1 Maier *et al.*: *Anesthesiology* 1993; 79:306–12.
- 2 Kang *et al.*: *Nature* 1987; 325:733–6.
- 3 Masliah *et al.*: *Neuroscience* 1997; 78:135–46.

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Neuroprotective effects of propofol in an *in vitro* model of cerebral ischemia

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Background and Main Goals: Propofol (2,6 diisopropylphenol) is a short-acting anesthetic agent that is commonly used in intensive care patients as a sedative/hypnotic agent. It has also been described as a potential neuroprotective agent, mainly in *in vivo* models of global and focal cerebral ischemia. In this study, we examined the neuroprotective effects of propofol in rat organotypic hippocampal slices.

Materials and Methods: Hippocampal slices were cultured for 14 days *in vitro* and then exposed to oxygen and glucose deprivation (OGD) for 30 min. Hippocampal damage in the CA1 area was identified and measured 24 hours later with the fluorescent dye propidium iodide (PI). We also examined whether propofol could affect the Ca^{2+} -induced opening of the mitochondrial transition pore (MTP) in neuronal mitochondria.

Results and Discussion: In untreated slices ($n = 12$), OGD induced a significant and selective CA1 increase in PI fluorescence, from 42 ± 4.7 (optic density units \pm SEM) to 85 ± 20 ($p < 0.01$ vs. control, ANOVA followed by Tukey's *w* test). Addition of 100 μM propofol ($n = 18$) to the medium immediately after OGD significantly reduced CA1 injury by 43% ($p < 0.01$ vs. OGD), whereas 30 μM propofol ($n = 12$) produced a non significant reduction. In neuronal mitochondria, the Ca^{2+} -induced opening of MTP was significantly reduced of 50% by 100 μM propofol ($p < 0.05$ vs. control).

Conclusions: Propofol is neuroprotective in an hippocampal *in vitro* model of cerebral ischemia. Propofol was also able to reduce the detrimental opening of neuronal MTP induced by elevated intracellular Ca^{2+} , a condition that mimicks what occurs in ischemic tissue. This well-tolerated agent may provide a therapeutic benefit in pathologies involving post-ischemic neurodegeneration.

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Anticonvulsant properties of sevoflurane in a genetic rodent model of absence epilepsy

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Background and Goal of Study: To date, sevoflurane has led to a controversy regarding its use in patients with epilepsy: EEG epileptiform-like activity has been described, particularly at low concentrations of sevoflurane (induction, recovery). However, the neural mechanism underlying these epileptiform-like activities as well of their meanings and consequences are still unknown (1). In addition, it is unclear to what extent, this phenomenon might be responsible for any adverse/deleterious effect of sevoflurane in

subjects with preexisting epileptic disorders. Thus, we assessed the effects of sevoflurane on rats suffering from genetically generalized epilepsy (2).

Materials and Methods: We used Genetically Absence Epilepsy Rats from Strasbourg (GAERS) which exhibit spontaneous non convulsive absence seizures (spike and wave discharges lasting 10 to 30 s, occurring 1.3 time/min on average). GAERS were equipped with four monopolar electrodes screwed in the skull over the frontal and parietal cortex and allowed one week for recovery. All rats served as their own controls and were exposed after 20 min basal EEG to sub-anaesthetic concentration of sevoflurane (0, 1.5% or 3% in O_2/AIR 50/50) during 60 min (3 consecutive EEG periods of 20 min), in a randomized order, with at least 8 days between each treatment.

Results: The spike-and-wave discharges characteristic of absence seizures in GAERS rats were significantly decreased by sevoflurane 1.5 and 3%. Epileptic discharges decreased with both concentrations of sevoflurane during the whole period of EEG recording, i.e. 60 min (55 to 61% for sevoflurane 1.5% and 59 to 83% for sevoflurane 3%). No rebound effect was observed.

Conclusions: Despite the commonly observation of somehow epileptiform-like activity, sevoflurane exhibit anti-convulsant properties in a genetic model of generalized non convulsive seizures, which has been shown to be a valid inherited model of human absence epilepsy (2).

References:

- 1 Jaaskelainen SK *et al.* *Neurology*, 2003; 1073–1078.
- 2 Danober L *et al.* *Progress Neurobiology*, 1998; 27–57.

A-370

Noxious stimulation and local cerebral metabolism during Propofol anesthesia in the rat

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Background and Goal of Study: While limbic structures are involved in processing emotionally active informations such as noxious stimulus, these valenced stimuli need not reach conscious awareness to engaged amygdala and related structures processing (1). Thus, we asked whether or not limbic areas could be still reactive to a noxious stimulus under deep anesthesia, although it is obvious that cerebral pathways are no more active at thalamic level.

Materials and Methods: Adult male Sprague-Dawley rats (8 controls and 7 pain-stimulated rats) were implanted with 4 cortical electrodes for EEG recordings and left femoral artery and vein were catheterized under valium/ imalgene anesthesia. On the following day, anesthesia was induced by intraperitoneal (i.p.) injection of propofol (100 mg/kg, 1%), followed 10 min later by continuous i.p. infusion (60 mg/kg/h). Local cerebral glucose utilization (LCGU) was measured 60 min after the induction of anesthesia, by the quantitative autoradiographic $2\text{-}^{14}\text{C}$ -deoxyglucose method (2). A noxious stimulus (a clamp on the right paw) was settled at the same time and maintained during all metabolic measurement, i.e. 45 min.

Results: EEG recordings were characterized by lost of gamma activity and high amplitude, low frequency delta waves. Following noxious stimulus, no EEG or behavior modifications (paw withdraw response) were observed. Basal LCGU values in controls were low, as previously described (3). In pain-stimulated animals, LCGU rates decreased ipsi- and contralaterally by 16 to 42% in all limbic areas studied (cingular cortices, accumbens nucleus, amygdala and hippocampus): these metabolic changes reaching significance in the area 2 of cingular cortex, the accumbens nucleus, and the basolateral amygdala (all $P < 0.05$). No difference was observed in thalamus.

Conclusions: These results show bilateral metabolic decreases in limbic areas during sustained unilateral pain stimulus under deep anesthesia. Such a decrease in cerebral metabolism is in agreement with compensatory mechanisms during processing information in limbic system (habituation) (1). The persistence of information processing as regard to emotionally valenced stimuli (pain) suggests that some forms of sub-cortical memories might exist under deep anesthesia, despite cortical activity depression.

References:

- 1 Petrovic *et al.*, *Pain* 83:459–70 (1999).
- 2 Sokoloff *et al.*, *J Neurochem* 28:897–916 (1977).
- 3 Dam *et al.*, *Anesthesiology* 73:499–505 (1990).

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A-372

Is additional dose of intravenous anesthetics protective for hypoxic neuronal insult during mild hypothermia?

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Background and Goal of Study: Mild hypothermia is clinically applied during cardiac surgery or neurosurgery to protect brain from hypoxic insult. Some

intravenous (iv) anesthetics are also thought to be protective for this insult. Mild hypothermia and iv anesthetics were often used simultaneously for cerebral protection. The goal of this study is to clarify combined effects of mild hypothermia and iv anesthetics on hypoxic insult by using neuronal culture.

Materials and Methods: Fourteen-days rat primary cultured neurons were exposed to hypoxia of 1% below oxygen atmosphere under 3 different temperatures of 30, 33 or 37°C for 24 hours. At the same time, 4 different kinds of anesthetics (thiamylal, propofol, midazolam and ketamine) were applied. Cell survival rate were measured by using staining technique with trypan blue. One-way ANOVA was used for statistic analysis.

Results and Discussions: At 37°C, propofol reduced cell death significantly (76% vs 64%). There were no significant protective effects in other anesthetics at 37°C. Mild hypothermia groups of 30 and 33°C without iv anesthetics reduced neuronal cell death significantly compared with 37°C group (69%, 62% vs 50%). However additional protective effect was not observed when the drugs were given with mild hypothermia.

Conclusion(s): Propofol was effective for neuronal hypoxic insult at 37°C. Mild hypothermia at 30 and 33°C was also effective for this insult. However combined effect of mild hypothermia and iv anesthetics was not additive.

A-373

Effects of mild hypothermia on hypoxia and glutamate toxicity in rat primary cultured neurons

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Background and Goal of Study: Recently, mild hypothermia is widely accepted as neuroprotective therapy. However, the mechanism of the protective effect has not been clarified well. Our goal of this study is to compare the protective effects of mild hypothermia on hypoxic and glutamate insults and to evaluate the mechanism of protection.

Materials and Methods: Neurons are collected from 18 days embryo-fetus rat brains and almost pure neurons were obtained after 14 day-culture in Neurobasal medium without serums. The neurons were exposed to 2 different insults: 50 μ M glutamate exposure for 10 min (GE) followed by normal culture for 24 hrs and 1% below oxygen atmosphere for 24 hrs (H). From the start of insult, cultured dishes were placed under 3 different temperatures of 30, 33 or 37°C. Cell survival rate were measured by using staining technique with trypan blue. One-way ANOVA was used for statistic analysis.

Results and Discussions: Cell survival rates in GE (n = 19) were 47, 43 or 39% at 30, 33 or 37°C respectively. Significant but slight difference was observed between 30 and 37°C. Cell survival rates in H (n = 36) were 47, 45 or 28% at 30, 33 or 37°C. Significant difference was seen at 30 and 33°C compared to 37°C.

Conclusion(s): Mild hypothermia reduced neural cell death against GE and H. However H was more protective. These data indicate that mild hypothermia is protective through inhibition of glutamate release at pre-synaptic site or inhibition of post-synaptic ischemic cascade related to hypoxia rather than glutamate toxicity.

A-374

Cerebral amygdala reactivity to noxious stimulation (formaline) during propofol anesthesia in the rat: a MRI study

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Background and Goal of Study: While limbic structures are involved in processing emotionally active informations such as noxious stimulus, awareness appear not necessary to engage amygdala (1). Thus, we determined whether or not changes in local cerebral blood flow could be observed in amygdaloid cerebral area following noxious stimulus under propofol anesthesia, using magnetic resonance imaging (MRI) in the rat.

Materials and Methods: Anesthesia was induced in adult male Sprague-Dawley rats, by intraperitoneal injection of propofol 100 mg/kg followed by repeated injection of propofol 50 mg/kg via an intraperitoneal catheter. After stabilization of anesthesia, half of the rats were equipped with subcutaneous monopolar electrodes to record EEG (EEG group, n = 11), while the other half of the rats were exposed to MRI (MRI group, n = 11). In MRI group, acquisition of basal data (4.7 T magnet, Fast Spin Echo, duration 6 minutes, T2 weighed, 15 slides, 1 mm) was performed and thus, formaline (10%, 50 μ l) was injected in the hindpaw, either in the right or left paw, in a randomized order. Three sets of images acquisitions were performed at 6, 15 and 24 min post-formaline. For analysis, all sets of images were normalized to basal acquisition images. In EEG group, rats were submitted to the same procedure: basal EEG recording (20 min) before formaline and then, 45 min EEG recording after formaline.

Results: Following formaline injection, no modification of EEG was observed using this regimen of anesthesia. Comparison between basal and post-formaline MRI acquisitions evidenced significant bilateral modifications in amygdala area. Analysis of variance on maximum pixels intensity in this Region of Interest showed a significant increase in local cerebral blood flow in both right and left amygdala area after formaline injection at each time (p = 0.0029), with a significant difference between right and left amygdala (p = 0.0217), and no significant effect of side of injection (p = 0.52).

Conclusions: The results show that formaline injection under deep propofol anesthesia, is responsible for a significant bilateral increase in regional cerebral blood flow in amygdala. This suggests a role for this limbic structure in the processing of noxious stimulus during anesthesia.

Reference:

1 Petrovic et al., *Pain* 83:459-70 (1999).

A-375

Correlation between hormonal disorders and myocardial injury after subarachnoid haemorrhage

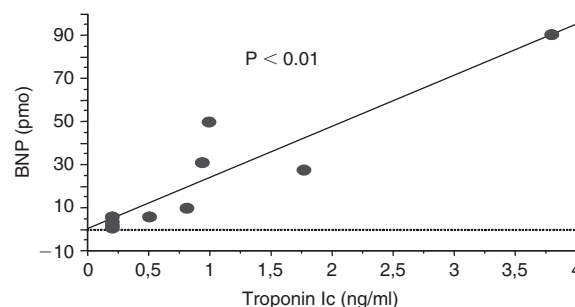
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Background and Goal of Study: Neuro-endocrine disorders are frequent following subarachnoid haemorrhage (SAH) (1) and associated with an increased circulating natriuretic peptides blood levels (NP). NP are elevated after cardiac injury (2). The goal of this study was to evaluate the correlation between neuro-endocrine disorders, and myocardial injury following SAH.

Materials and Methods: During 10 months, 10 patients WFNS 3 or 4 with confirmed aneurysmal SAH were included in an observational study. Salt intake was standardized at 4.5 mmol/kg/day (3). Water and sodium balances were calculated daily. Renal function, and hormones involved in electrolyte and water homeostasis (vasopressin, renin, angiotensin, aldosterone and natriuretic peptides) were assessed every 3 days for 14 days. Cardiac function was assessed using ECG, echocardiography and troponin I (Tn I). Outcome was assessed using 3 month G.O.S.

Results and Discussion: No hyponatremia occurred. Mild hypernatremia (152 \pm 7 mmol/l) occurred in 5 cases and was associated to an unfavourable outcome. In these patients, a more important activation of renin-angiotensin system with enhanced brain natriuretic peptide (BNP) secretion and a relative deficiency of vasopressin secretion were observed. Four of them had EKG changes (ST depression and T waves changes), and 2 of them had echocardiographic left wall motion abnormalities (inferior hypokinesia and apical dyskinesia). In addition, a significant correlation was observed between BNP and TnIc circulating levels in all patients (Figure).



Conclusion: A large and controlled sodium and fluid intake prevent hyponatremia occurrence despite increased BNP. Elevated BNP is correlated to worse outcome and elevated Tn I. These results suggest a cardiac origine of NP secretion.

References:

- 1 Am. Heart J. 1998;135:914-923.
- 2 Stroke 1998;29:1584-1587.
- 3 Lancet 1997;349:245-249.

A-376

Brain tissue oxygen pressure reactivity and delayed cerebral infarction after aneurysmal subarachnoid hemorrhage

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Background and Goal of Study: The index of brain tissue oxygen pressure reactivity ($b_{p_{iO_2}}$) characterises the long term response of p_{iO_2} to changes in

CPP [1]. The purpose of our study was to investigate the relation between $b_{p_{iO_2}}$ and the occurrence of delayed cerebral infarction after severe aneurysmal subarachnoid hemorrhage (SAH).

Materials and Methods: Brain tissue oxygen (p_{iO_2}) and cerebral perfusion pressure (CPP) were assessed in 51 patients after SAH Hunt&Hess III–V. The p_{iO_2} pressure reactivity index $b_{p_{iO_2}}$ was calculated as $b_{p_{iO_2}} = \Delta p_{iO_2} / \Delta CPP$ every 30 seconds, based on data recorded during the previous 12 hours of monitoring. Patients were divided into an infarction group ($n = 19$) in which delayed cerebral ischemia occurred, and a non-infarction group ($n = 32$).

Results and Discussions: Median $b_{p_{iO_2}}$ over the whole monitoring period was significantly higher ($p < 0.001$) in the infarction group ($b_{p_{iO_2}} = 0.25$) as compared to the non-infarction group ($b_{p_{iO_2}} = 0.12$). Clinical parameters, flow velocity as assessed by transcranial Doppler and data of CPP and p_{iO_2} alone did not distinguish between groups. Logistic regression revealed that $b_{p_{iO_2}}$ and age are predictive regarding the occurrence of delayed ischemic infarction, whereas the other mentioned factors were not.

Conclusion(s): The p_{iO_2} pressure reactivity index may distinguish between patients that will finally develop infarction after SAH and those who will not. In terms of predictive power, $b_{p_{iO_2}}$ seems to be superior to standard criteria such as TCD, CPP and p_{iO_2} .

Reference:

- 1 M Soehle, M Jaeger, J Meixensberger. Online assessment of brain tissue oxygen autoregulation in traumatic brain injury and subarachnoid hemorrhage. *Neurol Res* 2003; 25: 411–417.

A-377

Interventional neuroradiology – a Portuguese anesthetic experience

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Background and Goal of Study: Interventional neuroradiologic (INR) procedures represent treatment of central nervous system disease by endovascular access for the purpose of delivering therapeutic agents, including both drugs and devices. For optimal anesthetic management, anesthesiologists should be familiar with specific radiological procedures and their potential complications (1). The technique of anaesthesia used for INR procedures varies amongst institutions and is often influenced by the preferences of the neuroradiologist. This is a rather young department that asks for an appropriate anaesthesia management (2).

Materials and Methods: We perform a retrospective study of the 7 years of existence of the Interventional Neuroradiologic Unit at Hospital S. José. In our study, some of the anesthetic agents and techniques used in the INR were different from those used in the operating room. Both neuroleptic/conscious sedation (using Fentanyl and Morphine) and general anaesthesia were performed. All patients were monitored with an electrocardiogram, pulse oximetry, non invasive blood pressure, and capnography. **Results and Discussions:** The principles of safe neuroanaesthesia were applied to all 1141 patients. During conscious sedation, the awake patient serves as an effective overall monitor of neurological status. Reasons for the use of general anaesthesia include the length of time that the patient may have to lie still, as well as the repeated requests for absolute stillness for some of the radiological techniques. Monitoring standards for anaesthesia in remote locations as the INR suite should be no different from those in the operating room.

Conclusions: For optimal anesthetic management, anesthesiologists should be familiar with specific radiological procedures and their potential complications. Aneurysms with surgical difficult access, such as those of the posterior fossa, can be treated by interventional neuroradiology. Patients with high-risk medical conditions may also benefit from INR. Today an anesthesiologist should be involved in the care of the patient during INR.

References:

- 1 Osborn IP, *Int Anesthesiol Clin*, 2003; 41: 69–77.
- 2 Kamoen E, *Acta Anaesthesiol Belg*, 2000; 51: 191–6.

A-378

Prospective audit of endovascular coiling v. clipping for subarachnoid haemorrhage

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Background and Goal: Endovascular coiling is a new alternative to clipping for intracerebral aneurysms in Subarachnoid Haemorrhage. Our institution is the only one in the State to offer this treatment.

Materials and Methods: We conducted a 5 month (July–Nov. 2003) prospective audit to compare outcomes between these treatments.

Results and Discussions:

	Coiling	Clipping
Male/average age (yrs)	22/70 (31.5%)/46.7	8/35 (23%)/58.1
Female/average age (yrs)	48/70 (68.5%)/52.7	27/35 (77%)/51
No. of procedures/No. of aneurysms	85/88	37/37
% ASA 1	61%	48.5%
% Hunt and Hess 1	47/70 (67%)	26/35 (75%)
Family history	15/70 (21.4%)	8/35 (23%)
Smoking history	31/70 (44.2%)	9/35 (25.7%)
Elective procedures	20/85 (23.5%)	5/35 (14.3%)
Emergency	65/85 (76.5%)	30/35 (85.7%)
Multiple aneurysms	11/88 (12.5%)	7/37 (19%)
Anterior circulation aneurysms	55/88 (62.5%)	29/37 (78%)
Posterior circulation aneurysms	33/88 (37.5%)	8/37 (22%)
Neurological complications	31/88 (35.2%)	16/37 (43.2%)
Mortality	2/70 (3%)	2/35 (6%)
L.O.S	4–57 days	9–30 days

Conclusion(s): The mortality is higher (double) in the clipping group and clipping was associated with a greater complication rate. No overall difference in length of stay was noted. Elective coilings were associated with reduced morbidity and length of stay.

A-379

PS-100 beta in subarachnoid aneurysmal hemorrhage

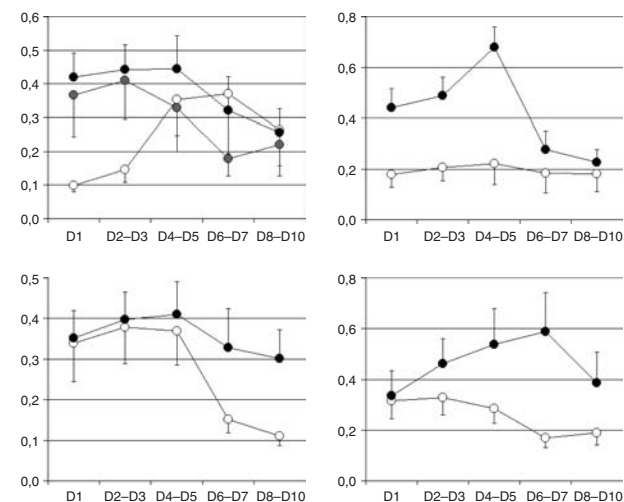
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Background: There are very few reports concerning the use of PS-100, a biological marker of brain ischemia, in subarachnoid hemorrhage.

Methods: PS-100 (normal value $< 0.15 \mu\text{g/L}$) was measured in 40 patients (age = 48 ± 14 yrs) every day during the 10 first days following acute subarachnoid hemorrhage (< 48 hours). Data are presented in figure as mean \pm SEM.

Results: Figure shows mean PS-100 values according to the initial WFNS (top left; white dot = WFNS 1, gray dot = WFNS 2–3, black dot = WFNS 4–5); the Fisher score (top right, white dot = Fisher 1–3, black dot = Fisher 4–5); presence of spasm (bottom left, white dot = no spasm, black dot = spasm) and outcome (bottom right, white dot = GOS 4–5, black dot = GOS 1–3).



The total amount of PS-100 was significantly higher in patients treated surgically than in patients treated by coiling (4.1 ± 3.4 vs $2.4 \pm 2.0 \mu\text{g/L}$, $p < 0.05$).

Conclusions: At admission, PS-100 was similar in patients with a WFNS score and 4–5, but much lower in patients with a WFNS 1 score. In contrast, patients having a Fisher score of 4–5 had a much higher PS-100 than patients with Fisher 1–3. Spasm increased PS-100 from D6 to D10. The total amount of PS-100 was higher in operated patients as compared to patients treated by coiling. PS-100 is linked to the outcome, assessed by the GOS score.

A-380**Cerebral microdialysis during temporary artery clipping: first clip results in more ischemic insults than later clips**

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Introduction: Temporary clipping facilitates dissection and clipping of cerebral aneurysms. There is a danger, however, that temporary clipping may cause neurological deficit. With intracerebral microdialysis glucose, lactate, pyruvate and glycerol can be measured. In the present study, we used high flow microdialysis (5 µl/min) to assess the incidence of focal brain ischemia induced by temporary clipping of the middle cerebral artery (MCA).

Patients and Methods: With IRB approval, 17 pts undergoing elective clipping of an MCA aneurysm were included. After opening of the dura, a microdialysis catheter (CMA70) was inserted into the cortex of the MCA territory and dialysates were collected every 3 min. Glucose, lactate, pyruvate, and glycerol were immediately analysed.

Results: In 14/17 pts, 44 episodes of TC were applied for m4.1 min (1–9 min). In 29/44 episodes (66%) we observed a decrease in glucose. In 20 episodes, we observed an increase in lactate/pyruvate ratio, suggesting a 45% overall incidence of impending local cerebral ischemia. Finally, in 14 episodes we observed a significant increase in local cerebral glycerol, suggesting a 32% of brain cell death induced by TC. When comparing the local metabolic characteristics of all "first" TC's (14 TC's) to the later TC's (30 TC's), we observed a significant less incidence of glucose decrease, lactate/pyruvate ratio increase and glycerol increase for the later TC's compared to the first TC. First TC resulted in a 60% incidence of lactate/pyruvate ratio compared to 38% for the later TC's. First TC resulted in a 40% incidence of glycerol increase compared to a 28% incidence of glycerol increase during later TC's.

Conclusion: Cerebral microdialysis reveals the local production of ischemia markers during TC. These first preliminary results revealed that the first TC results in twice as much ischemic insults as all other later TC's, possibly indicating the presence of some ischemic pre-conditioning of the brain.

A-381**Coiling in subarachnoid aneurysmal hemorrhage**

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Background and Goal of Study: Coiling has been validated in low grade patients by the ISAT trial. The goal of our study was to give a description of the clinical results of coiling vs surgery in a university hospital.

Materials and Methods: Patients treated in 2002 and 2003 by coiling or surgery in the first 4 days after bleeding were entered in a prospective file (n = 154; coiling = 84; surgery = 70; age = 49 ± 15 yrs). Coiling was more often performed for anterior (60% of the 61 ACA; 67% of the 46 carotidian or post. com. aneurysms) and posterior circulation aneurysms (90% of 11), whereas surgery was more often performed for sylvian aneurysms (80% of 36). The age, the WFNS and FISHER scores, the treatment type and the occurrence of spasm were entered in the logistic regression analysis model.

Results and Discussions: Table shows the odds ratio and confidence intervals for factors significantly correlated to a good outcome (GOS 4–5 at ICU discharge).

	Odds	95% inf	95% sup
Age < 40	4.57	1.94	10.75
FISHER 1–3	2.41	1.03	5.62
Coiling	3.03	1.36	6.63

The ICU length of stay was significantly lower with coiling for FISHER 1–3 patients only. The % of patients having a GOS 4–5 at discharge of the ICU was higher for coiling whatever the FISHER although the difference between the two treatments was more pronounced in FISHER 4–5 patients.

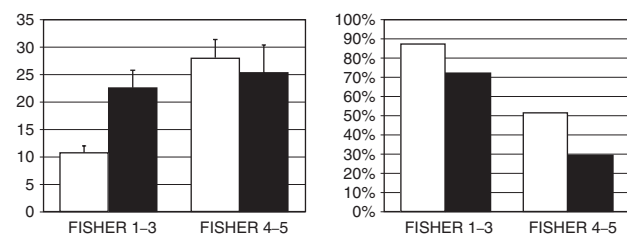


Figure. ICU length of stay (days, left) and percentage of GOS 4–5 patients (%), right) at discharge of ICU according to FISHER and treatment (white bars: coiling; black bars: surgery).

Conclusion(s): In today's standard practice, coiling improves outcome whatever the FISHER and reduces the LOS for FISHER 1–3 patients.

A-382**Anesthesia for interventional neuroradiology: a comparison between TIVA-TCI and sevoflurane techniques**

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Background and Goal of Study: Haemodynamic instability is often a major concern in patients undergoing interventional neuroradiology for endovascular treatment of cerebral aneurysms and malformations. Inhalation and totally intravenous anesthetic techniques are widely used in neurosurgical scenario. This perspective study evaluate the haemodynamic variability during sevoflurane versus propofol-TCI techniques for cerebral angiography and or coiling of vascular malformations and cerebral aneurysms.

Materials and Methods: 24 adult patients were randomized in two groups. Group S: propofol induction 2 mg/kg, fentanyl 3 mcg/kg, vecuronium 0,08 mg/kg; maintenance with sevoflurane MAC 0,8–1,2 in O₂/air 50/50 mix. Group T: propofol induction with TCI 3,5–5,1 mcg/ml, fentanyl 3 mcg/kg, vecuronium 0,08 mg/kg in O₂/air 50/50 mix; maintenance propofol TCI 2,3 ± 1,4 mcg/ml. Monitoring included, EtCO₂, SpO₂, MAC_{sevo}, propofol [C]_{effect site}, HR, invasive mean arterial pressure, recorded at T₀ baseline, T₁ intubation, T_a angiography, T_c coiling times. Variability was measured as (MAP_{max} – MAP_{min}/MAP_{baseline}) × 100.

Results and Discussions: the two groups were comparable for demographic characteristics and clinical baseline values. Mean MAP at induction was 73,5 ± 9 mmHg for S group, 76 ± 7,5 mmHg for T group and MAP variability was greater in S group limited to the intubation time: 18% vs 9,9%. No statistically significant difference was detected in the other phases of the procedure (see Table).

	S Group (%)	T Group (%)	p
T ₁	18	9,9	<0,05
T _a	12,1	11,1	ns
T _c	12,1	9,93	ns

Conclusions: Satisfactory anesthesia can be provided for cerebral angiography by either intravenous or allogenates techniques. Hemodynamic stability obtained with TCI technique is better for intubation phase, but comparable for maintenance.

Reference:

Manninen PH. Conscious sedation for interventional neuroradiology: a comparison of midazolam and propofol infusion. *Can J Anaesth.* 1997 Jan;44 (1):26–30.

A-383**TIVA for interventional neuroradiology: fentanyl vs remifentanyl**

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Background and Goal of Study: General anaesthesia offers good operative conditions for interventional neuroradiology (1). The aim of the present study was to assess the effects of two anaesthetic techniques using propofol (P) infusion associated with bolus fentanyl (F) or remifentanyl infusion (R).

Materials and Methods: After ethical committee approval 15 patients undergoing elective embolization procedures of intracranial vascular lesions were randomized to 2 groups. Anaesthesia was induced with P 1–2 mg kg⁻¹, and vecuronium bromide (V) 1 mg kg⁻¹ combined with either F 2 µg kg⁻¹ or R 0.1–0.25 µg kg⁻¹ min⁻¹. Anaesthesia was maintained with P infusion 5 mg kg⁻¹ combined with either F 2 µg kg⁻¹ or R 0.05–0.25 µg kg⁻¹ min⁻¹, titrated to blood pressure and heart rate. Monitored neuromuscular blockade was obtained with V. All patients were ventilated with O₂ in air 50% to mild hypocapnia. Routine monitoring was performed. Awakening times were recorded after anaesthetics were discontinued. Heart rate, systolic, diastolic and mean arterial pressure (MAP) were recorded with 5 min intervals. Statistics was performed by Wilcoxon Rank test; p < 0.05 was considered significant.

Results and Discussions: Demographic data and duration of procedure were similar for both groups. No significant differences seem to exist between the two groups in terms of hemodynamic conditions and awakening times. Both showed a moderate average decrease of MAP from baseline through the procedure. The decrease was slightly milder in the fentanyl group, though without statistical significance.

	Fentanyl (mean ± SD)	Remif. (mean ± SD)
Spontaneous ventilation	7.1 ± 5.3 min	8.8 ± 4.5 min
Extubation	12.4 ± 9.1 min	11.0 ± 5.5 min
Orientation	13.3 ± 5.9 min	13.0 ± 5.4 min
MAP decrease	20.6 ± 6.1 mmHg	27.8 ± 7.1 mmHg

Conclusion(s): Interim results from this ongoing study suggest that both fentanyl and remifentanyl combined with propofol in TIVA provide adequate level of anaesthesia without air pollution for interventional neuroradiology.

Reference:

1 Lai YC, Manninen PH. *Can J Anaesth.* 2001; 48(4):391–5.

A-385

Neurologic dysfunction after isoflurane sedation in intensive care unit

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Background and Goal of Study: Several studies have discovered neurologic dysfunction (ND), including hallucination, agitation, ataxia, peripheral neuropathy and chorea, after isoflurane sedation in intensive care unit (ICU). Nevertheless, the risk factor causing ND is not still clear. Our objective was to investigate whether the relationship between the ND and isoflurane sedation is the same in general ICU.

Materials and Methods: We studied consecutive 137 patients who received isoflurane sedation during mechanical ventilation in ICU.

Results: Nine patients subsequently developed ND manifested as chorea, systemic tremor, agitation and convulsion after sedation by isoflurane. ND lasted from 30 minutes to 6 days. The six (67%) of 9 patients were pediatric under 3 years in ND group. The rate of ND was 55 % (6 of 11) in pediatric patients and 2.3% (3 of 126) in non-pediatric patients. The rate of ND in patients receiving isoflurane over 30 MAC-hours and under 30 MAC-hours is 40% (6 of 15) and 2.4% (3 of 122). MAC-hours were 61 ± 43 (mean ± SD) pediatric ND patients and 76 ± 87 in pediatric non-ND patients. All ND resolved in all patients before ICU discharge. All ND resolved in all patients before ICU discharge.

Conclusion: A high occurrence rate of ND occurred in pediatric patients. The relationship between ND and MAC-hours was not evident.

Reference:

Kelsall AW et al. Reversible neurologic dysfunction following isoflurane sedation in pediatric intensive care. *Crit Care Med* 1994; 22: 1032–1034.

A-386

Does the autonomic storm compromise cardiac harvesting in brain-dead patients?

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Background and Goal of the Study: After experimental brain death, the occurrence of an autonomic storm (AS) may be responsible for severe myocardial dysfunction (1). This relationship is not clear in the clinical setting. However, myocardial dysfunction may prevent cardiac harvesting in young donors. The aim of this study was to analyze the relationship between VS and cardiac harvesting.

Materials and Methods: During a two-year period, brain death diagnosis was established in 159 patients. Among them, 46 patients, under 60 years, without history of cardiac disease, were considered as potential cardiac donors. VES diagnosis included SAP > 200 mmHg associated with tachycardia > 130/min. Heart acceptance criteria associated CPK, troponin I and echocardiography. Factors associated with cardiac harvesting were studied with univariate analysis (Chi square and Mann-Whitney tests).

Results and Discussion: AS was observed in 29 patients (69%). Hypertension was treated in 12 patients (esmolol n = 6, urapidil n = 5, nicardipine). Cardiac harvesting was performed in 28 donors (61%).

	Cardiac harvesting (n = 28)	No cardiac harvesting (n = 18)	p
Age	39.0 ± 10.8	36.9 ± 10.9	0.61
Time between admission-BD (d)	3.0 ± 2.7	2.7 ± 2.6	0.65
LVEF (%)	65.5 ± 5.5	37.0 ± 10.7	<0.001
CPKMB/CPK > 10% (%)	7.1	37.5	0.02
Troponin I (ng/ml)	1.2 ± 1.7	3.5 ± 5.0	0.16
AS (%)	64.3	61.1	0.83
AS treatment (%)	39.3	5.5	0.008

Mean ± SD; BD: brain death; LVEF: left ventricle ejection fraction.

Occurrence of AS did not compromise cardiac harvesting if treatment was instituted.

Conclusion: Aggressive management of hypertension during AS may limit myocardial dysfunction and increase the number of available cardiac grafts.

Reference:

1 Transplantation. 1994;58:414–418.

A-387

Effect of decompressive craniectomy on brain tissue oxygenation and intracranial pressure in patients with intracranial hypertension

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Background and Goal of Study: The value of decompressive craniectomy in the treatment of patients with intracranial hypertension is discussed controversially. Previous clinical research has mainly focussed on patient outcome following decompression, however only little is known about the pathophysiological effects of craniectomy. The purpose of this study was to investigate the intraoperative changes of brain tissue oxygenation (p_tO₂) and intracranial pressure (ICP) during decompressive craniectomy.

Materials and Methods: Intraoperative monitoring of p_tO₂ (Licox) and ICP (Codman) was performed in seven patients suffering from intractable intracranial hypertension due to severe brain swelling. The underlying pathology was traumatic brain injury, subarachnoid hemorrhage or space-occupying cerebral infarction.

Results and Discussions: Mean preoperative ICP and p_tO₂ values were 50 and 9 mmHg, respectively. Mean ICP decreased immediately to 22 mmHg after removal of bone flap and further dropped to 8 mmHg following dura opening. Simultaneously, mean p_tO₂ increased rapidly to 17 and 24 mmHg, respectively. Both ICP and p_tO₂ remained at non-critical ranges postoperatively.

Conclusion(s): Decompressive craniectomy is highly effective in the treatment of patients suffering from severely elevated ICP and critically diminished p_tO₂. When applied early, it may avoid impending secondary ischemic damage and improve patients' clinical status.

A-388

Thiopentone might decrease the incidence of sensorineural hearing loss but not that of facial palsy following microvascular decompression in hemifacial spasm patients

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Background and Goal of Study: Sub burst-suppression dose of thiopentone might protect cells from ischemia. Microvascular decompression (MVD) for treating hemifacial spasm (HFS), could cause sensorineural hearing loss (SSHL) or facial palsy (FP) postoperatively. This study was performed to reveal the effect of thiopentone on SSHL and FP after MVD.

Materials and Methods: Randomized double blind prospective study was performed in 243 HFS patients (aged from 22 to 77 yrs) undergoing MVD between 1998 and 2000. Among them, 225 patients had normal hearing with (6 pts) or without (119 pts) facial palsy preoperatively were enrolled in this study. Thiopentone, 5 mg/kg (Group P, n = 69) or placebo (Group C, n = 174), was administered intravenously 3 minute before cerebellar retraction. Anesthetic regimen was identical to all patients and standard monitorings (ECG, invasive BP, ET CO₂, esophageal temperature) as well as intraoperative brainstem auditory evoked potential monitoring were applied. Occurrence of SSHL (when patient complained of hearing impairment) and FP was evaluated with pure tone audiometry or physically at discharge from hospital (mostly within 7 days) and at follow-up periods (1–3 years) by the neurosurgeon who did not know the patient's group. 'Trans' or 'Perm' type of injury was classified according to remission within 6 months or persistence thereafter, respectively. Statistical analysis was performed with χ^2 test with Yates correction between two groups according to the incidence of SSHL or FP.

Results and Discussions:

Table. Incidence of SSHL or FP after MVD.

Injury type	Group C	Group P	P-value
SSHL			
Tran.	19/161 (11.8%)	3/64 (4.7%)	0.170
Perm.	5/161 (3.1%)	0/64 (0%)	0.355
Overall	24/161 (14.9%)	3/64 (4.7%)	0.057
FP			
Tran.	28/146 (19.2%)	11/53 (20.7%)	0.964
Perm.	1/146 (0.7%)	0/53 (0%)	0.596
Overall	29/146 (19.9%)	11/53 (20.7%)	0.951

Conclusion(s): Thiopentone administered prior to cerebellar retraction during MVD may decrease the incidence of SSSL, not that of FP postoperatively.

Reference:

Schmid-Elsaesser, R. *J Neuro Sci*, 1999, 162:14–9.

A-389

Cerebral hemodynamic and cognitive function under beta-adrenergic blockade with esmolol

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Background and Goal of Study: Recent studies demonstrated that esmolol depresses electrocortical activity during anaesthesia (1, 2, 3). However, the exact mechanism of this phenomenon remains to be elucidated. Thus, functional magnetic resonance imaging (fMRI) based on the blood oxygenation level dependent (BOLD) contrast was employed to explore esmolol effects on cerebral blood flow, cerebral vasoreactivity and cognitive function in human volunteers.

Materials and Methods: Ten healthy male volunteers were investigated in two separate experimental sessions using fMRI. One session comprised of a hyperventilation task and the Colour Word Matching Stroop task. During this session subjects had to perform both tasks twice, once after administration of an esmolol bolus of 1 mg kg⁻¹ followed by a continuous infusion of 150 µg kg⁻¹ min⁻¹ and once without β-blockade in a random order. During the second session subjects were scanned at resting state after administration of 1 mg kg⁻¹ over 2 minutes followed by an esmolol infusion of 150 µg kg⁻¹ min⁻¹.

Results and Discussion: Esmolol decreased heart rate and blood pressure ($p < 0.05$), but continuous infusion of esmolol did not affect the BOLD signal during the functional challenges or the reaction times during the Stroop task. However, bolus injection of esmolol caused immediate BOLD signal increases in the frontal cortex, in the cerebellum as well as in the white matter ($p < 0.01$) and in the parietal and temporal lobe ($p < 0.05$). The observed BOLD signal increase in the occipital lobe ($p > 0.2$) failed to reach significance. These findings suggest a transient cerebral vasodilatation associated with the esmolol bolus.

Conclusion(s): We interpret our findings as autoregulatory response of cerebral blood vessels in order to compensate the sudden drop in cerebral perfusion pressure associated with acute β-blockade. The results of the study further demonstrate that continuous β-blockade with esmolol does not affect cerebral blood flow, cerebral vasoreactivity or cognitive performance. Thus, the esmolol-induced cortical depression during anaesthesia (1, 2, 3) cannot be explained by sedative or other central actions of the drug.

References:

- Johansen JW et al. *Anesthesiology* 1997; 86: 364–371.
- Johansen JW et al. *Anesth Analg* 1998; 87: 671–676.
- Johansen JW. *Anesth Analg* 2001; 93: 1526–1531.

A-391

Venous air embolisms during neurosurgical procedure in sitting position and neurological postoperative complications

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Background and Goal of Study: Venous air embolisms (VEA) are positional hazards confronting patients placed in the sitting position for cervical spine (CSS) or posterior fossa surgery (PFS) (1). Depending on monitoring procedures used during operation the incidence of VEA is described to be as high as 76% (2). VEA may be fatal or a cause of different postoperative complications.

Materials and Methods: We retrospectively reviewed data of 104 patients who underwent neurosurgical procedure in sitting position in a period of 4 years in general anaesthesia (TIVA with propofol and remifentanyl, O₂/air mixture). Precordial Doppler ultrasound and PETCO₂ were used for detection of VAE.

Results and Discussions: Data are shown in the table:

	PFS	CSS	Total
No. of pts	76	28	104
Embolisms detected (no./%)	15/20	3/11	18/17
VSD prev. known (%)	0	0	0
Ishemic lesions on CT scan (no./%)	2/3	0	2/2
Postoperative IPPV (no./%)	1/1	1/4	2/2
Death (no./%)	1/1	0	1/1

Conclusion: Despite of sufficient early detection of VAE and anesthetists intervention intraoperatively it is still surgeon's responsibility to locate the possible site of air entry and to prevent occurrence of VAE consequently reducing postoperative complication.

References:

- Porter JM, Pidgeon C, Cunningham AJ. *Br J Anaesth* 1999; 82: 117–28.
- Papadopoulos G, Kuhly P, Brock M, et al. *Acta Neurochir* 1994; 126: 140–3.

A-392

Predictive value of cerebral microdialysis in neurosurgical patients

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Introduction: Cerebral microdialysis (MD) monitors local cerebral metabolism and ischemia. In the present study, we evaluated whether MD revealed changes in local metabolism that might have any postoperative prognostic significance after major neurosurgery.

Patients and Methods: With IRB approval, 28 patients scheduled for major neurosurgery were included. After opening of the dura, a MD catheter was inserted in the cortex of the most critical brain area during neurosurgical intervention. The catheter was perfused by at 5 µl/min, enabling sampling every 3 min. and immediate analysis for glucose, lactate, pyruvate, glycerol and glutamate. Glucose mainly reflects local cerebral perfusion, an increased lactate/pyruvate ratio reveals impending cerebral ischemia, whereas an increased glycerol reveals neuronal cell death. Glutamate is excessively released during cerebral ischemia and induces in itself neuronal injury and death.

Results: In almost all pts we observed significant decreases in extracellular cerebral glucose. Increased lactate/pyruvate was observed in 16 pts. Increased glycerol was observed in 11 pts. In 26 pts, we observed no or only a modest (less than 2-fold) increase in glutamate. In 2 other pts (1 aneurysm pt and 1 tumor pt), we observed a marked increase (4- to 10-fold) in glutamate. Neurosurgical procedure was uneventful in 24 pts. In 4 pts, major intraoperative complications occurred (1 brain bulging, 3 intraoperative bleedings). In 2 of these pts, a marked increase in glutamate, occurring during or slightly after the surgical problem, was observed. Both these pts had a significantly worse neurological outcome than the other 2 pts with major intraoperative complications, and than the other 20 pts in whom the neurosurgical procedure was uneventful. The neurological outcome of pts with perioperative increases in lactate/pyruvate ratio, or in glycerol, was not different from the other patients.

Conclusion: Use of perioperative MD confirmed the deleterious and prognostic role of increased extracellular cerebral glutamate.

A-393

Diagnostic protocol in spinal cord injury at an emergency department

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Introduction: Spinal cord injuries (SCI) recognize in patients (pts) with major trauma and concomitant head injury (HI) a rate of 4.8% at the cervical and dorsal level reaching a rate of 8.0% in case of severe HI. The aim of our study was to assess the usefulness of a diagnostic protocol at our Emergency Department (ED) in detecting the SCI in trauma pts (1,2).

Material and Methods: From 01/10/02 to 30/06/03 all pts admitted to our ED with a major trauma underwent to the following protocol: (1) Awake pts with spinal pain and neurological symptoms: LL and AP cervical/dorsal X-ray plus open mouth odontoid view. (2) Comatous and/or abdominal-thoracic injured pts: spinal assessment by spiral CT scan. (3) To detect ligamentous injury: flexion-extension cervical spine X-ray or NMR.

Results: 271 pts entered the protocol study: 49 (18.08%) showed SCI and presented the following characteristics M = 34 (69.5%), age 44.9 ± 18.7; F = 15 (30.6%), age 44.1 ± 26.9; ISS > 15 = 38 (77.5%). Level of SCI: C1–C7 = 22 (44.9%), D1–D12 = 13 (26.5%), L1–L5 = 10 (20.4%), multiple levels = 4 (8.1%). Death occurred in 11 (22.4%) pts. Causes of death were: (a) CNS = 6 (54.5%), (b) cardiocirculatory or respiratory failure = 2 (18.2%), a + b = 1 (9.1%), (c) MOF = 2 (18.2%). Among 271 pts one reported anterior ligamentous lesion (lystesis C5 > C6); in this pt the flexion-extension cervical spine X-ray was not performed before the mobilization.

Conclusion: (1) Protocol we used was able to identify the SCI. (2) High sensibility (98%) and specificity (100%) made the protocol an essential tool in the management of the trauma pts. (3) The difficult identification of legamentous injury is well known. Therefore in trauma but still awake pts the spinal

cord study must be completed by a dynamic X-ray, while in comatous pts a more sophisticated study, as NMR, is strongly recommended.

References:

- Hoffman JR et al Selective cervical spine radiography fo blunt trauma victims: results of the National Emergency X-ray radiography Utilization Study Acad Emerg Med 6: 451, 1999.
- Lewis LM et al Flexion extension views in the evaluation of cervical spine injury Ann Emerg Med 20: 117–21, 1991.

A-394

Perioperative levels of catecholamines in cerebrospinal fluid and plasma

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Background and Goal of Study: Anxiety before anaesthesia and perioperative procedures may be associated with increased secretion of stress-related hormones such as dopamine, epinephrine, and norepinephrine (1,2). Under certain conditions, these hormones can act as central neurotoxins (3) and cause neurological damage. In the present study, we examined the course of these catecholamine concentrations perioperatively in cerebrospinal fluid (CSF) and plasma.

Materials and Methods: After approval of the ethics committee, we performed a prospective study in 23 patients (ASA III, 65–85 years) who underwent elective implantation surgery of the hip joint with intrathecal catheter anaesthesia. The concentrations of dopamine, epinephrine, and norepinephrine in the cerebrospinal fluid and plasma were determined by means of HPLC immediately before and after surgery as well as 6 and 24 hours after surgery.

Results: In most patients, dopamine and epinephrine were not detectable in the CSF. The concentration of norepinephrine in the CSF was between 106 ± 66 pmol/l and 177 ± 91 pmol/l with no significant perioperative differences. The dopamine plasma concentration was barely above the detection threshold. Plasma epinephrine showed an increase from 50 ± 31 pmol/l preoperatively to 103 ± 51 pmol/l 6 h postoperatively and had returned to baseline 24 h postoperatively. Plasma norepinephrine concentrations rose from 365 ± 141 pmol/l intraoperatively to 535 ± 219 pmol/l and remained nearly stable for up to 24 hours after surgery.

Conclusions: In the course of a routine, complication-free intrathecal anaesthesia for elective orthopaedic surgery of the inferior limb, the catecholamine levels of neurologically sound patients were higher in the plasma than in the CSF. Determining CSF levels of catecholamines therefore shows no advantage as compared to measuring the plasma levels. As a consequence of the high technical demands and the non-significant changes observed, catecholamine level determination is not a useful parameter for evaluating perioperative stress.

References:

- Br J Anaesth 1991;66:587–90.
- Anesth Analg 1999;88:787–92.
- Experimental Neurology 1999;159:217–24.

A-396

Intraoperative definition of temporal lobe area resection in epileptic patients by etomidate stimulation – An electrocorticographic register

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Background and Goals: Etomidate blocks GABA channels so epileptic patients may benefit this property to increase cortical irritability during electrocorticographic studies, and to define epileptogenic area during craniotomy under general anaesthesia.

Material and Methods: 30 patients under general anaesthesia with propofol, remifentanyl and cisatracurium went for temporal lobectomy. The electrocorticographic register in lateral temporal area was achieved with a 20 electrode blanket an another one in mesial temporal area with 4 to 8 electrodes. Cortical brain was stimulated with etomidate 1 mg/kg while cortical activity is recorded before, during and after stimulation. J. Engel functional classification for epilepsy is recorded one year after surgery.

Results: A increase in spikes frequency is produced by etomidate, especially in lateral-temporal areas, where interictal activity was previously observed. We also notice an increase in spikes depth and in their frequency. All patients were in Engel functional class I and II, one year after surgery.

Conclusions: Etomidate proves to be effective for intraoperative studies in epileptic patients, as we can obtain a precise delimitation of temporal areas to be removed. There is no need to superficialize anaesthesia and long term results are very satisfactory.

References:

- Agents pharmacologiques épileptogènes en anesthésie. N. Brude, M. Bonet. Ann Fr Anesth Réanim 2001; 20: 171–9.
- GABAergic Mechanism in Epilepsy. David. M. Treiman. Epilepsia 2001; 42(suppl 3): 8–12.

A-397

The effects of milrinone on jugular bulb oxygen saturation and cerebrovascular reactivity to carbon dioxide during coronary artery bypass graft surgery

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Background and Goal of Study: We investigated the effect of milrinone on the balance between cerebral blood flow (CBF) and cerebral metabolic rate (CMR), and the cerebrovascular reactivity to the changes of arterial carbon dioxide tension (PaCO₂) by measuring jugular bulb oxygen saturation (SjvO₂) (1,2).

Materials and Methods: Thirty patients scheduled for off-pump coronary artery bypass graft surgery (CABG) were studied prospectively. After sternotomy, normoventilation (PaCO₂ 35–40 mmHg) (T1) and hyperventilation (PaCO₂ 25–30 mmHg) (T2) were induced. Between T1 and T2, the differences in SjvO₂ and PaCO₂ (C-ΔSjvO₂ and C-ΔPaCO₂, respectively), and C-ΔSjvO₂/C-ΔPaCO₂ (C-CCO₂R) were measured. Normoventilation was reestablished (T3). Thereafter, milrinone 50 μg kg⁻¹ was loaded (T4), which was followed by hyperventilation (T5). Between T3 and T5, the differences in SjvO₂ and PaCO₂ (M-ΔSjvO₂ and M-ΔPaCO₂, respectively), and M-ΔSjvO₂/M-ΔPaCO₂ (M-CCO₂R) were measured. A P value of less than 0.05 was considered statistically significant. Data are mean ± S.D.

Results and Discussions: C-ΔSjvO₂ showed significant linear correlation with C-ΔPaCO₂ (C-ΔSjvO₂ = 8.54 + 0.85(C-ΔPaCO₂), R² = 0.14, P = 0.044). At T4 compared with T3, cardiac index and mixed venous oxygen saturation increased, and mean arterial pressure and systemic vascular resistance index decreased without significant changes of SjvO₂. M-ΔSjvO₂ showed significant linear correlation with M-ΔPaCO₂ (M-ΔSjvO₂ = 8.20 + 0.66 × (M-ΔPaCO₂), R² = 0.15, P = 0.034), but did not correlate with the changes of haemodynamic variables following milrinone administration. M-CCO₂R was not different with C-CCO₂R ($1.7 \pm 0.5\%$ per mmHg and $1.5 \pm 0.6\%$ per mmHg, respectively, P = 0.16).

Conclusions: Although milrinone induced significant haemodynamic changes, it preserved not only the balance between CBF and CMR, but also CCO₂R.

References:

- Sulek CA, Blas ML, Lobato EB. J Cardiothorac Vasc Anesth 2002; 16: 64–9.
- De Deyne C, Van Aken J, Decruyenaere J, et al. Acta Anaesthesiol Belg 1998; 49: 21–31.

A-398

The effect of remifentanyl on recovery period added propofol or sevoflurane during craniotomy

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Introduction: The aim of this study was to compare the effect of remifentanyl on recovery period; it is added to propofol or sevoflurane during supra-tentorial craniotomy.

Material and Methods: After approval of local ethics committee, 30 patients, undergoing craniotomy ASA I–II, GKS: 15, were divided into two groups. Induction is achieved by 2 mg kg⁻¹ propofol, 1 μg kg⁻¹ remifentanyl and 0.1 mg kg⁻¹ vecuronium in both groups. Maintenance was provided by 50–100 μg kg⁻¹ min⁻¹ propofol and 0.25 μg kg⁻¹ min⁻¹ remifentanyl in the first group (n = 15), and by % 1–1.5 sevoflurane, 0.25 μg kg⁻¹ min⁻¹ remifentanyl and % 50 O₂–air mixture in the second group (n = 15). Preoperatively, at induction, intubation, pin head-holder, skin incision, opening dura, closing dura and at the end of the operation; mean arterial pressure (MAP), heart rate (HR), and also recovery of spontaneous respiration, occurrence of respiration, starting of swallowing reflex, opening of eyes and extubation times were recorded. Postoperatively MAP, HR, Modified Alderate Score, Camron Awakeness Score, nausea-vomiting and tremor were

assessed in every 10 minutes. For statistical analysis Student T test, Mann Whitney U test, Ki-Square test were used.

Results: Demographic data and hemodynamic changes were similar between groups ($p > 0.05$). There were no difference between groups according to recovery of spontaneous respiration, occurrence of enough respiration, starting of swallowing reflex, opening of eyes and extubation times (Table 1) ($p > 0.05$). Also postoperative Alderate Score and Camron Awakeness Score were similar between the groups.

Table 1.

	Group I	Group II
Recovery of spontaneous respiration (min)	4,5 ± 4,1	3,5 ± 2,4
Swallowing reflex starting (min)	5,2 ± 4,3	5,2 ± 2,4
Occurrence of respiration (min)	6,1 ± 4,6	7,1 ± 5,0
Extubation time (min)	7,2 ± 5,3	8,2 ± 5,1
Opening of eyes (min)	8,7 ± 8,6	8,2 ± 7,1

Conclusion: Remifentanyl added to propofol or sevoflurane during craniotomy provides stable hemodynamics and short recovery times. For this reason both method can be used safely during supratentorial operations.

A-400

Sevoflurane and propofol anesthesia equally maintain the direct cerebral vasodilatory effects of nitrous oxide

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Introduction: Nitrous oxide is reported as a direct cerebral vasodilator, that might be influenced by the co-administration of intravenous or inhalational hypnotics. In the present study, we wanted to evaluate the net cerebrovascular effects, as estimated by jugular bulb oximetry, of adding nitrous oxide to propofol or sevoflurane.

Patients and Methods: With IRB approval, 40 pts scheduled for elective brain tumor surgery were randomized into 4 groups (propofol/alfentanil with (65%)/without N₂O or sevoflurane/alfentanil with (65%)/without N₂O). In order to guarantee equipotent hypnotic doses, we titrated the main hypnotic component (propofol or sevoflurane) to BIS values between 40 and 60. The analgetic component (alfentanil) was titrated to autonomic responses (blood pressure, heart rate). Statistical analysis was performed with Anova.

Results: We did not find any significant difference in PaCO₂, in hemodynamic parameters, nor in analgetic needs (alfentanil) between all 4 groups. In both N₂O groups, we observed a decreased (although non-significant) need in hypnotics. We found a significant increase in mean SjO₂ values between propofol without (mSjO₂ 49.5%) and with N₂O (mSjO₂ 57.5%) and between sevoflurane without (mSjO₂ 57.6%) and with N₂O (mSjO₂ 67%). The change in SjO₂ incurred by the administration of N₂O was more pronounced, but not significantly different in the sevoflurane group compared to propofol.

Conclusion: Using BIS to guide equipotent hypnotic conditions, jugular bulb saturations revealed similar cerebral vasodilatory effect of adding N₂O to propofol or to sevoflurane.

A-401

Investigating correlation between changes in auditory evoked potentials and intraoperative memory following propofol-remifentanyl based anaesthesia

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Background and Goal of Study: There is conflicting evidence that memory of intraoperative experiences may occur even though anaesthesia appears to be adequate to surgical stimulus. Middle latency auditory evoked responses (MLAERs) monitoring have been proposed as a measure of the hypnotic state during anaesthesia (1). The aim of this study was to investigate the effects of three target concentration of propofol in association with remifentanyl on memory formation and its correlation with changes in MLAERs.

Materials and Methods: We studied 60 patients, ASA I-II, undergoing laparoscopic cholecystectomy. General anaesthesia was induced with propofol 5 mcg/ml, remifentanyl 0.25 mcg/kg/min and cisatracurium 0.15 mg/kg. For the maintenance of anaesthesia, patients were randomly assigned to receive one of three constant calculated concentration of propofol in the Diprifusor algorithm: 3.5, 4 and 4.5 mcg/ml for the groups A, B, C respectively. Remifentanyl was administered at variable infusion rate in order to maintain BIS values less than 50. An audiotape with an implicit

memory task was played 10 minutes after skin incision. MLAERs were recorded while the patients were awake and during anaesthesia immediately before and after audiotape listening. After awakening, patients were asked if they had a dream during anaesthesia. Explicit and implicit memory was assessed 24 hours after retrieval from anaesthesia. Data were analysed by using Mann-Whitney and Kruskal-Wallis tests as appropriate.

Results: No episodes of memories for intraoperative listening were registered. Three patients having a dream (one from group A and two from group B) showed an intraoperative MLAERs wave pattern similar to that of awake state. Recall of intraoperative dream was associated with a Pa latency increase significantly smaller compared to that of the patients who were not able to remember any dream (6.3 ± 0.7 vs 26 ± 10 m sec; $p < 0.05$).

Conclusion: This suggest that anaesthetised patients who showed MLAERs preservation during anaesthesia can remember intraoperative dream after awakening. The ability to recall the dream was not necessarily related to the target of propofol administered.

Reference:

1 Loveman E. *Br J Anaesth* 2001; 86: 513-18.

A-403

How to study implicit memory during anesthesia: suggestions for an optimal selection of the items for the word stem completion test (WSCT)

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Background and Goal of Study: Unconscious processing of words during general anaesthesia has been suggested after surgery with tests of implicit memory such as the word stem completion test (WSCT). After surgery subjects are given three-letters word stem and are asked to complete with the first word that comes to mind. Implicit memory is indicated when the completion with a word previously presented during anaesthesia is more frequent than a casual completion. This facilitation of task performance is known as priming and it is measured by the priming score. Our aim was to provide a list of words to be used for a WSCT.

Materials and Methods: *Pilot study:* 22 low frequency words were chosen from a frequency of usage dictionary of Italian basic language, WSCT was performed in volunteers and priming score was calculated. *Free completion test:* 100 subjects (age 18-75 yrs) were presented with 22 stems and asked to freely complete them with the first ten words that came to mind. Total frequency was estimated for each word (absolute frequency and frequency of position of the word in the series provided by the subjects). Selected words were tested in a WSCT in awoken and anesthetized subjects.

Results and Discussion: Priming score revealed lots of false positives indicating that frequency of usage does not accurately predict the probability of free completions. 718 words were collected. For each word we evaluated (1) the absolute frequency; that is how frequently the word occurred as completion of the corresponding stem in the population and (2) the frequency of position; that is in which position (from the 1° to the 10°) the word was reported in the series provided by each subject. For each stem we analyzed the distribution of total frequencies of free completions. Experimental words were selected according to the following criteria: middle total frequency, three syllable nouns, stress on the second syllable.

Conclusion(s): WSCT with the selected words was able to discriminate formation of implicit memory from casual response in both experimental conditions.

A-404

Generation of procoagulant microparticles in cerebrospinal fluid and in blood after traumatic brain injury

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Background and Goal of Study: Traumatic brain injury (TBI) can induce apoptosis of neuronal cells (1). Circulating procoagulant membrane microparticles (MP) shed by apoptotic or stimulated cells are a reliable marker of cell damage. MP diffuse in the fluids prothrombotic, proadhesive and proinflammatory potentials which may determine the clinical prognosis (2). The aim of this study was to investigate the generation and the kinetic of MP in cerebrospinal fluid (CSF) and plasma in severe TBI patients.

Materials and Methods: Circulating MP were isolated from CSF and arterial blood from sixteen patients with severe TBI. MP were quantified by functional prothrombinase assay at the onset of TBI and during a 10 days

follow-up. Values were compared to those of control patients (CP). Cellular origins of MP were determined by capture onto specific antibodies and quantified by prothrombinase assay. Results are expressed as median \pm inter quartile range and compared using a Mann-Whitney test.

Results and Discussions: High levels of procoagulant MP were detected in CSF and arterial blood at the onset of TBI with respect to values measured in CP, (respectively 4.98 [3.28;6.00] vs 0.86 [0.70;1.09] nM PhtdSer Eq; $p = 0.02$ for CSF values and 3.30 [1.75;4.00] vs 1.57 [1.1;2.73] nM PhtdSer Eq; $p = 0.02$ for blood values). MP were mainly of platelet and endothelial origin. Fas-bearing MP found in CSF might testify to the extent of neuronal cell apoptosis. MP levels decreased in the CSF during the follow-up (Day 10: 0.20 [0.10;0.60] nM PhtdSer Eq; $p = 0.05$) except in 2 patients (one non survivor and one with neurological bad outcome).

Conclusion(s): High levels of procoagulant MP, shed by apoptotic or stimulated cells, were detected in CSF and venous blood at the onset of TBI. MP might be a useful tool to assess neuronal and vascular cell damage and prognosis during TBI. A sustained generation of MP in CSF might be associated with a poor clinical outcome.

References:

- 1 Smith FM. *Acta Neuropathol* 2000; 100: 537–45.
- 2 Freyssonnet JM. *J Thromb Haemost* 2003; 1: 1655–62.

A-405

EEG spectral entropy correlates with regional cerebral blood flow during sevoflurane and propofol anaesthesia

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Background and Goal of Study: The M-ENTROPY index monitoring based on spectral entropy of the electroencephalogram (EEG) has recently been launched as a promising new method to measure the depth of anaesthesia. We examined the association between spectral entropy and regional cerebral blood flow (rCBF) in healthy subjects anaesthetized with a volatile or an intravenous anaesthetic agent.

Materials and Methods: Fronto-central and temporo-occipital EEG was continuously recorded and spectral entropy from frequency band 0.8–32 Hz calculated at 0 (awake), 1, 1.5 and 2 minimum alveolar concentration/effective plasma concentration 50 levels of either sevoflurane or propofol anaesthesia in 16 healthy subjects, eight in both groups. Each concentration level was maintained for 30 min and at each level, rCBF was assessed using [15 O]-labeled water and positron emission tomography. Spectral entropy was correlated with absolute rCBF in the frontal cortex and the whole brain. In addition, the correlation between voxel-level values of relative flow and concomitant spectral entropy values was analyzed using subject-specific regression analysis and statistical parametric mapping (SPM) software.

Results: Individual frontal (sevoflurane: Pearson's $r = 0.88$, $p < 0.001$; propofol: $r = 0.97$, $p < 0.001$) and global (sevoflurane: $r = 0.82$, $p < 0.001$; propofol: $r = 0.97$, $p < 0.001$) rCBF values correlated with frontal spectral entropy across the conditions, but not within the concentration levels. Statistically significant group level correlations were found in the SPM analysis for both anaesthetics. In the sevoflurane group, associated areas were located bilaterally in large areas of the parietal lobe, the posterior cingulate, small parts of the frontal, occipital and temporal lobes, and unilaterally in the left head of caudate. In the propofol group, the areas covered the frontal cortex, and parts of the temporal and parietal lobes and cingulate gyrus bilaterally. The results for both types of analyses were almost identical using the posterior derivations.

Conclusions: rCBF reductions induced by sevoflurane and propofol anaesthesia associated with spectral entropy of EEG in distinct brain areas suggesting that this novel measure of anaesthetic depth can be used as an indicator of neuronal activity during anaesthesia. The site of EEG recording did not seem to be critical.

A-406

Effects of isoflurane anaesthesia on zero flow pressure and estimated cerebral perfusion pressure

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Background and Goal of Study: Non-invasive methods of determining zero flow pressure (ZFP)¹ and estimated cerebral perfusion pressure (eCPP) have been previously described². However, the effects of isoflurane (iso) with or without hypocapnia on these parameters are unknown. Our study aims to address this.

Materials and Methods: We recruited 10 patients (ASA 1–2) aged 18–50 years undergoing non-neurological surgery. The middle cerebral artery blood flow velocity (FV) was measured using a 2 MHz Doppler ultrasound probe. Baseline non-invasive blood pressure (BP) and end-tidal carbon dioxide ($P_{E'}\text{CO}_2$) were recorded. Anaesthesia was induced with TCI propofol 6 $\mu\text{g}/\text{ml}$ and a rocuronium 0.6 mg/kg bolus. An LMA was inserted and subjects ventilated to normocapnia. Isoflurane in oxygen to 1.2 MAC was introduced and the calculated plasma propofol concentration was allowed to fall below 1 $\mu\text{g}/\text{ml}$. Further measurements were taken at normocapnia and hypocapnia (1 kPa below baseline). The eCPP and ZFP were calculated using²: $eCPP = BP_{\text{mean}} - ZFP$

$ZFP = [(BP_{\text{diastolic}} \times FV_{\text{systolic}}) - (BP_{\text{systolic}} \times FV_{\text{diastolic}})] / (FV_{\text{systolic}} - FV_{\text{diastolic}})$

Results and Discussion: Median (interquartile range)

	Baseline	Iso 1.2 MAC	Iso & hypocapnia	Friedman
$P_{E'}\text{CO}_2$ kPa	4.5(4.3,4.7)	4.4(4.3,4.6)	3.6(3.4,3.7)	$p < 0.001$
BPmean mmHg	95(87,105)	79(70,87)	77(72,94)	$p = 0.012$
FVmean cm/s	59(53,74)	41(28,51)	28(22,40)	$p < 0.001$
ZFPmean mmHg	27(7,31)	29(22,37)	43(31,50)	$p = 0.014$
eCPP mmHg	71(62,97)	52(32,65)	37(32,52)	$p < 0.001$

Conclusion: During isoflurane anaesthesia, eCPP reduces due to a combination of a decrease in BPmean and an increase in ZFP. Hypocapnia-induced increases in ZFP are preserved, leading to further decreases in eCPP.

References:

- 1 Weyland A, et al. *J Neurosurg Anesthes* 2000;12: 210–16.
- 2 Michel E, et al. *Neurol Res* 1995;17: 149–5.

A-407

Ophthalmodynamometry in noninvasive assessment of cerebral perfusion pressure

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Background and Goal of Study: In patients with brain injury cerebral perfusion pressure (CPP) < 60 mmHg is a strong predictor of unfavorable prognosis. We suggest that the accuracy of this criterion depends upon the method used for intracranial pressure (ICP) measurements.

Materials and Methods: Thirty-five neurosurgical patients were studied. Noninvasive ICP measurements were carried out using a method of ophthalmodynamometry (ODM) during which the eyeball needs to be compressed until visualization of the collapsed central vein of the retina. Simultaneously, ICP in brain ventricles was measured invasively. CPP was calculated as a difference between the mean arterial pressure (MAP) and ICP. Pittsburgh and Glasgow scale scores (PS, GS) were used in defining the severity of brain injury and lethality rate in patients with CPP $>$ and < 60 mm Hg. The results of invasive and noninvasive ICP measurements were compared. Statistical analysis was performed using the Mann-Whitney U test and Fisher test, $P < 0.05$.

Results and Discussions:

	Noninvasive ICP		Invasive ICP	
	CPP > 60 (n = 18)	CPP < 60 (n = 17)	CPP > 60 (n = 25)	CPP < 60 (n = 10)
GS	12,1 (8–13)	7,8 (5–9)*	10,4 (6–13)	8,2 (5–9)*
PS	12,2 (9–15)	10,3 (7–13)*	10,7 (7–15)	10,5 (7–13)
Leth %	11,1	47,0*	24,0	40,0

ODM data have shown that CPP is more efficient in predicting the severity and outcome of brain injury vs invasive ventricular ICP. We believe that the pressure in the central vein of the retina corresponds to ICP and reflects the pressure in brain parenchyma but not the cerebrospinal fluid pressure.

Conclusion: Venous ODM is an effective noninvasive method for CPP assessment.

A-408

Changes in total peripheral resistance and zero flow pressure in the cerebral circulation during a valsalva manoeuvre

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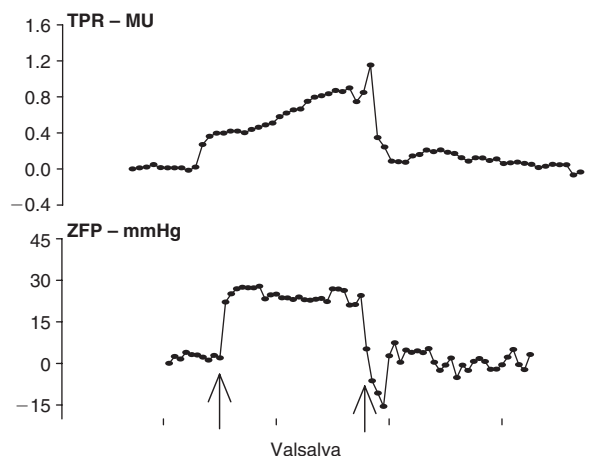
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Background: Zero flow pressure (ZFP) is defined as the arterial pressure at which blood flow ceases in the cerebral circulation. Changes in vascular

tone are suggested to determine the ZFP in healthy subjects¹. The Valsalva manoeuvre is known to substantially increase the total peripheral resistance (TPR). We aimed to assess if these increases in TPR were reflected by the changes in ZFP.

Materials and Methods: Ten healthy volunteers were trained to perform consistent Valsalva manoeuvres under controlled resting conditions. Continuous measurements were recorded for off-line analysis. The heart rate, blood pressure, cardiac output and TPR were measured using a Finometer®, whilst the middle cerebral artery flow velocity (FV) was measured using transcranial Doppler ultrasonography with a 2 MHz probe. For each FV pulse wave, ZFP and cerebral perfusion pressure were estimated using established methods².

Results and Discussions: Beat-to-beat changes (from baseline) in the mean values of TPR and ZFP are shown in the figure. Both TPR and ZFP increased at the onset of the Valsalva manoeuvre; TPR continued to increase substantially but no further changes in ZFP were seen.



Conclusion: Different patterns of changes in TPR and ZFP were seen which suggests that factors other than TPR are also likely to determine ZFP.

References:

- 1 Hancock SM et al. *Anesth Analg* 2003;**96**(3):847–51.
- 2 Michel E et al. *Neurol Res* 1995;**17**:149–55.

A-409

Effect of body temperature on peripheral venous pressure measurements and its agreement with central venous pressure in neurosurgical patients

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Background and Goal of Study: Previous studies suggest a correlation of central venous pressure (CVP) with peripheral venous pressure (PVP) in different clinical setups. The effect of body temperature on PVP and its agreement with CVP in patients under general anesthesia is investigated in this study.

Materials and Methods: Fifteen ASA I–II patients undergoing elective craniotomy were included in the study. CVP, PVP, core (Tc) and peripheral temperatures (Tp) were monitored throughout the study. A total of 950 simultaneous measurements of CVP, PVP, Tc and Tp were recorded at 5-minute intervals. The measurements were divided into low and high Tc and Tp groups by medians as cutoff points. Bland Altman assessment for agreement was used for CVP and PVP in all groups.

Results and Discussion: PVP measurements were within range of ± 2 mmHg of CVP values in 94% of the measurements. Considering all measurements mean bias was 0.064 mmHg (95% CI, -0.018 to 0.146). Corrected bias for repeated measurements was 0.173 ± 3.567 mmHg (mean \pm SD_{corrected}). All of the measurements were within mean ± 2 SD of bias, which means that PVP and CVP are interchangeable in our clinical setting. When we evaluated the effect of Tc, all the measurements were within mean ± 1 SD of bias when Tc $> 35.8^\circ\text{C}$ indicating a better agreement with CVP. The effect of peripheral hypothermia was not as prominent as core hypothermia.

Conclusion: Peripheral venous pressure measurement may be a noninvasive alternative for estimating central venous pressure. Body temperature

seems to interfere with the agreement of CVP and PVP, improving its reliability in normothermia.

References:

- 1 Bland JM, Altman DG. *Lancet* 1986; **I**: 307–10.
- 2 Charalambous C et al. *Anaesth Intensive Care* 2003; **31**: 34–9.

A-410

Jugular bulb saturation monitoring during emergence from anesthesia for elective cerebral tumor surgery

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Introduction: Systemic hypertension is a common consequence of stress during neurosurgical recovery, associated with an increased risk of postoperative intracranial hemorrhage. In this study, we monitored the cerebral hemodynamic reactions (by monitoring of jugular bulb saturations S_jO₂) to emergence from neuro-anesthesia.

Patients and Methods: With IRB approval, 30 patients scheduled for elective brain tumor surgery were studied. Anesthesia was induced with propofol/alfentanil and maintained with sevoflurane/alfentanil. Sevoflurane was titrated to BIS 40 to 60, whereas opioids were titrated to autonomic reactions. At end of surgery, alfentanil was stopped at bone flap placement, and sevoflurane was titrated to BIS 60 to 80 and was stopped at last surgical stitch. Emergence period was defined as from last surgical stitch to 1 hour post extubation. S_jO₂ was monitored from induction of anesthesia until end of the emergence period. Statistical analysis of cerebral and systemic hemodynamic parameters for the emergence period (compared to the earlier perioperative period) was performed with Anova statistical analysis.

Results: Mean duration of emergence period was 78 min, (extubation performed m18 min after stop of sevoflurane). MAP during the whole emergence period was 86.2 mmHg, which tended (although not statistically significant) to be higher than the baseline perioperative values (82.7 mmHg). MAP at the moment of extubation (98.2 mmHg) was significantly higher. S_jO₂ monitoring revealed a significant, short-lasting increase from stop of sevoflurane to a mean of 10 minutes post extubation. They increased from m65% to m79%.

Conclusion: Arterial hypertension, observed at emergence from neuro-anesthesia, seems to induce a short-lasting state of cerebral hyperperfusion, as observed by significant increases in jugular bulb saturation. This urges from extreme caution to sudden arterial hypertension at emergence from neuro-anesthesia.

A-411

Hyperventilation results in more jugular bulb desaturations during propofol than during sevoflurane anesthesia

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Introduction: Perioperative use of hyperventilation will reduce intracranial pressure but it may also reduce cerebral perfusion over the limits of cerebral ischemia. The purpose of the present study was to compare the effects of short-term hyperventilation during equipotent hypnotic doses (referring to BIS) of propofol versus sevoflurane on jugular bulb oxygen saturation (S_jO₂).

Methods: With IRB approval, 20 patients scheduled for elective supratentorial brain tumor surgery received either propofol or sevoflurane. The hypnotic component was titrated to BIS 40 to 60, whereas the analgetic component (alfentanil) was titrated to autonomic responses. Mechanical ventilation was installed to normocapnia, and for a 30 min period, it was adjusted to a PaCO₂ of 5 to 10 mmHg below. S_jO₂ values were compared between both groups. Anova test was used for statistical analysis.

Results: There was no difference in PaCO₂ values before (mean of 35.7 (1.8) mmHg for propofol and mean of 35.1 (1.5) mmHg for sevoflurane) and after hyperventilation between both groups (mean of 27.4 (2.0) mmHg for propofol and of 27.1 (1.7) mmHg for sevoflurane). We observed no differences in hemodynamic parameters before and after hyperventilation in both groups. S_jO₂ values before hyperventilation were significantly lower in the propofol group (mean S_jO₂ 53.5 (7.2) %) compared to the sevoflurane group (mean S_jO₂ 61.6 (5.8) %). Hyperventilation resulted in an equal decrease in S_jO₂ in both groups (mean S_jO₂ 47.3 (6.2)% for propofol compared to 56.3 (8.2)% for sevoflurane). We observed a significantly higher incidence of jugular desaturations (S_jO₂ below 50%) during propofol anesthesia (8 of 10 patients for propofol, 3 of 10 patients for sevoflurane).

Discussion: In view of the already reduced cerebral perfusion under propofol anaesthesia, any further reduction of perfusion as induced by hyperventilation might induce more cerebral ischemia during propofol anaesthesia.

A-412

Preliminary evaluation of an iterative computer model of the cerebral circulation

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Background and Goal of Study: The qualitative aspects of cerebral blood flow (CBF) regulation are well understood, but the interaction between different regulatory mechanisms is non-linear. Predicting the effect of such interactions has not been possible with simple models. Previous attempts to model the cerebral circulation have largely relied on solving multiple differential equations. (1) These may accurately predict an outcome from a set of physiological variables, but do little to elucidate the mechanism involved. We have used a 'bottom-up approach' based on basic physiological principles to create a new model of the cerebral circulation.

Materials and Methods: The model consists of an array of parallel vessels divided into serial beds representing the middle cerebral artery followed by arteriolar and venous segments. Inflow and outflow pressures, and vessel compartmental radii determine the flows through the vessels. Compartmental radii are derived from vessel compliance curves. A variable forcing function represents the inflow pressure. Blood flow velocity, through the vessels is calculated using a micro-timeslicing, iterative process. Two separate modes of flow regulation have been incorporated: pressure regulation, whereby the vessels are set to achieve target radii during variation of pressure, and carbon dioxide reactivity, where deviation from a CSF CO₂ target results in modulation of vessel radius. Initial validation has consisted of qualitative description of the effects of varying mean inflow pressure, arterial carbon dioxide tension and the interaction between the two.

Results and Discussions: The model fits published data. Cerebral blood flow changes 30% per kPa change in CO₂. The limits of pressure autoregulation for the model lie between 50 mmHg and 150 mmHg.

Conclusion(s): This initial validation suggests that this modelling technique may be a useful tool to investigate the dynamics of cerebral blood flow.

Reference:

1 Ursino M and Lodi CA. *Am J Physiol* 274: H1715–H1728.

A-413

Laryngeal tube during anaesthesia with intraoperative recovery in procedures with recognising of eloquent areas in brain during surgery of supratentorial brain tumors

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Background and Goal of Study: Anaesthesia for procedures with recognising the eloquent areas in brain is very specific because it requires intraoperative recovery in order to achieve full co-operation of patient. This is needed for evaluation of sensomotoric function and changes in memory and behaviour of patient during removing tumor tissue. Patient has to be deeply anaesthetised for craniotomy and fully awake during operation on brain to be able to answer questions of psychiatrist. The airway management should allow for easy extubation during surgery and must not influence the ability to create voice responses of the patient i.e. tone of voice. The aim of the study was to evaluate the use of laryngeal tube for airway management during anaesthesia for craniotomy in neurosurgery with intraoperative recovery.

Materials and Methods: 15 patients (4 female and 11 male) ASA 1, mean age 40.07 yr (Sd 13.42), BMI 26.48 (Sd 5.06) were anaesthetised with continuous infusion of propofol and remifentanyl (TIVA). After induction to anaesthesia the laryngeal tube (No 4 or 5) was installed for airway management. Patients lung were ventilated with IPPV parameters: FiO₂ 0.4, tidal volume 10 ml/kg, respiratory rate 12/min, E:I 1:1. The scalp was locally anaesthetised with 0.33% bupivacaine (150 mg). Patients were supine positioned with trunk elevated 20–30% and head turned.

Results and Discussions: Mean duration of surgery was 107 min (Sd 33.55). The ventilation parameters were within acceptable limits: inspiratory peak pressure 19.99 cmH₂O (Sd 3.99), mean pressure 9.72 (Sd 2.25), air leak tidal volume 8.2% (Sd 2.61). Mean duration to recovery and extubation after discontinuation of propofol infusion was 20.22 min (Sd 6.76), and after 5.2 min (Sd 1.7) they

were able to answer questions of psychiatrist-the evaluation of somatosensory function begun. There were no complications with tone of voice.

Conclusion(s): Laryngeal tube is good tool for airway management and ventilation for general anaesthesia during craniotomy. The use of laryngeal tube does not influence ability to speak after extubation, patients had not changed tone of voice.

A-414

General anaesthesia for placement of electrodes in the subthalamic nucleus to treat Parkinsons disease does not worsen outcome

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Background and Goal of Study: Deep Brain Stimulation of the subthalamic nucleus (STN) for treatment of Parkinson's disease (PD) depends on accurate electrode positioning. This is normally determined in alert patients by combinations of MRI mapping, intraoperative clinical assessment and electrophysiological measurement. We present an observational series including patients who had electrodes positioned using MRI and electrophysiology under general anaesthesia (GA) to determine the effects of GA.

Materials and Methods: The notes of 20 consecutive patients treated between August 2001 and September 2003 were reviewed. The first 10 patients (Group LA) had electrodes positioned under local anaesthesia and the rest under general anaesthesia (Group GA) using propofol, fentanyl, isoflurane and atracurium. The unpaired t test was used for statistical analysis (Graphpad Prism 4.0 software) having confirmed normal Gaussian distribution of data.

Results and Discussion: All patients were classified as ASA 3. Other results are shown as means with 95% confidence intervals in brackets. Postoperative length of stay (LOS) is used as a surrogate for postoperative complications and terminal chosen for chronic stimulation as a surrogate for successful electrophysiological STN identification and subsequent accuracy of electrode placement.

	Group LA	Group GA	P value
Age: years	59 (53.8–64.2)	59.2 (53–65.4)	0.956
Surgery duration: hours	8.7 (8.2–9.3)	7.3 (6.7–7.8)	0.0005
Postoperative LOS: days	4.3 (2.3–6.3)	2.9 (2.7–3.1)	0.138
Stimulation terminal: L brain	2.2 (1.6–2.9)	1.8 (1.5–2.1)	0.175
Stimulation terminal: R brain	6.0 (5.5–6.5)	6.1 (5.6–6.2)	0.767

Conclusions: Numbers are small but concerns that prolonged GA might markedly increase postoperative complications and alter or abolish the electrophysiological signal from the STN appear to be unfounded at present.

A-415

Comparison of desflurane-remifentanyl with desflurane-fentanyl on haemodynamic and recovery profile in patients undergoing intracranial surgery

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Background and Goal of Study: The aim of this study was to compare the haemodynamic and recovery profiles of desflurane-remifentanyl and desflurane-fentanyl in patients undergoing intracranial surgery.

Material and Methods: Sixty patients were randomly assigned to one of two anaesthetic treatment groups in order to compare haemodynamic variables and recovery profiles with desflurane-remifentanyl (Group DR) or desflurane-fentanyl (Group DF). Anaesthesia induction was performed by propofol and either remifentanyl or fentanyl. Anaesthesia was maintained with an infusion of remifentanyl 0.25 µg kg⁻¹ min⁻¹ plus desflurane 1, 5–2%–50% N₂O/50% O₂ in group DR or bolus doses of fentanyl (2 µg kg⁻¹) plus desflurane 3–6%–50% N₂O/50% O₂ in group DF. In both group, haemodynamic variables were recorded at baseline, after anaesthesia induction, tracheal intubation, pin application, skin and dural incision, and dural closure. At the end of the surgery, time to extubation, eye opening, follow the verbal commands, side effects were recorded.

Results and Discussion: No significant difference in SBP, DBP, MAP and HR was found between the groups during anaesthesia induction. After intubation

and skin incision, DBP, HR and MAP values were significantly higher in the DF group. Time to extubation, eye opening and follow verbal commands were significantly shorter in DR groups than in DF group ($p < 0.05$). Analgesic consumption and side effects were similar between two groups.

Conclusion: Remifentanyl $0.25 \mu\text{g kg}^{-1} \text{min}^{-1}$ plus desflurane 1, 5–2% led to rapid emergence from anaesthesia, good control of haemodynamic responses and similar side effects in patients undergoing intracranial surgery compared to giving bolus doses of fentanyl ($2 \mu\text{g kg}^{-1}$) plus desflurane 3–6%.

A-416

Implicit memory and noxious stimulation under propofol/remifentanyl TCI anaesthesia

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Background and Goal of Study: It is unclear if noxious stimulation, which is necessary for the processing of implicit memory (unconscious recall) during anaesthesia, awakens the patients or causes a sympathetic stimulation that enhances memory in unconscious patients (1).

Materials and Methods: 20 young healthy volunteers were randomised in 2 groups in a crossover design and anaesthetised with a TCI of propofol (using Infusion Toolbox (ITB) (2) with the set of Marsh) with a stepwise increase of the target blood concentration (Cp) until loss of consciousness (LOC). A 1st set of 10 French words repeated 3 times was then played while a noxious stimulus was applied (hand in cold water: $2-4^{\circ}\text{C}$). Afterwards, a TCI of remifentanyl (ITB set of Minto) was started with a progressive stepwise increase of Cp until no withdrawal reaction (WR) was observed after a 2nd similar stimulus. Then a 2nd set of words was played. Implicit memory was tested after recovery with the word stem completion test (1). Mann-Whitney, paired and non paired-T tests were used as appropriate for statistical analysis.

Results and Discussions: 17 over the 20 volunteers were awakened by the 1st noxious stimulus and none by the 2nd. Cp propofol at LOC and Cp remifentanyl at no WR were respectively $2.9 \mu\text{g/ml} \pm 0.6$ and $2.0 \text{ ng/ml} \pm 0.6$. Systolic blood pressure (BP) and heart rate (HR) significantly increased ($p < 0.05$) compared to LOC values (BP: $109 \text{ mmHg} \pm 11$, HR: $66 \text{ bpm} \pm 11$) when the 1st noxious stimulus was applied (BP: $123 \text{ mmHg} \pm 10$, HR: $77 \text{ bpm} \pm 11$), evidencing a sympathetic stimulation, but not when the 2nd stimulus was applied (BP: $106 \text{ mmHg} \pm 9$, HR: $59 \text{ bpm} \pm 10$). No patient showed explicit memorisation. The 20 subjects remembered significantly ($p < 0.05$) more words of the 1st list than controls (1.9 ± 1.2 vs 0.9 ± 0.7), but not of the second list (1.0 ± 0.8 vs 1.1 ± 0.9 ($p = 0.82$)). The 3 volunteers who remained unconscious during the 1st stimulus remembered significantly ($p < 0.05$) less words than the 17 others and not more ($p = 0.26$) than controls (0.3 ± 0.6 vs 2.1 ± 1.0 vs 0.9 ± 0.7).

Conclusion(s): Under propofol TCI anaesthesia in young healthy volunteers, implicit memory is evidenced only when a noxious stimulation is associated with a short period of consciousness.

References:

- 1 Andrade J. *Br J Psychol* 1995; (86): 479–506.
- 2 Cantraine F. *J Clin Monit Comput* 2000; (16): 3–10.

A-417

Evaluation of remifentanyl(R)-propofol(P) anaesthesia in parkinsons disease patients (PKP) undergoing stereotactic stimulation of the subthalamic nucleus (STN)

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Background and Goal of Study: Anaesthesia for STN requires a fast and predictable recovery allowing for a safe extubation, especially in these patients with high risk of airway obstruction. P is safe in PKP but the association R-P has not been evaluated (1, 2).

Materials and Methods: One year observational prospective study. Each subject was studied during 3 periods: T1 = anaesthesia induction; T2 = MRI subthalamus nucleus stereotactic locating; T3 = awake after extubation, electrophysiology and clinical tests to determine the optimal

target of electrode implantation. Anti-parkinsonian medications were stopped 12 h preoperatively. General anaesthesia (GA) was induced and maintained by P (AIVOC, Diprifusor®) and R (continuous infusion). Intubation was performed without glottic anaesthesia. N_2O was prohibited. Cisatracurium was used if tremor syndrome persisted during T2. The duration of GA and STN, total doses of P and R, times for recovering spontaneous ventilation (SV) and extubation, haemodynamic and respiratory incidents were recorded.

Results and Discussion: We studied 22 PKP (aged 48–69 years). No incident was observed during or just after extubation. Cooperation in clinical tests was excellent. One PKP (very rigid) developed minor respiratory failure at the end of the STN. Electrophysiology was disturbed in one case. Five episodes of bradycardia (HR $< 40/\text{min}$) and hypotension (SAP $< 70 \text{ mmHg}$) occurred in 7 PKP. 3 PKP required cisatracurium during T3.

GA duration:	287 min [255;385]
STN duration:	480 min [420;630]
Times to SV:	10 min [0;28]
Times to extubation :	31 min [5;56]
Total dose propofol:	2240 mg [1600;3800]
Total dose remifentanyl:	1230 μg [740;4710]

Mediane [range]

Extubation was delayed because of rigidity due to lack of anti-parkinsonian drugs and because of expected reintubation difficulties due to stereotactic frame.

Conclusion(s): Remifentanyl – propofol anaesthesia seems appropriate to STN.

References:

- 1 Nicholson G et al. *Br J Anaesth* 2002; 89: 904–16.
- 2 Huggins NJ. *Anaesthesia* 1998; 53: 53–3.

A-420

Recovery after remifentanyl-desflurane or remifentanyl-sevoflurane anaesthesia for intracranial tumour surgery

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Background and Goal of Study: The pharmacology of remifentanyl and desflurane suggests that recovery will be faster if used in combination compared to remifentanyl/sevoflurane anaesthesia[1,2]. This could be important after prolonged anaesthesia for craniotomy for tumour where slow recovery of mental function is a concern. We compared emergence from the remifentanyl/desflurane vs remifentanyl/sevoflurane anaesthesia in patients undergoing craniotomy for tumour.

Materials and Methods: 20 patients undergoing anaesthesia for elective craniotomy for tumour were randomly assigned to receive remifentanyl/desflurane or remifentanyl/sevoflurane anaesthesia. Recovery times were recorded.

Results and Discussions: Recovery measurements (min:mean (standard deviation)).

	Desflurane/remifentanyl (n = 10)	Sevoflurane/remifentanyl (n = 10)
Spontaneous ventilation*	5.1 (1.4)	10.2 (1.6)
Opening eyes*	5.3 (1.6)	9.8 (2.4)
Extubation*	5.7 (1.6)	10.7 (1.6)
Stating name*	7.2 (2.5)	13.5 (3.6)
Stating date of birth*	7.9 (2.4)	15.4 (5.7)
PARS > 9*	9.9 (1.7)	22.3 (5.6)

PARS (Post anaesthesia recovery score (Aldrete))

*Significantly different ($p < 0.05$) t-test between groups

Conclusion(s): Recovery of patients undergoing craniotomy for tumour is significantly faster after remifentanyl/desflurane compared to remifentanyl/sevoflurane anaesthesia allowing earlier neurological examination.

References:

- 1 Kleinschmidt S, Grundmann U, Bach F, Becker S, et al. Anaesthesia with remifentanyl combined with desflurane or sevoflurane for lumbar intervertebral disc operations. *Anaesthesiol Reanim.* 2000; 25(6): 151–7.
- 2 Wilhelm W, Schlaich N, Harrer J, Kleinschmidt S, et al. Recovery and neurological examination after remifentanyl-desflurane or fentanyl-desflurane anaesthesia for carotid artery surgery. *Br J Anaesth.* 2001 Jan; 86(1): 44–9.

Local and Regional Anaesthesia

A-421

The preemptive analgesic effect of 3-in-1 block on postoperative pain and tramadol consumption in total hip arthroplasty

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Background and Goal of Study: In this study we investigated that a lumbar plexus block, using an anterior approach called 3-in-1 block, would provide effective analgesia for total hip arthroplasty or not.

Materials and Methods: Thirty ASA I-II patients undergoing elective total hip arthroplasty were randomized to receive general anesthesia with 3-in-1 block using 40 ml of bupivacaine 0.25% in Group I (n = 15) or with sham block in Group II (n = 15). The block was performed 30 minutes before induction of anesthesia. At the end of surgery, all patients received intravenous-tramadol via a standard patient-controlled analgesia device. Pain scores were evaluated at 0 (in recovery room), 1/2, 1, 4, 8, 12, 24 and 48 h at rest and on movement of the hip, using a 10 cm visual analogue scale (VAS). Intraoperative fentanyl consumption, total tramadol consumption, rescue meperidine requirement, adverse effects and patient satisfaction were recorded. 'Chi-square' and 'independent samples t-test' tests were used for statistical analysis with a p value of 0.05 considered significant.

Results and Discussions: The proportion of patients receiving supplemental fentanyl intraoperatively was more than three times greater in group II (4 of 15 vs. 15 of 15, p = 0.001). Pain scores were significantly lower in group I both at rest (p = 0.000) and movement (p = 0.000) during the first postoperative 12 h and also it was lower at movement 24 h postoperatively (p = 0.000). In the recovery room, a greater than threefold reduction in pain score was observed in group I both at rest (VAS at arrival 1.7 ± 0.9 vs 5.7 ± 0.9 , p = 0.000) and movement (VAS at arrival 2.3 ± 1.3 vs 7.5 ± 1.0 , p = 0.000). In group II, 2 patients were administered rescue meperidine boluses whereas in group I none of the patients were administered. Total tramadol consumption was lower in group I (633.0 ± 119.3 mg) than in group II (991.1 ± 41.0 mg) (p = 0.000). Patient's satisfaction scores were higher in group I (2.9 ± 0.3) than in group II (1.5 ± 0.5) (p = 0.000). and 1 hours with p values respectively 0.002, 0.003 and 0.006.

Conclusion(s): Preemptive 3-in-1 block provides effective postoperative pain relief for total hip arthroplasty, reducing intra and postoperative opioid requirements.

A-422

Adding magnesium to lidocaine for intravenous regional anesthesia

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Background and Goal of Study: Magnesium has been added to local anesthetics for central and peripheral nerve blocks, resulting in prolonged, increased anesthesia and improved analgesia. This study was conducted to evaluate effects of magnesium when added to lidocaine for intravenous regional anesthesia (IVRA).

Materials and Methods: Following ethic committee approval and written informed consent, 30 patients (ASA I-II) scheduled for hand surgery were randomly divided into two groups. The control group received 0.5% lidocaine of total 40 mL; the study group received mg of magnesium + 0.5% lidocaine completed to total of 40 mL. Sensory and motor block onset and recovery times and anesthesia quality were noted. Before and after the tourniquet application at 5, 10, 20, 40 min, heart rate (HR), mean arterial pressure (MAP), SpO₂ values, tourniquet pain and sedation, and rescue analgesic use were noted. Intraoperatively, boluses of 1 µg/kg fentanyl were provided for tourniquet pain treatment when pain score was above 3. Postoperative 30 min, 2, 4, 6, 12, and 24 h, HR, MAP, SpO₂, pain and sedation scores, time to first analgesic requirement, analgesic consumption, and side effects were noted. Patients were instructed to receive 75 mg diclofenac, when was above 3. Student's t test, Mann-Whitney U test was used as appropriate.

Results and Discussions: Shortened sensory and motor block onset times (p < 0.05), improved quality of anesthesia (p < 0.05), lower use of analgesics in intraoperative period (p < 0.05) and prolonged time to first analgesic requirement (p < 0.05) were found in the magnesium group. Two patients informed of pain in injection of magnesium.

Conclusion(s): We conclude that magnesium as an adjunct to lidocaine improves quality of anesthesia, perioperative analgesia and is beneficial in IVRA.

A-424

Comparison of analgesic effects of intraarticular ropivacaine+fentanyl administration in knee arthroscopy

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Background and Goal of Study: Intraarticular local anaesthetics and opioids are usually used in outpatient arthroscopic surgery for postoperative analgesia. In our study we aimed to compare the analgesic effect and analgesic requirement of ropivacaine a new local anaesthetics agent and ropivacaine + fentanyl combination.

Material and Methods: After hospital ethical and patient permission, we studied 22 patients who were between 15 and 65 years old, and ASA I and ASA II. During the operation, opioids were not administered. Under general anesthesia were monitored with ECG, SpO₂ and noninvasive blood pressure. At the end of the surgery, while pneumatic tourniquet was on we administered intraarticular 150 mg ropivacaine to Group I (n:12) and 150 mg ropivacaine + 50 µgr fentanyl combination to Group II (n: 10). We diluted the drugs with 20 ml 0.9% NaCl. Ten minutes after the drug administration the tourniquet was off. VAS, sedation scale and analgesic requirements were compared with each other in postoperative 15, 30, 60 minutes and 2, 4, 6, 12, 24 hours. Statistical analyses were performed using the Mann-Whitney U test and repeated measurement analyses of variance.

Results: In demographic and hemodynamic parameters, there was no significant difference between Group I and Group II. Also there were no statistical differences in VAS values, sedation scale and analgesic requirements. Each group had no additional analgesic requirement. Mean VAS values of two groups were less than two in every assessment.

Conclusion: Because of similar VAS values in two groups, we concluded that fentanyl addition to intraarticular ropivacaine has no extra analgesia. Also we suggested that administration of 150 mg intraarticular ropivacaine is enough for postoperative analgesia, because the VAS values are suited to minimal or lack of pain.

A-425

The addition of dexmedetomidine to lidocaine for intravenous regional anesthesia

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Background and Goals: Intravenous regional anesthesia (IVRA) is a simple and reliable method of providing anesthesia for hand surgery but, it often does not provide effective postoperative analgesia. The aim of this study was to determine the quality of anesthesia and postoperative analgesia by the addition of dexmedetomidine to local anaesthetic solution intravenous regional anesthesia.

Material and Methods: Forty patients scheduled for elective hand surgery (carpal tunnel release or tenolysis), written consent to participate in this prospective double-blind study, which was approved by our institutional review board. IVRA was achieved using 3 mg/kg lidocaine diluted with saline to a total dose(volume) of 40 ml in the control group or 1 µg/kg⁻¹ of dexmedetomidine plus 3 mg/kg lidocaine diluted with saline to a total dose(volume) of 40 ml in the dexmedetomidine group. The quality of anesthesia (Excellent:4, Good:3, Moderate:2, Unsuccessful:1), postoperative pain scores (VAS), and postoperative analgesic use were recorded.

Results: Data are presented in the table.

	Cont G (n = 20)	Dex G (n = 20)
Quality of anesthesia ⁺	3 (2-4)	4 (3-4)*
Postoperative pain score (VAS) ⁺		
0 min	0 (0-5)	0 (3-0)*
15 min	2.5 (0-7)	0 (0-3)*
30 min	3 (0-7)	0 (0-5)*
60 min	2 (0-6)	0 (0-2)*
120 min	0 (0-5)	0 (0-1)
No. of patients receiving fentanyl in PACU	13	1*

Cont G: Control group, Dex G: Dexmedetomidine group

⁺Data are presented median (min-max)

*P < 0.05 when compared with control group

Conclusions: The addition of $1 \mu\text{g kg}^{-1}$ dexmedetomidine to lidocaine for IVRA improves quality of anesthesia and postoperative analgesia.

A-426

Plasma kinetic lidocaine concentration after intranasal application of swab sticks soaked in 5% lidocaine plus naphazoline in septorhinoplasties

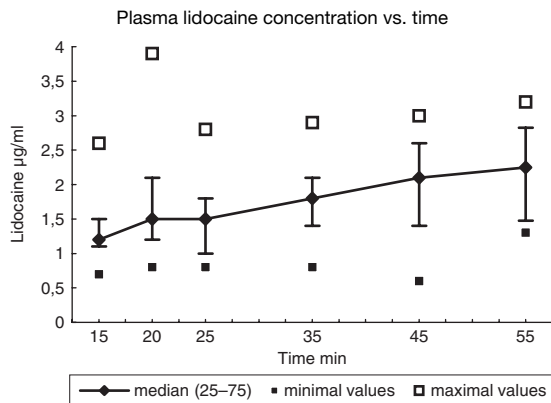
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Background and Goal of Study: In septorhinoplasties, both anesthesia of the nasal mucosa by application of swabs soaked in 5% lidocaine plus naphazoline and general anesthesia, have been shown to improve the surgical condition and promote a better post-operative analgesia[1]. We have studied the plasma kinetic lidocaine concentration after laryngeal topical anesthesia and intranasal swab sticks application.

Materials and Methods: After informed consent, 14 patients undergoing septorhinoplasties were studied. Anesthesia was induced with propofol (3 to 5 mg/kg) and sufentanil (0.5 $\mu\text{g/kg}$). The laryngeal topical anesthesia (LTA) was done with 5% lidocaine (1.5 spray/10 kg). The nasal cavity was then anesthetized with 20 ml 5% lidocaine plus naphazoline applied with swab sticks during 10 minutes. The plasma lidocaine concentration were sampled 15, 20, 25, 35, 45, 55, minutes after LTA. Anesthesia was maintained with sevoflurane and sufentanil.

Results and Discussions:



After LTA and application of swab sticks, the plasma lidocaine concentrations remain below toxic levels. The plasma kinetic show two peaks, the first at 20 minutes and a second rise at 35 minutes. A biphasic pattern of absorption, leading to the occurrence of two separate lidocaine peak concentration, was observed in this study as well as others [2]. The plasma lidocaine concentration at 55 minutes, and the maximal values must alert the anesthetist during lidocaine infiltration done by a surgeon or the associated use of nebulization, spray and swab sticks for awake fiberoptic nasotracheal intubation.

References:

- 1 El Abbassi, SFAR 2001.
- 2 Andreas Crit Care Med 1991;19: 911-915.

A-427

The effect of spinal block level on the requirements of propofol for conscious sedation

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Background and Goal of Study: It has been reported that spinal anesthesia has a sedative effect and the degree of sedation is related to the level of spinal anesthesia. The level of spinal anesthesia seems to be an influencing factor in determining the hypnotic requirements for conscious sedation. Therefore, we conducted a prospective randomized study to investigate the effect of spinal anesthesia level on hypnotic requirements for conscious sedation.

Materials and Methods: Forty-five adult patients (aged 20-65, categorized as ASA 1 or 2), scheduled to undergo spinal anesthesia for anal surgery, were randomly allocated to one of the two groups (Group 1: spinal anesthesia with 13 mg of 0.5% hyperbaric bupivacaine, Group 2: saddle block with 13 mg of

0.5% hyperbaric bupivacaine). Ten minutes after the block, target controlled infusion of propofol was started at a target concentration of $1 \mu\text{g/ml}$ and we checked lowest bispectral index (BIS) during 5 min observation period after effect site concentration of $1 \mu\text{g/ml}$ was reached. Target controlled infusion of propofol was restarted at a target concentration of $1.5 \mu\text{g/ml}$ and we checked the lowest BIS during 5 min observation period after effect site concentration of $1.5 \mu\text{g/ml}$ was reached. We checked the effect site concentration when the BIS reached 80 and 70 during observation period. Statistical analysis of the data was done with Mann-Whitney U-test using SPSS 10.0 software program. **Results:** Data was expressed as mean \pm SD (standard deviation). The minimum BIS at $1 \mu\text{g/ml}$ effect site concentration was 80.4 ± 8.9 , and 80.6 ± 8.5 in group 1 and group 2 respectively. The minimum BIS at $1.5 \mu\text{g/ml}$ effect site concentration was 64.2 ± 13.4 , 67.6 ± 10.0 respectively. The effect site concentration of propofol when BIS 80 was checked at first was $1.1 \pm 0.3 \mu\text{g/ml}$, $1.1 \pm 0.3 \mu\text{g/ml}$ respectively. The effect site concentration of propofol when BIS 70 was checked at first was $1.3 \pm 0.3 \mu\text{g/ml}$, $1.4 \pm 0.3 \mu\text{g/ml}$ respectively. **Conclusion:** There was no significant difference in the requirements of propofol for conscious sedation between thoracic anesthesia group and saddle block group.

References:

- 1 Gentili M, et al. Br J Anaesth 1998; 81: 970-971.
- 2 Pollock JE, et al. Anesthesiology 2000; 93: 728-734.

A-428

A comparison of epidural levobupivacaine 0.5% with ropivacaine 0.5% for inguinal hernia repair procedure: blood pressure and heart rate alterations

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Background and Goal: Levobupivacaine and Ropivacaine are both enantiomers of bupivacaine and are considered to have similar properties but less toxicity than bupivacaine¹. In this study, we compared 0,5% solution of levobupivacaine and ropivacaine as far as blood pressure and heart rate alterations during surgery are concerned.

Materials and Methods: 30 patients ASA I-III, scheduled for elective inguinal hernia repair, undergoing epidural anaesthesia, were randomized into two groups: group L received levobupivacaine 0,5% while group R received ropivacaine 0,5%. After the intravenous infusion of 500 ml of crystalloid solution, an epidural block was performed using either a midline or a paramedian approach at L 4-5 interspace. The volume of the local anesthetic given, was estimated so as to provide anesthesia up to T 7 dermatome according to patient's age and height. Mean arterial pressure (MAP), heart rate (HR) and oxygen saturation (SpO₂) were recorded before (baseline) and every five minutes after epidural block performance, until the end of the surgery. Statistical analysis was performed using Mann Whitney U test. In all cases the tests were double sided and p value of 0,05 was considered to indicate statistical significance. Data are expressed as mean \pm sd.

Results and Discussion: There were no statistical differences in demographic characteristics between the two groups. There was also no statistical difference between the two groups regarding other measured parameters: (MAP, HR, height of the sensory block and duration of surgery). However MAP was statistically significantly lower ($p < 0,05$) in group L compared to group R in all measurements following 15 min after epidural block performance. HR and SpO₂ did not differ significantly between the two groups. There were also no differences in the total fluids given [1620 ± 120 ml (group L) vs 1510 ± 150 ml (group R)]. 2 patients in group L and 1 patient in group R received atropine (HR < 45 beats per minute), while vasoconstrictor was not used.

Conclusion: There was no difference as far as the level of the sensory block is concerned levobupivacaine seems to reduce MAP more than ropivacaine indicating an extended sympathetic block.

Reference:

- 1 Kopacz, Anesthesia and Analgesia 2000 90:642-8.

A-429

Effects of lignocaine on ischemia reperfusion induced plasma platelet activating factor levels

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Background and Goal of Study: Platelet activating factor (PAF) is a potent proinflammatory mediator released in response to ischemia-reperfusion (IR) (1). Reperfusion of ischemic limb can induce systemic inflammatory response

syndrome (2). We hypothesized that lignocaine decreases plasma PAF concentrations following IR.

Materials and Methods: Eighteen adult patients undergoing hand surgery requiring application of a tourniquet were randomly allocated either to receive lignocaine 150 mg or normal saline 30 ml intravenously immediately after the application of tourniquet and before the start of surgery. Plasma concentrations of PAF, platelet activating factor acetyl hydrolase (PAF-AH), IL-1 α , IL6 and IL8 were measured immediately prior to the application of the tourniquet (T0), immediately prior to the release of the tourniquet (T1) and 5 (T2), 30 (T3), 120 minutes (T4) and 24 (T5) hours after release of the tourniquet. Data were analyzed with two way repeated measures ANOVA and post hoc Bonferroni tests.

Results and Discussions: Compared with baseline, the concentrations (pg ml $^{-1}$) of PAF, IL-8, IL-6 and IL-1 α increased during ischemia and reperfusion in control and lignocaine groups. Plasma PAF concentrations were substantially less in patients in the lignocaine group compared to those in the control group after the reperfusion, at T2 (189.7 \pm 38.4 vs. 683.3 \pm 216 [P < 0.05]), T3 (147.8 \pm 35.6 vs. 824.4 \pm 291.6 [P < 0.01]), T4 (192.8 \pm 31.5 vs. 654.6 \pm 374.6 [P < 0.05]) and T5 (235.9 \pm 49.7 vs. 720.2 \pm 185.1 [P < 0.05]) respectively. Values are mean \pm standard deviation.

Conclusion: Our study demonstrates that lignocaine decreases the plasma concentrations of PAF in the setting of tourniquet induced IR.

References:

- Zimmerman GA et al. *Crit Care Med* 2002; 30: S294–S301.
- Yassin MM et al. *World J Surg* 2002; 26: 115–121.

A-430

Incidence and risk factors of postoperative nausea and vomiting (PONV) and a look into patient satisfaction

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Background and Goal of Study: Risk scores for PONV are necessary to screen patients for individual risks and then introduce them to a risk-related balanced antiemesis. We examined incidence and evaluated risk factors of PONV and had special look into patient satisfaction.

Materials and Methods: 612 patients were followed up for 24 h postoperatively. Incidence of PONV and risk factors were evaluated. Patients could give a score from 1 = very good to 6 = very bad judging their satisfaction. Patient were divided in group A (n = 190), regional anaesthesia, and B (n = 422), general anaesthesia. All patients in group B had TIVA, no nitrous oxide or volatile anaesthetics were used.

Results and Discussions: Total incidence for PONV was 21.6%, with group A, 21.1% and group B, 21.6%. Significant risk factors for PONV were a history of PONV (odds ratio = OR 6.17), motion sickness (OR 3.58), female sex (OR 2.36), body mass index < 25 (OR 1.88), non-smokers (OR 1.79), laparoscopic surgery (OR 2.5), duration of surgery > 120 min (OR 2.53), use of postoperative opioids (OR 1.73) and days 1–7 of menstrual cycle (OR 3.03). Age, time of day, surgical speciality, urgency of surgery, preoperative anxiety and cycle of the moon did not prove to be significant risk factors. Patient satisfaction was significantly lower in patient who suffered from PONV.

Conclusion(s): Total incidence of PONV of 21.6% reflects data found in literature. Against popular belief, the surgical speciality does not seem to have an influence on the incidence of PONV. With the appearance of PONV, average patient satisfaction drops; since we do care more and more about general patients well-being, eliminating PONV is necessary and helpful step ahead.

Reference:

- Apfel CC et al. (1998) *Anaesthesist* 47; 732–740.

A-431

The effect of lidocaine on neutrophil and endothelial adhesion molecule expression and IL-1 β concentrations induced by hypoxia/reoxygenation in-vitro

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Background and Goals: Lidocaine is commonly used in the perioperative period and has actions potentially of benefit during ischaemia reperfusion (1). The effects of lidocaine on neutrophil and endothelial adhesion molecule expression and endothelial supernatant IL-1 β concentrations in response to hypoxia reoxygenation were studied.

Material and Methods: Isolated human neutrophil CD11b and CD18, human umbilical vein endothelial cell (HUVEC) intercellular adhesion molecule-1 (ICAM-1) expression and endothelial supernatant IL-1 β concentrations in response to hypoxia reoxygenation (H/R) were studied in the presence or

absence of different concentrations of lidocaine (0.005, 0.05 and 0.5 mg ml $^{-1}$). Adhesion molecule expression was measured using flow cytometry and IL-1 β concentrations by ELISA. Differences were assessed with ANOVA and Student t-test where appropriate.

Results: Exposure to H/R increased neutrophil CD11b, CD18, endothelial ICAM-1 and endothelial supernatant IL-1 β concentrations expression compared to normoxia. CD11b expression on lidocaine (0.5 mg ml $^{-1}$, but not at 0.005, 0.05 mg ml $^{-1}$ concentrations) treated neutrophils was less than controls (40.52 \pm 13.19 vs 94.33 \pm 40.65 MCF, p = 0.04). Treatment with lidocaine (0.005 mg ml $^{-1}$) decreased neutrophil CD18 expression (71.07 \pm 10.14 vs 109.84 \pm 35.44 MCF, p = 0.03) and endothelial ICAM-1 expression (133.25 \pm 16.05 vs 146.62 \pm 16.78 MCF, p = 0.03) compared to control. Endothelial supernatant IL-1 β concentrations in lidocaine (0.5 mg ml $^{-1}$, but not at 0.005, 0.05 mg ml $^{-1}$ concentrations) treated HUVECs were less than controls (3.41 \pm 0.36 vs 2.25 \pm 0.21 mg ml $^{-1}$, p = 0.04).

Conclusion: These findings may explain protective effects of lidocaine in ischaemia-reperfusion injury.

Reference:

- Hahnenkamp K, Theilmeier G, Van Aken HK, Hoenemann CW. *Anesth Analg* 2002; 94: 144–7.

A-432

Incidence of complications related to epidural catheterization in the lower thoracic region

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Background and Goal of Study: We reported that the incidence of paresthesia associated with epidural catheterization was high in the lower thoracic region using paramedian approach (PA) (1). We hypothesized that the stiffness of epidural catheter might affect the incidence of complications during epidural catheterization in the region. We compared the incidence of complications between polyamide (PLA; soft) catheter and polyethylene (PLE; stiff) catheter during epidural catheterization using PA.

Materials and Methods: After obtaining IRB approval and informed consent, adult patients were randomly divided into two groups according to the type of epidural catheter; i.e. Group A: 20G, PLA catheter (n = 221) and Group B: 18G, PLE catheter (n = 213). The patient was positioned in a moderate chest-knee position. Epidural puncture was performed at T11–12 interspace. The epidural space was identified by the loss-of-resistance technique to saline. The catheter was inserted 5 cm in the epidural space. Occurrence of complications was recorded. Data were analyzed with unpaired t-test or Chi-square analysis with Yate's correction as appropriate. P < 0.05 was considered significant.

Results and Discussions: Patients characteristics and number of attempts at needle insertion (Group A: 1.2 (0.5) and Group B: 1.2 (0.5) mean (SD)) were comparable between the groups. No signs suggesting major complications were recognized in all patients. Resistance to catheter introduction was significantly different between the groups (8.6% vs. 1.9%, P = 0.004). The incidence of blood in catheter (1.8% vs. 4.2%, P = 0.232) and transient paresthesia (6.8% vs. 8.0%, P = 0.770) did not vary between the groups. Because the lumbar enlargement of the spinal cord extends from the T9 to L1 vertebrae, the shape of the epidural sac forms an oval or a hexagon (2). This might influence the ultimate position of the catheter, and the higher incidence of resistance during catheter insertion in soft catheter group.

Conclusion(s): This study indicates that PA should be the safe technique for epidural catheterization at lower-thoracic level regardless of the catheter stiffness.

References:

- Ogura A. ASA meeting: 2000: A-891.
- Fukushige T. *EJA*: 1999; 16: 628–633.

A-433

EMG and muscular activity during spinal anaesthesia

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Background and Goal: Bromage scale is used to describe muscular relaxation during spinal anaesthesia (1). The purpose of this study was to validate EMG (electromyography) as a tool describing the spontaneous muscular activity during spinal anaesthesia (2).

Material and Methods: At the first part of the study, 13 patients undergoing day case surgery were studied. They received 10 mg hyperbaric bupivacaine, at interspace L3–L4, lying on the side to be operated. EMG was then

measured from the non-operated quadriceps muscle at 5 min intervals during the first 30 min and after that every 15 min until the patient was able to flex the knee. At the second part of the study, 18 patients undergoing knee arthroplasty were studied. Group I received 5 + 5 mg bupivacaine through 28G spinal catheter (Kendall C-Span®) at the interspace L3–4. Additional bolus 2.5 mg was administered if needed. Group II received single bolus (15–20 mg) bupivacaine spinal anaesthesia at L3–4. EMG was measured as above (ABM®, Datex, Finland).

Results: At the first part of the study, EMG compared to modified Bromage scale (1–5) had significant correlation ($P < 0.01$, Pearson correlation)(Figure 1). EMG 20 was set to the limit for bolus bupivacaine. At the second part of the study, the amount of bupivacaine was reduced with EMG guidance (Group I mean 14.2 mg vs. mean 17.5 mg in Group II). The time from induction of anaesthesia until the patient was able to flex the knee was significantly reduced: Group I, mean 178.1 min vs. mean 218 min in Group II ($P < 0.01$ Mann-Whitney U).

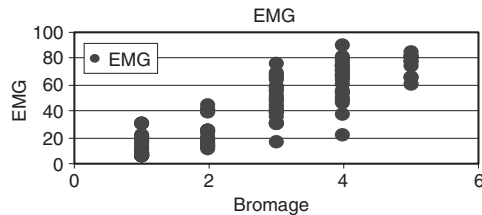


Figure 1. EMG compared to modified Bromage scale (3).

Conclusions: In spite of noise, EMG-guided administration of spinal anaesthesia significantly reduced anaesthesia time and amount of bupivacaine.

References:

- 1 Bromage Acta Anaesth Scand 1965; 16: 55–62.
- 2 Paloheimo M. Acta Anaesthesiol Scand Suppl 1990; 93: 1–83.
- 3 Imarengiaye CO et al. Anesthesiology 2003; 98: 511–515.

A-434

Are stimulating catheters useful for continuous peripheral nerve blocks? A prospective evaluation

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Background and Goal of Study: The aim of this prospective randomized study was to evaluate the advantages of stimulating catheters (Stimulong plus®, Gamida, France) during insertion and in the postoperative period in order to control the catheter tip location during continuous peripheral nerve blocks.

Materials and Methods: 20 stimulating catheters were inserted preoperatively (10 interscalene IS and 10 sciatic popliteal SP nerve blocks). The minimal intensities with the insulated needle (I1), with the stimulating catheter 0.5 cm after the needle tip (I2) and during threading when the muscular response disappeared (I3) were noted. 0.4 ml/kg of 0.5% ropivacaine were injected. Sensory and motor blockades were reported at 30 min and a radiograph of the pelvis was done. In the postoperative period, patients were randomly allocated into 2 groups according to infusion modes of 0.2% ropivacaine: G1 (n = 5 IS and 4 SP) 0.1 ml/kg/h continuous infusion, G2 (n = 5 IS and 6 SP) bolus 0.25 ml/kg each 8 hours. VAS scores, the motor response obtained with the stimulating catheter wire and minimal intensities obtained at H0, H1, H4, H8, H12 and then every 12 hours until catheter removal were noted.

Results and Discussions: The intensities and catheters insertion lengths are reported in table. In the postoperative period, the median values of VAS scores during 48 h were 0[0–2]. No catheter could be stimulated in G1. In G2, 7 catheters over 11 could be stimulated after H18, but 6 hours after LA boli, with a median intensity of 2.06 mA [0.62–3.1]. During removal 7 catheters over 11 permitted to find a nervous response (1.34 mA [1.07–1.65]). No adverse events were reported.

Median [25–75%]	IS blocks	SP blocks
I1 (mA)	0.42 [0.32–0.47]	0.45 [0.36–0.5]
I2 (mA)	0.95 [0.7–1.49]	1.57 [0.97–2.25]
I3 (mA)	1.6 [0.8–2.3]	1.14 [0.7–1.85]
Length (cm)	5 [4.5–6]	6.5 [6–8]

Conclusion: Stimulating catheters allowed the physician to control the catheter tip location. During threading the minimal intensity of the catheter wire was superior to the nerve stimulation value obtained with the needle. In the postoperative period, the nerve stimulation through the catheter is possible only 6 h after LA bolus injections and could not be realised if a continuous infusion is chosen.

A-435

Comparison of hemodynamic effects and block quality of unilateral spinal anaesthesia and combined sciatic and femoral 3-in-1 block

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Background and Goal of Study: We aimed to compare unilateral spinal block and combined sciatic and femoral 3-in-1 block (CSFB) regarding to hemodynamic changes, quality and duration of sensory and motor block and postoperative analgesia in operations of the lower leg.

Materials and Methods: With the approval of the ethics committee, ASA I–II, 18–65 years 40 patients were randomized into 2 groups. In Group I, 8 mg 0.5% hyperbaric bupivacaine was given while patients were lying on operation side and kept 15 min in that position. In Group II, distal sciatic nerve block was performed with 20 ml 0.5% bupivacaine at 10 cm superior to the skin crease of popliteal fossa. For femoral 3-in-1 block, 1 cm lateral to the femoral artery and 2.5 cm distal to the inguinal lig. 25 ml 0.5% bupivacaine was given after observing patellar movement. Heart rate (HR), mean arterial blood pressure (MAP) after blocks and throughout the operation, onset and quality of motor and sensory blockades on 5th, 10th, 15th and 30th min and duration of the block, first analgesic requirement time, complications were recorded on 0, 2nd, 4th, 6th, 12th, 18th and 24th hours postoperatively.

Results and Discussions: There was no significant difference between HR and MAP of groups. In Group I there were significant decreases in HR at 15th, 30th, 60th, 90th and 120th min and in MAP at 10th and 60th min. Spinal block was significantly superior than CSFB regarding to sensorial and motor blocks. The degree of sensorial and motor blocks were higher in Group II on postop 2nd, 4th, 6th hours and 12th, 18th, 24th hours, respectively. VAS values were significantly higher in Group I on 0, 2nd, 4th, 6th and 12th, 24th hours postoperatively. Postoperative first analgesic requirement time was longer in Group II. While there was 1 urine retention, 2 headaches and 1 nausea-vomiting in Group I, no complication was observed in Group II.

Conclusion(s): We concluded that; because of producing adequate anaesthesia like neuroaxial blocks, having lower potential for complications and side effects and providing prolonged postoperative analgesia, peripheral nerve blocks can be extensively used for lower limb surgery.

A-436

Single-injection paravertebral block before general anaesthesia enhances analgesia after breast cancer surgery with associated lymph node biopsy

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Background and Goal of Study: Paravertebral block (PVB) has been reported to decrease postoperative pain and incidence of postoperative nausea and vomiting (PONV) after breast surgery, but because the studies have not been placebo-controlled, the results may have been biased.

Materials and Methods: In our study, 60 patients scheduled for breast cancer surgery were randomly given single-injection PVB ipsilaterally at Th3 level with either bupivacaine 5 mg/ml (1.5 mg/kg) or saline before the induction of general anaesthesia. The patient and all attending staff were blinded to the study drug as the PVB was performed behind a drape curtain by an anaesthesiologist who was not otherwise involved in the care of the patient or assessment of the study parameters. Plasma bupivacaine concentrations and several recovery parameters including analgesic and antiemetic drug consumption were monitored.

Results and Discussion: Patients given PVB with bupivacaine had less postoperative pain and PONV and needed 40% less opioid medication in PACU ($P < 0.01$). They also recovered significantly better as indicated by psychomotor function tests. The highest bupivacaine plasma concentrations were measured 20 min after the injection. A significantly higher intraoperative

need for ephedrine in the bupivacaine group than in the saline group was probably due to sympathetic block indicating successful PVB.

Conclusions: Single-injection PVB at Th3 with 15–25 ml of bupivacaine 5 mg/ml before general anaesthesia reduced postoperative pain and PONV and improved recovery after breast cancer surgery. This may be related to lower opioid consumption. PVB might be especially useful in day-case surgery.

A-437

Influence of temperature on the flow rate of Baxter™ elastomeric infusion pumps

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Background and Goal of Study: The function of elastomeric infusion pumps is based on the Poiseuille-Hagen law which defines the flow rate of a solution through a flow regulating capillary. The variables which modify the flow rate are: temperature and viscosity of the solution, size and length of the catheter connected to the capillary, high difference between the pump and the catheter. The technical data concerning the Baxter™ LV elastomeric infusion pumps is: 5% glucose solution, temperature 33 °C. The goal of this study was to determine the influence of temperature on the flow rate of the Baxter™ elastomeric infusion pumps LV5, LV7 and LV 10 in conditions close to those of clinical use.

Materials and Methods: Infusion pumps containing 270 ml of ropivacaine 0.2% were connected to Plexolong UP™ catheters (20 G, 50 cm) placed at the same level than the pump. The whole device was then placed underneath a warming blanket and the temperature was raised from 31°C to 39°C by 1°C steps. The flow rates were indicated in ml/h (mean ± SD) and compared to the theoretical value (univariate T test, $p < 0.05$). The effect of temperature (°C) was studied through linear regression.

Results and Discussions: The LV5 flow (5.7 ± 0.5 ml/h) and the LV7 flow (8.6 ± 0.8 ml/h) were higher ($p < 0.0001$) than the theoretical values (5 and 7 ml/h respectively), but not the LV10 flow. There was a positive relation between the temperature and the flow rate concerning the LV5 pump ($r^2 = 0.85$, fig. 1) and the LV7 pump ($r^2 = 0.68$, fig. 2).

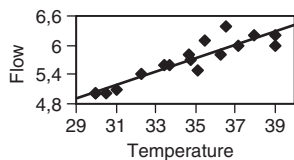


Fig. 1

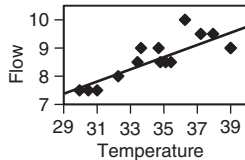


Fig. 2

Conclusion(s): The Baxter™ infusion pumps LV5 and LV7 used in conditions close to those of clinical use deliver flow rates higher than expected. An increase in temperature increases the flow rate of the LV5 and LV7 pumps. This effect has to be taken in account if the infusion pump is placed close to the patient, in his bed for example.

A-438

Mechanical properties of spinal anesthesia micro-catheters

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Background and Goal of the Study: As a consequence of a nearly ruptured intrathecal micro-catheter during attempted removal in our institution we looked for comparative data describing the material strengths of different continuous spinal anesthesia micro-catheters.

Material and Methods: Continuous spinal anesthesia micro-catheters (each $n = 6$): B.Braun Spinocath® G 22, B.Braun Spinocath® G 24 (B.Braun Melsungen AG., D-34209 Melsungen, Germany), Pajunk Intralong® G 25, Pajunk Intralong® G 27 (Pajunk GmbH, D-78187 Geisingen, Germany), Portex™ Microcatheter system G 28 (SIMS Portex Ltd., Hytle, Kent, England) were tested. For tensile testing a spindle driven universal testing machine AGe 100 kN controlled via an EDC 100 control system (Shimadzu Corp., Japan) with testing software (Fa. Messphysik, Fürstenfeld, Austria) was used. Load during testing was detected through a 5 kN load cell. A constant stretching speed of 1 mm/min at room temperature of 21°C was used. Force [N] when catheter ruptures was determined.

Results and Discussion:

	Catheter Rupture [N]
G 22 B.Braun Spinocath®	29.56 ± 1.56
G 24 B.Braun Spinocath®	16.77 ± 1.61
G 25 Pajunk Intralong®	9.20 ± 0.48
G 27 Pajunk Intralong®	4.61 ± 0.25
G 28 Portex™ Microcatheter system	5.07 ± 0.59

Conclusion: In case of difficult removal of a continuous spinal micro-catheters, choosing a catheter with higher strength characteristics may reduce the risk of catheter rupture with all possible consequences.

References:

- 1 Meyers MA, Chawla KK. Mechanical behaviour of materials. New Jersey: Prentice-Hall Inc., 1999.
- 2 Ashby MF, Jones DRH. Engineering materials 1: An introduction to their properties and applications. 2nd ed. England: Cambridge University, 1996.

Acknowledgements: We thank Technical University Graz, Institut für Materialprüfung und Baustofftechnologie mit angeschlossener Technischer Versuchs- und Forschungsanstalt für Festigkeits- und Materialprüfung, Graz, Austria.

A-439

BIS index monitoring for propofol-sedation under neuraxial anesthesia

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Background and Goal of Study: The purpose of this study was to compare the BIS index monitoring with clinical criteria for the determination of the optimum level of hypnosis during propofol-sedation in patients under neuraxial anesthesia.

Materials and Methods: With IEC approval and informed consent obtained, 89 elderly ASA physical status III–IV patients undergoing elective lower abdominal surgery were enrolled in this prospective randomised study. All patients had standard preanesthesia protocol. The neuraxial technique consisted either in thoracic epidural (T9–11), either combined spinal-epidural needle through-needle (L2–3). The standard monitoring was combined with continuous BIS monitoring for 44 patients (group I) or with clinically assessed OAA/S scale (5 – awake, 1 – no response) for 45 patients (group II). After the confirmation of the neuraxial block the patients were given propofol at a dose of 75–100 mcg/kg/min for 3–5 minutes and then titrating to the desired level of sedation (BIS = 75–85, OAA/S = 2–3), with a generally required maintenance rate over time of 25–75 mcg/kg/min, according to clinical response (1). Clinical criteria for changing the rate of infusion were desaturation ($SpO_2 < 92\%$), RR < 10/min and hypotension. Statistical analysis was with student's t-test and χ^2 -test; significance accepted $p < 0.05$.

Results and Discussions: For group I the average BIS values during surgery was 80.4 ± 7.6 (range: 73–90); BIS values increased significantly prior to patients responses and additional sedation requirement was given promptly. For group II, OAA/S scores recorded every 10 minutes was insufficient to detect properly in advance the need to sedation and the intermittent bolus of propofol conducted to a higher risk of respiratory depression who needed ventilation by a face mask. Anyway there is a correlation of BIS index values with OAA/S scores and clinical parameters.

Conclusion(s): In the elderly, ASA III–IV patients for prevention of unnecessary sedation (BIS < 70) the BIS monitoring may allow better balancing of propofol administration with fewer unwanted intraoperative events and with minimum effective dose of hypnotic required.

Reference:

- 1 Clinical value of hypnosis monitoring, Arvy Yli-Hankala, Tampere University Hospital, Clinical Window – issue 7, Nov. 2001.

A-440

Comparison of Stimuplex A and Stimuplex D needle efficiency in vertical infraclavicular brachial plexus blockade

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Introduction: In peripheral nervous blockade insulated needles gained wide acceptance against uninsulated ones in recent years. Insulated needles (Stimuplex-A) more precisely locate the peripheral nerve than uninsulated needles (1). New design Stimuplex-D needles have more insulation and the entire stimulus current concentrates at the very needle tip. However there is no clinical study that comparing Stimuplex-A and Stimuplex-D.

Material and Methods: 23 patients with chronic renal failure who had an operation for creation of arteriovenous fistula included into the study. Patients randomized into two groups. In group A (n = 11) Stimuplex® A needle and in group D (n = 12) Stimuplex® D needle used to perform vertical infraclavicular brachial plexus blockade described by Kilka et al (2). 40 ml 1% prilocaine and 10 ml 0.5% bupivacaine with epinephrin administered for blockade. Time needed to achieve motor blockade and anesthesia for radial, median, ulnar and musculocutaneous nerves were recorded with 5 minute intervals.

Results: Similar mA levels obtained in both groups. The difference in the overall success and time needed for brachial plexus anesthesia did not reach statistical significance between the two groups. However number of attempts to achieve minimum required mA was significantly lower in group D (2.36 ± 1.56 vs 1.25 ± 1.27 , $p < 0.05$).

Conclusion: Needles which is more insulated (Stimuplex® D), may be more appropriate to achieve minimum required electrical current with minimum effort.

References:

- 1 Ford DJ, Pither CE, Raj PP: Comparison of insulated and uninsulated needles for locating peripheral nerves with a peripheral nerve stimulator. *Anesth. Analg.* 63:925, 1984.
- 2 Kilka HG, Geiger P, Mehrkens HH: Infraclavicular vertical brachial plexus blockade. A new method for anesthesia of the upper extremity. *An anatomical and clinical study. Anaesthesist* 44(5):339–44, 1995.

A-441

Estimating the risk of unintentional renal puncture during psoas compartment block

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Background and Goal of Study: Supracapsular renal hematoma related to renal puncture has been repeatedly reported during performance of lumbar plexus blocks (1). Reasons presumed are insertion site above L3 level or needle directed cranially. Recently, it has been shown that orientation at the intercrestal line as usually practiced for L4 identification might be inaccurate (2). Additionally, variations or anomalies in kidney location as well as renal motion during respiration have not been considered up to now. We evaluated the risk of unintentional renal puncture during PCB using ultrasonic needle guidance.

Materials and Methods: After institutional approval 104 consecutive patients undergoing total knee arthroplasty in PCB and sciatic nerve block were enrolled. PCB was performed according to Capdevila's approach. For appropriate identification of the insertion site the echoes of lumbar transverse processes were counted by means of ultrasound. Needle was advanced using neurostimulation and ultrasonic imaging by a lateral approach as used for urologic examinations, allowing a view to the psoas muscle, spine and iliac crests. The following distances were measured: kidney–spine, kidney–iliac crests, kidney–needle as well as the excursion during respiration induced motion. Anomalies of kidney location were recorded.

Results and Discussions: Measurements could be performed in 94 patients. The distances measured were kidney–spine $2.8 \text{ cm} \pm 0.9$, kidney–iliac crest $8.5 \text{ cm} \pm 2.5$, and kidney–needle $6.0 \text{ cm} \pm 2.5$. Inspiration induced motion was $1.7 \text{ cm} \pm 0.5$, however, during forced ventilation $3.5 \text{ cm} \pm 0.9$. In 11% of patients distance needle–kidney was less than 3 cm which was regarded to be a risk factor for unintentional renal puncture. Pelvic location of the kidney was observed in 4% of patients, lower pole cysts in 11%.

Conclusion(s): PCB performance above the L4 level should be avoided. Missing the correct interspace as well as deep respiration will increase the risk, too. US guided puncture may decrease the risk of unintentional renal puncture.

References:

- 1 Aida S, Takahashi H, Shimoji K. *Anesthesiology* 1996;84:452–5.
- 2 Broadbent CR, Maxwell WB, Ferrie R, et al. *Anaesthesia* 2000;55:1122–6.

A-442

Effect of intraperitoneal levobupivacaine on pain after laparoscopic cholecystectomy

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Background and Goal of Study: Although pain after laparoscopic cholecystectomy is less intense than after open cholecystectomy, some patients still experience considerable discomfort. In a randomized, double-blind, placebo-controlled trial, we evaluated the effect of intraperitoneally administered levobupivacaine (L), ropivacaine (R) or saline solution (S) on pain management and analgesic requirements after laparoscopic cholecystectomy.

Materials and Methods: Thirty ASA physical status I or II patients received in double-blinded fashion 40 ml of 0.9% normal saline solution (group S), ropivacaine 0.5% (group R), levobupivacaine 0.5% (group L). Induction and maintenance of anesthesia were standardized in all patients. Locals anesthetics or normal saline solution were applied: 20 ml under the right emidiaphragm and 20 ml to the gallbladder bed after its removal. Postoperative overall pain at rest (S_R, R_R, L_R) and at deep inspiration (S_A, R_A, L_A) was assessed during the first 24 h at 6 time-points (T0: end of surgery; T1 2 h; T2 4 h; T3 8 h; T4 12 h; T5 24 h) using visual analogic scale (VAS 0–10).

Results: Data (mean \pm SD) concerning pain score at rest and at deep inspiration are show in Table:

	T0	T1	T2	T3	T4	T5
L_R	1.4 \pm 0.51*	2.1 \pm 0.56*	1.6 \pm 0.69	1.3 \pm 0.48	0.7 \pm 0.67*	0.3 \pm 0.48*
R_R	2.1 \pm 1.19*	2.3 \pm 0.67	2 \pm 0.66	1.6 \pm 0.51	0.9 \pm 0.56*	0.6 \pm 0.51*
S_R	2.5 \pm 0.97*	2.8 \pm 1.03*	2.9 \pm 0.56	2.9 \pm 1.19	2.1 \pm 1.19*	1.4 \pm 1.07*
L_A	1.5 \pm 0.84*	2 \pm 0.66	1.5 \pm 1.08*	1.1 \pm 0.73	0.7 \pm 0.67*	0.7 \pm 0.67*
R_A	2.2 \pm 1.31	2.6 \pm 0.96	2.4 \pm 1.17*	1.8 \pm 0.78	1.2 \pm 1.03*	0.9 \pm 0.99
S_A	2.7 \pm 1.05*	3 \pm 1.05	3.3 \pm 0.82*	2.4 \pm 0.51	2.2 \pm 1.3*	1.6 \pm 1.17*

Pain was less intense in the levobupivacaine group at each time point. Statistical significance was found in T0–T4–T5 among groups L_R, R_R, S_R, and T0–T2–T4–T5 among groups L_A, R_A, S_A (Anova one-way * $p < 0.05$ † $p < 0.01$)

Conclusion: We conclude that reducing pain with intraperitoneal levobupivacaine is effective, easy to administer and without side-effects.

References:

- 1 Mraovic N. *Acta Anaesthesiol Scand* 1997;41:193–6.
- 2 Labaille T. *Anesth Analg* 2002;94:100–5.
- 3 Moiniche Sblock. *Anesth Analg* 2000;90:899–912.

A-443

Combined general and epidural anesthesia versus general anesthesia alone in colorectal cancer surgery

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Background and Goals: The purpose of our study is to compare two different methods of anesthesia in colorectal cancer surgery and to evaluate advantages and limitations of each method on recovery characteristics and course of early postoperative period in these patients.

Materials and Methods: One hundred patients scheduled to undergo elective colorectal resections were randomized to receive either combined general and epidural anesthesia followed by epidural analgesia (GA + EA group) or general anesthesia followed by systemic pethidine analgesia (GEN group), 50 patients in each group. Induction of general anesthesia was performed the same way (propofol, fentanyl, pipecuronium) in both groups. Total doses of fentanyl and muscle relaxants to maintain adequate anesthesia were registered intraoperatively. Recovery characteristics were also evaluated. Visual analogue scale (VAS) was used to compare intensiveness of postoperative pain between two groups during 24 hours postoperatively. Side effects of both analgesia techniques were evaluated.

Results: Total doses of fentanyl (0.21 ± 0.07 mg) and pipecuronium (2.34 ± 2.25 mg) for were significantly lower in GEN + EA group as compared with 0.73 ± 0.23 mg and 3.74 ± 1.65 mg respectively ($p < 0.05$). Tracheal extubation time was 5 ± 2 min in GEN + EA group to compare with 12 ± 17 min in GEN group. VAS pain scores at rest and on coughing were significantly better in GEN + EA group to compare with GEN group ($p < 0.01$). Moreover, additional analgesics were needed 8 (16%) and 26 (58%) patients respectively to keep VAS pain scores below 5. Adverse effects such as nausea and vomiting occurred in 25 (50%) patients of GEN group to compare with 12 (24%) patients in GEN + EA group ($p < 0.05$). Sedation level during 24 hours postoperatively was also more profound in GEN group.

Conclusions: 1. General and epidural anesthesia has demonstrated better recovery characteristics than general anesthesia alone. 2. Postoperative epidural analgesia was more effective for postoperative pain management with fewer adverse reactions to compare with systemic opioid analgesia.

A-444

The role of patient posture in production of successful unilateral spinal anaesthesia: how early is it?

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Background and Goal: Patient's (pt) posture, time spent in lateral position, use of directional pencil point needles to inject low dose of hyperbaric local

anaesthetic solution at slow rates are the main factors facilitating production of a selective unilateral spinal anaesthesia (1). Keeping constant the aforementioned factors, we evaluated the role of pt's posture (lateral vs "sitting and then immediately lateral" oftenly used in clinical practice), during the induction phase of a spinal anaesthesia (puncture time), on production of a successful selective unilateral block.

Materials and Methods: 50 pts, ASA I-II, scheduled for unilateral hernioplasty were divided into 2 groups (G1/G2: 25/25pts, males 19/18, aged $58 \pm 4/56 \pm 4$ yrs, wt $73 \pm 3/71 \pm 3$ Kg, ht $167 \pm 2/170 \pm 1$ cm) in a prospective randomized, blinded study. Spinal anaesthesia was performed in sitting position then immediately turned on the operative side (G1) and in lateral decubitus on the operative side (G2). Premedication, monitoring, fluid preloading were standardized; the same operator performed all dural punctures at L2-3, midline, with a 27G Whitacre. Needle orifice was oriented toward the operated side; all pts received 10 mg 1% hyperbaric bupivacaine at 0,05 ml/sec without barbotage and maintained 20 min laterally and horizontally on the operative side. Block was assessed by cold sensitivity, pinprick and mod. Bromage scale at fixed times. Data were analysed by t-test, 95%CI. $p < 0.05$ statistically significant.

Results: Data (mean \pm SEM) are shown in the table:

	G1	G2	p
T to reach max. height	17 \pm 0,7	10 \pm 1,3	***
T of Sensory block	282 \pm 13	201 \pm 9	***
T of non-dependent limb motor block	130 \pm 12	34 \pm 10	***

*** $p = 0.0001$; T = time (min)

Selective unilateral sensory and motor block was observed in 4 pts of G1 (16%) vs 18 pts of G2 (72%) ($p = 0.0001$).

Conclusions: The lateral decubitus kept during and not only after the performance of dural puncture was successful in the production of a faster onset, restricted unilateral surgical block with an earlier sensitive recovery.

Reference:

- 1 Kuusniemi KS, Pihlajamäki KK, Pitkanen MT. Reg Anesth Pain Med 2000; 25:605-610.

A-445

The effects of double-injection technique on sciatic nerve blockade: a prospective, randomized comparison between the classic posterior and lateral popliteal approach

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Background: For peripheral nerve blockade, the double-injection technique proved to be superior to a single injection in previous investigations¹⁻². No information is currently available comparing the effects of two different approaches to the sciatic nerve with a double-injection technique. The purpose of this prospective, randomized, blinded study was to compare onset time and efficacy of two different double-injection approaches for sciatic nerve block with 0.75% ropivacaine.

Methods: A total of 50 ASA I-II patients undergoing foot surgery were randomly assigned to receive sciatic nerve blockade by means of the classic (Labat) posterior approach¹ ($n = 25$), or a lateral popliteal approach² ($n = 25$). All blocks were performed with the use of a nerve stimulator (stimulation frequency 2 Hz; intensity < 0.5 mA) and both major components of the sciatic nerve (tibial and common peroneal nerves) received separately 10 ml of 0.75% ropivacaine. Success rate was defined as a complete sensory and motor block associated with pain free surgery. Time required for onset of sensory and motor block in the distribution of the tibial and common peroneal nerves were recorded.

Results and Discussion: A greater success rate was observed in the classic group (96%) as compared with the popliteal group (68%; $p < 0.05$). A general anesthetic became necessary in six patients (24%) with the lateral popliteal approach and none following the classic approach ($p < 0.05$). The onset of complete sensory and motor blockade was significantly faster in the classic group (12 ± 6 min) as compared to the popliteal group (26 ± 10 min; $p < 0.05$). Separation of the tibial and common peroneal nerves at highly variable distances above the popliteal fossa crease and the presence of fat or multiple layers of connective tissue within the popliteal space may explain the slower onset of nerve block and the greater failure rate in the lateral popliteal approach as compared with the other proximal approach³.

Conclusion: A double-injection with a comparatively low volume of ropivacaine 0.75% generated a higher success rate and a shorter onset time of

sensory and motor blockade after the classic Labat than after a lateral popliteal approach.

References:

- 1 Bayley SI, et al. Reg Anesth 1994; 19: 9-13.
- 2 Paqueron X, et al. Anesth Analg 1999; 89: 1221-1225.
- 3 Vloka JD, et al. Anesth Analg 2001; 92: 215-217.

A-446

Influence of the injection site (L2/3 or L3/4) and the posture of the vertebral column on selective spinal anesthesia for ambulatory knee arthroscopy

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Background and Goal of Study: We tested the hypothesis that selective spinal anesthesia (SSA) (1) for ambulatory knee arthroscopy can be accomplished with a small dose of hyperbaric bupivacaine at L3/4 interspace with or without tilting the vertebral column 5 degrees cranially.

Materials and Methods: In this double-blind study, 123 patients received randomly spinal anesthesia with 4 mg of hyperbaric bupivacaine inserted at either L2/3 interspace while the vertebral column was kept horizontal (L2/3 group), or at L3/4 level with the vertebral column horizontal (L3/4H) or tilted 5 degrees cranially (L3/4T) during the first 6 min. At 7 min, the patient was tilted cranially for 3 min in all groups, if the sensory block was inadequate.

Results and Discussions: In the L3/4T group the sensory block (median Th8) reached a higher level compared with both the L2/3 (median Th10) ($P = 0.008$) and L3/4H (median Th11) ($P < 0.001$) groups, respectively. To reach an adequate level of sensory block, 39% of the patients in the L3/4H group had to be kept cranially tilted for 3 min at 7 min, compared with 10% ($P = 0.004$) in the L3/4T group. Sacral block developed later and recovered faster ($P < 0.05$) in the L3/4T group compared to L3/4H group. The motor block was more selective in the L3/4T compared to L3/4H group: 60% vs. 88% of the patients had the myotome L5 blocked in the groups L3/4T and L3/4H ($P = 0.005$), respectively.

Conclusion(s): When using SSA, the posture of the vertebral column is a major determinant of both sensory and motor segments to be blocked. A 4 mg dose of hyperbaric bupivacaine at the L3/4 interspace with a 5 degree cranial tilt of the vertebral column for 6 min is recommended for knee arthroscopy.

Reference:

- 1 Vaghadia H. Can J Anaesth 1998; 45: R63-70.

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A-447

Vasodilatation and cutaneous thermal effects after axillary block with mepivacaine

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Background and Goal: Axillary block of brachial plexus produces cutaneous anaesthesia, sympathetic block, skin-vasodilatation and an increase in skin-temperature. The goal of the study was to assess the photoplethysmographic and cutaneous thermal changes after axillary block of brachial plexus.

Materials and Methods: With Ethical Committee approval and informed consent we studied 15 patients (ASA-I) scheduled for elective hand surgery under axillary block with 1% mepivacaine (40 ml). Vasodilatation and temperatures on the skin were assessed by digital photoplethysmography and thermometry, respectively. The thermocouples were attached to hand, forearm and arm. All recordings were performed every 5 min to 30th after injection of mepivacaine. Anova for repeated measures, Dunnet and Pearson correlation tests were used.

Results and Discussion: Skin temperature and photoplethysmography only increased on the hand ($3.9-5.2^{\circ}\text{C}$ ($p < 0.01$) and 11.8 ± 3.0 mV/V ($P < 0.01$)). Arm and forearm do not show any increase in skin temperature. We found a significant correlation between hand-temperatures and photoplethysmography amplitudes $r = 0.7$ ($p < 0.001$).

Conclusions: Axillary plexus block with surgical anaesthesia below elbow only produces vasodilatation in the hand with an correlated increase in skin temperatures. The sympathetic inhibition of digital arterio-venous anastomoses could explain these changes.

A-448**Continuous thoracic epidural anesthesia induces segmental sympathetic block in the awake rat**

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Background and Goal of Study: Thoracic epidural anesthesia (TEA) reduces perioperative mortality and improves intestinal function. Segmental sympathetic block that results in blood flow redistribution is supposed to be a key mechanism of these protective effects. This study was designed to evaluate changes in skin sympathetic activity in a new model of continuous TEA in awake rats.

Materials and Methods: 13 male rats were instrumented with a thoracic epidural catheter and randomly assigned to saline infusion (CON) or bupivacaine 0.5% infusion (TEA) at 15 µl/h for 120 min on the first and third postoperative day. Mean arterial pressure, heart rate, respiratory rate, arterial pCO₂ and motor score were recorded at baseline and after 30, 60, 90 and 120 min. Simultaneously, skin temperature was measured at the front paws, high-, mid- and low-thoracic segments, hind paws, proximal and distal tail. Changes in skin temperature from baseline values (ΔT) were determined to detect changes in sympathetic activity.

Results and Discussions: Hemodynamic parameters and respiratory function remained unchanged during TEA and only mild motor deficits occurred.

In high-, mid- and low-thoracic segments, ΔT was significantly higher in TEA than in CON ($p < 0.001$ at all time points; e.g. ΔT 0.62 ± 0.01 °C vs. -0.05 ± 0.01 °C low thoracic after 90 min). In the distal tail, skin temperature decreased in TEA while it increased in CON ($p < 0.05$ after 60, 90 and 120 min; e.g. ΔT -0.86 ± 0.25 °C vs. 0.26 ± 0.18 °C after 90 min). In a subgroup analysis, ΔT on day 3 was comparable to day 1.

Conclusion(s): In this new small animal model, TEA induces a segmental sympathetic block with refractory increased sympathetic activity outside of the blocked area in awake rats. The effects are stable for 3 days. These results support the concept of regional sympathicolysis by TEA. This technique is suitable to study the effects of continuous neuraxial blockade in rats both in health and in severe systemic disease such as pancreatitis and sepsis.

A-449**A comparison of superficial and combined (deep and superficial) cervical block for carotid endarterectomy: evaluation of analgesic efficiency and side effects**

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Background and Goal of Study: Both superficial and combined (deep and superficial) cervical blocks have been extensively used for carotid endarterectomy. The deep cervical block carries a substantially higher risk of complications, but it is not clear if it offers any advantages. Therefore, we assessed analgesic efficiency and side effects of both techniques.

Materials and Methods: 149 patients were randomly assigned to receive either a superficial cervical block only (group 1) or a combined, deep and superficial, cervical block (group 2) for carotid endarterectomy. The block was performed using bupivacaine 0.5%, lidocaine 2% with epinephrine 1:200 000. Intraoperatively lidocaine 1% with epinephrine or fentanyl intravenously were added when required. Analgesic efficiency was assessed using visual analogue scale (VAS) intraoperatively in intervals of 10 minutes and postoperatively hourly for 12 hours.

Results and Discussions: There is a statistically significant difference in VAS and additional analgesic supplement between the two groups. Intraoperative VAS in the group 1 was 0.7 ± 0.56, in the group 2 it was 0.3 ± 0.33 ($p < 0.01$). Additional analgesia provided by lidocaine 1% was 6.4 ml in group 1 and 4.1 ml in group 2 ($p < 0.05$), or fentanyl 0.07 mg in group 1 and 0.03 mg in group 2 ($p < 0.01$). Negative correlation was found between volume of local anesthetic and intraoperative VAS score $r = -0.24$, $p < 0.05$. Postoperatively mean VAS did not differ between the groups. In each group one patient developed dysrhythmia due to the bupivacaine cardiotoxicity. The difference in VAS and in the amount of additional fentanyl and lidocaine were clinically irrelevant. The finding that the volume of anaesthetics, not the dose, was negatively correlated with VAS might explain the high efficiency of the superficial cervical block.¹

Conclusion(s): We find that the combined (superficial and deep) cervical block has no clinical advantage over superficial cervical block for carotid endarterectomy.

Reference:

¹ Pandit JJ, Dutta D, Morris JF. *Br J Anaesth* 2003;91:733-5.

A-450**Continuous popliteal sciatic nerve block for foot surgery in 531 patients: efficacy and adverse effects**

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Background and Goal of the Study: Orthopaedic foot surgery is very painful, resulting in the consumption of significant quantities of analgesics in the postoperative period. We have evaluated the efficacy and acceptability of lateral popliteal sciatic nerve blockade using an indwelling perineural catheter in this setting.

Materials and Methods: We prospectively studied over a 3 year period (1999-2002) 531 patients undergoing foot surgery. Perineural catheters were inserted preoperatively via the classical posterior approach of the poplitea fossa, using a nerve stimulator (1). A continuous infusion of 0.2% ropivacaine was used. The rate of infusion was left at the discretion of the anaesthesiologist in charge, according to clinical efficacy.

Patient age and gender, infusion rates of 0.2% ropivacaine, pain scores at day 1 and 2, side-effects and technical difficulties were systematically recorded. Postoperatively paracetamol and ketoprofen were prescribed around the clock.

Results and Discussion: 531 patients were included in the study, of which 89.5% were women. The average age was 53.6 ± 12.7 years. Infusion rates for ropivacaine 0.2% varied from 2 to 12 ml/h. The average VAS scores on days 1 and 2 were 6 ± 12.5/100 and 8.2 ± 14/100, respectively. Reported side effects were nausea and vomiting (2%), transient paresthesia (1.3%), motor block (2.8%), catheter related incidents in 6% of which unintentional withdrawal (1.1%), occlusion (1%), leakage (0.7%) and non-functioning catheter (2%). A patient presented with an extensive cellulitis of the thigh complicated by septic shock which resolved without sequelae following treatment. The causative agent found locally was MRSA, most likely of iatrogenic origin. The severity of the case was proved by a long postoperative course in ICU, requiring repeated surgery (incision and drainage of abscess), inotropic support and systemic antibiotherapy.

Conclusion: Continuous popliteal sciatic nerve block is an extremely efficacious analgesic technique, easy to perform and well tolerated, with few side-effects provided appropriate safety and hygiene standards are obeyed.

Reference:

¹ Singelyn FJ et al. *A&A* 1997;84:383-6.

A-451**Psoas compartment block using ultrasonic guidance by a lateral view in patients**

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Background and Goal of Study: Ultrasound has been proven to be a helpful tool in performing upper extremity nerve blocks providing direct visualisation of the nerves as well as observation of local anesthetic spread as the most valid predictor of successful blocks (1). For PCB ultrasonic guidance is only reported in cadavers but not in patients (2). The prone position as used in (2) is hard to take in for patients with arthritis undergoing typically total knee arthroplasty (TKA). We therefore examined a lateral approach as usually performed in ultrasound examinations of the kidney for ultrasonic needle guidance for PCB in patients undergoing TKA.

Materials and Methods: After institutional approval 104 consecutive patients underwent PCB using Capdevila's approach in the lateral decubitus position with the operated side uppermost. Needle (Plexolong, Pajunk, Germany) advancement was performed using neurostimulation (Braun, Germany) and ultrasonic guidance by a lateral approach allowing visualisation of the kidney, the spine and the psoas muscle. Needle was identified by needle tip reflex. If muscle twitches of both the quadriceps and the psoas muscle were elicited local anesthetic mixture (ropivacaine 0.375% and mepivacaine 1%) were injected. The pattern of local anesthetic spread was observed.

Results and Discussions: Ultrasound conditions were judged difficult in 10% of patients because of obesity or intestinal air. Needle advancement could be visualized in 94% of patients and PCB was successful in all but one patient. In 5 patients epidural anesthesia developed. Those patients showed a medial restricted spread of local anesthetic as opposed to dorso-medial spread as usual. No puncture complications occurred.

Conclusion(s): Ultrasound may be helpful in performing PCB and avoiding puncture complications. Direct visualisation of local anesthetic spread

allows prediction of successful blocks. Medial restricted spread may result in epidural anaesthesia.

References:

- 1 Chan VW, Perlas A, Rawson R, et al. *Anesth Analg* 2003;97:1514–17.
- 2 Kirchmair L, Entner T, Kapral S, et al. *Anesth Analg* 2002;94:706–10.

A-452

Surface landmarks and anatomic relationships of sciatic nerve for anaesthetic blockade: cadaveric study

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Background and Goal of Study: Traumatic injuries of femur and hip are more frequent than pelvic bone fractures¹. Aim of this study was to re-evaluate the regional anatomy of the sciatic nerve (SN) for anaesthetic blockade by using anatomic landmarks other than greater trochanter which is used as the classical approach².

Materials and Methods: The study was approved by local ethics committee, and bilateral dissections on sciatic nerve were performed on 10 embalmed male and female cadavers (46 to 69 years at death). The excursion of SN from the line drawn between posterior superior iliac spine (PSIS) to ischial tuberosity (IT) and laterally from IT was measured. The safe area on the SN was determined according to the branching of vascular structures and nerves. The branching of posterior cutaneous nerve (PCN) from the SN was also determined. Data are given as mean \pm SD.

Results and Discussion: The distance between PSIS and IT was 13.1 \pm 6.5 cm. Upper and lower rim of SN on this line were 7.8 \pm 0.7 (A) and 9.1 \pm 0.6 (B) cm from PSIS respectively. SN was also 1.8 \pm 0.5 (C) and 2.9 \pm 0.6 (D) cm lateral from IT. Slightly and inferior concave lines drawn from A to D and B to C forms the surface projections of SN. Lower half of this area was relatively free from neurovascular structures. Division of PCN was also in this area at 90% of cases.

Conclusion: SN was found to be located more inferior than defined previously³. This study suggests new and alternative landmarks for determining the surface projections of SN in more reliable region rather than describing fixed points. The alternative landmarks defined in this study does not require special positioning such as hip flexion, and seems to be more accurate and safe.

References:

- 1 van Staa TP, et al. *Bone* 2001; 21: 517–22.
- 2 Winnie AP. *Surg Clin North Am* 1975; 55: 861–92.
- 3 Mansour NY. *Reg Anesth* 1993; 18: 322–3.

A-453

Paravertebral block for post-thoracotomy pain: prospective, randomized comparison of two different methods

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Background and Goal of Study: This study was designed to determine whether a thoracic paravertebral block inserted before surgery offers a higher quality of analgesia than a catheter inserted by the surgeon under direct vision before chest closure.

Materials and Methods: 45 patients undergoing elective postero-lateral thoracotomy were included in a prospective, randomized and blinded study after obtaining approval from the Local Ethics Committee and informed patient consent. Patients were randomized into two groups. Group A: pre-operative catheterization of the paravertebral space (T5–7) using a standard technique (loss of resistance). 20 ml of 0,375% bupivacaine were injected before the start of surgery. Group B: catheter was inserted by the surgeon before chest closure. 20 ml of 0,375% bupivacaine were injected. Both groups received a continuous postoperative infusion of 0,25% bupivacaine 5 ml h⁻¹ during 48 h. All patients used an intravenous PCA system of morphine without background infusion during first 24 h.

Pain scores (visual analogue scale VAS) at rest and on movement, intra-operative fentanyl consumption, morphine requirements and pulmonary function test (PEFR) were collected. The number of patients required in each group was determined. Data were compared by using the unpaired Student's t test or Mann-Whitney U-test for nonparametric data (pain scores). $p < 0,05$ was considered statistically significant. Data are expressed in mean \pm SD or median (interquartile range).

Results: 42 patients could be analysed. The two groups were homogeneous. Pain scores (VAS) both at rest and on movement were no significantly

different, except after 4 h when patients in the group A had lower VAS than group B. At rest: 1 (0,25–3,75) vs. 4 (2,50–5) $p < 0,023$; on movement: 4 (2,25–5,75) vs. 5,50 (4–7) $p < 0,015$. Intraoperative fentanyl requirements were significantly higher in group B ($p = 0,02$). There were no significant differences regarding the cumulative morphine consumption and pulmonary function.

Conclusion(s): Results suggest that the two methods provide a good pain relief in this kind of surgery. A possible leakage into the interpleural space could explain the differences observed.

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Continuous versus single shot lumbar plexus blocks for total knee replacement surgery: effects on analgesia and outcome

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Background and Goal of Study: Continuous lumbar plexus infusion of local anaesthetic (LA) following total knee replacement (TKR) surgery has been shown to improve analgesia and early recovery as compared with PCA morphine (1). Any specific benefit of an infusion over a single shot lumbar plexus block has not been demonstrated however: this is our goal.

Materials and Methods: In a prospective, double-blind, randomized controlled trial, 32 ASA I-III patients undergoing unilateral TKR for osteoarthritis were allocated to one of two groups according to a computer based randomization scheme – 0.1% levobupivacaine infusion or saline infusion. All patients received a lumbar plexus block with 25 ml 0.5% levobupivacaine using a posterior approach (2) with a catheter left in situ, and a sciatic nerve block with 15 ml 0.5% levobupivacaine using Labat's technique (3). Every patient also received a spinal anaesthetic using 0.5% heavy bupivacaine. At the end of surgery the patients' lumbar plexus catheters were connected to the appropriate infusion solution in a double-blinded fashion, which was run at 10 ml/hour for 48 hours. All patients also received regular oral non-steroidal analgesia and PCA morphine. The primary endpoint was morphine use from the PCA machine. Secondary endpoints included pain scores, day of first post-operative mobilization, and nausea. These data were recorded at multiple times in the 72 hours following surgery. Morphine usage was compared using Student's two-tailed t-test, other data using the Mann-Whitney U-test.

Results and Discussions: Patients receiving the LA infusion used significantly less morphine than those receiving saline (20.4 mg (SD 16.9) vs. 35.7 mg (SD 23.1), $p = 0.04$). Those in the LA group also first walked earlier (day 1 or 2) than saline group (day 2 or 3), $p = 0.006$. Pain scores were similar. No adverse effects were noted.

Conclusion: Post-operative infusion of LA into the lumbar plexus reduces morphine requirement and improves early recovery following TKR as compared to single shot blocks.

References:

- 1 Capdevila et al. *Anesthesiology* 1999; 91: 8–15.
- 2 Dalens et al. *Anesth Analg* 1988; 67:750–8.
- 3 Labat G. *Regional Anesthesia – Its Technique and Clinical Application*. W.B. Saunders, 1929.

A-455

Comparison of posterior versus latero-popliteal sciatic nerve block in foot and ankle surgery

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Background and Goal of the Study: Sciatic nerve block combined with a femoral one is a well recognized technique for providing anaesthesia and postoperative analgesia for foot and ankle surgery. We perform this block frequently using either the classical posterior approach (1) or the more recently described lateral approach at popliteal fossa level (2), and have the clinical impression that the posterior sciatic block (PSB) is more efficient than the latero-popliteal sciatic block (LPSB). In order to confirm these hypothesis, we compared the onset, the duration of action, the success rate and the complications between these two techniques for ankle and foot surgery.

Materials and Methods: After Institutional Board Approval, we analysed our database, between April 2001 and January 2003, 287 patients operated for foot and ankle surgery under sciatic nerve block associated with femoral block. PSB was performed in 149 patients and LPSB in 138 patients. All patients received 30 ml of ropivacaine 0.5% on the sciatic nerve which ever technique used. Data were compared with unpaired t-test or chi square as indicated and are presented as mean \pm SD or % of patients. $p < 0.05$ was considered significant.

Results and Discussion: Demographic data were similar in both groups. Technical, anaesthetic and postoperative characteristics of both blocks are shown in table 1. No complications were noted.

Table 1.

	PSB (n = 149)	LPSB (n = 138)	p value
Time to perform (min)	2.5 ± 2	4.5 ± 4	p < 0.001
Delay to TN blockade (min)	13.5 ± 13	23 ± 26	p < 0.001
Delay to CPN blockade (min)	9 ± 6	13 ± 11	p < 0.0001
Sensitive block < 15 min	77%	54%	p < 0.0007
Sensitive block < 30 min	89%	74%	p < 0.0007
Sedation for delayed block	0%	11%	p < 0.005
Duration of sensitive block (min)	960 ± 310	1130 ± 470	p < 0.006
Duration of motor block (min)	925 ± 240	1055 ± 230	p < 0.006
Success rate	98.6%	96.4%	NS

TN = tibial nerve. CPN = common peroneal nerve.

Conclusion: The PSB, when compared to LPSB, is easier to perform, allows a quicker start of surgery without sedation but shows a shorter duration of action.

References:

- 1 Labat G. Regional Anesthesia. Philadelphia, WB Saunders, 1922, pp 286–91.
- 2 Fournier R, Weber A, Gamulin Z. *Anesthesiology* 2001; 95: A919.

A-456

The incidence of back pain after lumbar epidural anaesthesia in ambulatory patients: comparison of two different needle sizes

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Background and Goal: Low back pain is often reported after epidural anaesthesia. Needle trauma is thought to be one of the suggested mechanisms (1), however there are studies that disagree (2). The effect of the size of the epidural needle on the incidence of low back pain in ambulatory patients was evaluated.

Material and Methods: We studied 372 ambulatory patients ASA I–II, aged 22–70 years old undergoing lumbar epidural anaesthesia (levobupivacaine 0.5%). Patients were assigned randomly to one of the two following groups: group-16 (n = 185) and group-18 (n = 187) in which epidural needle Tuohy 16G and 18G was used respectively. Epidural puncture was performed by median approach (lateral position, L4/5 or L3/4 interspace). Standard monitoring was used. All patients were mobilised 6–7 hrs after operation. We recorded the number of epidural puncture attempts and the occurrence and duration of backache in the patients. All patients were followed up for one month. In the case of backache mild analgesics and NSAID's were prescribed together with rest. Statistical analysis was achieved by using chi-square test and ANOVA-one way. Significant difference accounted for p < 0.05.

Results and Discussion: Both groups were comparable. There was no difference in the number of epidural attempts in the total number of patients (group-16: 2 ± 0.7, group-18: 1.7 ± 0.6). The incidence of low back pain was significantly higher (p < 0.05) in group-16 (12%) versus group-18 (4.5%). The number of epidural attempts in patients suffering from backache didn't differ between the two groups (group-16: 2.25 ± 1, group-18: 2 ± 1). The back pain appeared between 2nd and 5th day after the epidural technique and its duration was higher in group-16 (10.5 ± 3 days) than in group-18 (8 ± 2 days), difference 18% (p < 0.05).

Conclusions: From the above results we conclude that the size of the epidural needle plays an important role in the percentage and duration of back pain possibly due to the more intense trauma caused by it.

References:

- 1 Gentili ME. *Cah Anesthesiol.* 1994;42:247–255
- 2 Chan ST. *Med J Malaysia.* 1995;50:241–245

A-457

Topical anesthesia or paravulbar block for ambulatory cataract surgery

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Background and Goal of the Study: The choice of local anesthesia for cataract surgery depends on estimation whether the patients are capable to be cooperative during surgery. We compared preoperative estimation and intraoperative behavior of patients scheduled for topical anesthesia or paravulbar block (PBB).

Material and Methods: Single center prospective study of 736 consecutive patients underwent topical anesthesia (4 times local anesthetic before

surgery) or PBB (2 needles injection) with premedication (midazolam i.v. 0.5–2 mg) and with/without propofol conscious sedation. Investigated parameters were objective – anesthesia efficacy and safety and subjective – surgeon/patient' satisfaction. Statistical method was chi square test.

Results: Out of 736 patients, ages 53–99 (x = 73), ASA I (16%), II (62%) III (22%), 155 pts (21%) were operated in topical anesthesia and 581 pts (79%) in PBB. Distribution frequencies of patients with different ASA score were similar in both groups.

Parameters	Topical	PBB	p
Preoperative extreme anxiety	12 (8%)	66 (11%)	0.124 n.s.
Noncooperative pts:			
Eye movement/partial akinesia	43 (28%)	50 (8%)	0.000
Incomplete anesth (initial)	/	18 (3%)	
Supplemental PBB	4 (3%)	13 (2%)	
Without propofol	29 (19%)	138 (23%)	0.213 n.s.
Surgeon' satisfaction	112 (78%)	48 (95%)	0.000
Patient' satisfaction	150 (97%)	580 (99%)	0.000
Anesthesia complications:			
Palpebra hematoma	/	7 (1.2%)	
Conjunctiva hemosis	/	17 (3%)	
Transitory vertical diplopia	/	1 (0.1%)	
Transitory amaurosis	/	2 (0.2%)	

Conclusion: Efficacy and safety (a few local PBB transitory complications) were excellent with both techniques; preoperative estimation of patients' cooperation during surgery was inadequate in 28%; surgeon' and patient' satisfaction was better with BPB.

A-458

Interadductor approach to Obturator Nerve Block in transurethral bladder surgery – a review of 32 cases

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Background and Goal of Study: The Obturator Reflex (violent adductor contractions induced by the electroresectoscope) is a common phenomenon during transurethral resection of bladder tumors, often leading to bladder perforation, abdominal hemorrhage and incomplete tumor resection (1). Obturator Nerve Block (ONB), in combination with spinal or general anesthesia (GA), is referred as the best way to eliminate the obturator reflex (2).

The Interadductor Approach (IA) to this technique is assessed.

Materials and Methods: 32 patients, age 63 ± 13 yrs, ASA II and III, scheduled for transurethral resection of bladder tumors under spinal and GA, received an ONB during surgery, due to persistent obturator reflex. The IA to the Obturator Nerve and a local anesthetic (LA) solution of 2% lignocaine with epinephrine where used.

Induction time (from the administration the LA to elimination of adductor contractions), effectiveness (total absence or persistence of contractions after the block), recovery time (time to total adductor recovery), signs of systemic toxicity and complications where registered.

A concise full multimedia description of the technique will also be displayed.

Results and Discussions: Main data is summarized in the table:

	Spinal n = 25	GA n = 7
Block induction time	7 mints + 1.5	9 mints + 1.5
Effectiveness	96% (1 failure)	100%

No complications occurred

Conclusion(s): The ONB trough the IA is an easy, reliable and safe way to eliminate the obturator reflex improving surgical conditions and reducing morbidity. The use of a Nerve Stimulator and the IA allows better accuracy and the use of smaller volumes of LA on performing this block, with no need to reposition the patient during surgery.

References:

- 1 Rubial Alvarez M et al. *Actas Urol Esp* 1989 Mar–Apr; 13(2): 79–81.
- 2 Ong EL et al. *Ann Acad Med Singapore* 2000 Mar; 29(2): 259–62.

A-459

Ultrasound-guided infraclavicular block is more rapidly performed but less complete than ultrasound-guided supraclavicular block

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Background and Goal of Study: This prospective study compared ultrasound-guided infraclavicular block and ultrasound-guided supraclavicular

block for speed of execution and quality of block. It was hypothesized that the infraclavicular approach would have shorter execution times while maintaining a quality of block similar to that of the supraclavicular approach.

Materials and Methods: Eighty patients were randomized into two groups of forty; group I (infraclavicular) and group S (supraclavicular). All blocks were performed using ultrasound for recognition of the plexus and neurostimulation for confirmation of correct needle position. Anesthetic mixture consisted of bupivacaine 0.5% and lidocaine hydrochloride 2% (1:3 vol) with epinephrine 1:200 000. The onset and quality of sensory block for the musculocutaneous, median, radial and ulnar nerves were evaluated using a visual analogue scale over a 30 min period.

Results and Discussions: At 30 min, 80% of patients in group I and 95% of patients in group S had a partial or complete block of all nerve territories ($p = 0.05$). Surgical anesthesia without supplementation was achieved in 80% of patients in group I compared to 87% in group S ($p = 0.39$); no patient in either group underwent general anesthesia. The quality of radial block at 30 min was significantly inferior in group I (0.82) compared to group S (0.97; $p = 0.01$). Radial block quality was significantly different when the first 20 patients of each group were compared (I: 0.77 vs S: 0.99; $p = 0.02$), but not in the last 20 patients of each group (I: 0.88 vs S: 0.96; $p = 0.15$). When supplementation rates were compared for individual territories, a significant difference was found only for the radial sensory territory: 18% in group I vs 0% in group S ($p = 0.006$). Overall execution times were not different between the two groups (4.0 min in group I vs 4.65 min in group S; $p = 0.43$). Execution times were significantly shorter in the last 20 patients of group I vs group S (2.35 min vs. 3.7 min respectively; $p = 0.02$). No major complication occurred in either group.

Conclusion(s): We conclude that ultrasound-guided infraclavicular block is more rapidly performed but does not cover the radial sensory territory as well as supraclavicular block.

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Painful paresthesias are associated with motor response at low amperage during peripheral blocks

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Background and Goal of Study: Paresthesia during locoregional procedures is associated with neurological sequelae.¹ Pediatric patients are usually unable to report paresthesias. The safety of peripheral nerve blocks performed with the aid of an electroneurostimulator (ENS) has been recently challenged because a high incidence of paresthesia without motor response has been observed.^{2,3} We investigated whether the presence of paresthesia during peripheral blocks may be associated with a motor response persisting at a very low electrical output (0.15 mA).

Materials and Methods: Consented adult un sedated patients undergoing upper or lower limb surgery were enrolled. Insulated needles were used as negative electrodes. ENS parameters were: square wave current, impulse frequency 2 Hz and duration 0.3 msec, 1 mA searching output. Paresthesias reported as painful or bothersome were noted. The presence of a motor response was tested at 0.5 and 0.15 mA. In case of paresthesia or persistence of muscle twitch at 0.15 mA, the needle was redirected. Results were defined as true positive when paresthesia was reported and a twitch persisted, true negative when there was no paresthesia and disappearance of twitch at 0.15 mA. Sensibility, specificity, positive and negative predictive values (PPV, NPV) were computed.

Results and Discussions: 117 nerves were identified in 22 patients. A painful paresthesia was reported during identification of 23/117 nerves (19.7%). All paresthesias were associated with persistence of motor response at 0.15 mA. In 8/117 (6.8%) cases persistence of twitch without paresthesia was observed. Persistence of twitch was associated with a painful paresthesia with a 100% sensibility, 91% specificity, PPV 74% and NPV 100%.

Conclusion(s): When performing a block on patients unable to report paresthesia, the identification of a twitch persisting at low output (0.15 mA) suggests that a paresthesia may be present and therefore the needle should be redirected; a twitch confirmed at 0.5 mA and disappearing at 0.15 mA may be considered safe.

References:

- 1 Auroy. *Anesthesiology* 1997; 87:479–86.
- 2 Urmey. *Anesthesiology* 2002; 96:552–4.
- 3 Mulroy. *Anesth Analg* 2002; 95:762–3.

A-461

Ultrasound-guided lumbar facet nerve block: high accuracy of a new technique confirmed by CT-scan control

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Background and Goal of Study: Lumbar facet nerve block for pain relief in facet joint mediated pain is currently performed under fluoroscopic or CT-scan guidance to ensure success and to avoid complications (1). This implies X-ray exposure and possible restrictions due to the availability of expensive and immobile imaging devices. To overcome these problems, we recently developed an ultrasound-guided approach for lumbar facet nerve block (2). In this imaging study we tested the accuracy of our technique in 5 human cadavers at the levels L1–5 with CT control.

Materials and Methods: According to our previously described technique (2), a total of 50 needles were placed under real-time ultrasonographic guidance with a 5 MHz curved array transducer (Sonoline VersaPlus; Siemens). Then, axial transverse CT scans (Synergy; GE Medical Systems) were obtained to trace the inserted needles on 1 mm slices, before and after the application of 1 ml of undiluted contrast dye. CT scans were evaluated by a radiologist.

Results and Discussions: In 46/50 approaches, the needle tips were placed successfully at the target site, previously defined as the bottom of the groove between the lateral surface of the superior articular process and the cephalad margin of the respective transverse process. In the remaining 4 cases, the needle tips were located on the lateral surface of the superior articular process three times and once on the posterior surface of the transverse process, always closer than 5 mm to the target site. Moreover, 48 out of 50 cases showed a local distribution of contrast dye within the target site, indicative of a successfully performed block.

Conclusion(s): These data confirm high accuracy and support the clinical relevance of our new methodology. Ultrasound guidance in lumbar facet nerve block can help to significantly increase practicability while eliminating X-ray exposure.

References:

- 1 Dreyfuss P. *Spine* 1997; 22: 895–902.
- 2 Greher M. *Anesthesiology* 2004; in press.

A-462

Effect of sitting position on the incidence of vasovagal syncope during awake upper limb surgery under interscalene brachial plexus block

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Background and Goal of Study: Vasovagal episodes (hypotension, bradycardia or symptomatic) have been reported in up to 42% of patients during shoulder surgery in the awake sitting position [1,2]. The aim was to quantify the effect of the sitting position and other factors on the incidence and severity of syncope.

Materials and Methods: Data were collected prospectively on 200 consecutive patients undergoing awake shoulder surgery in the erect sitting position (interscalene with superficial cervical plexus block) and 27 patients undergoing awake upper limb surgery in the supine or lateral positions (interscalene with intercostobrachial block). Levobupivacaine and lidocaine in 1:400,000 epinephrine were used. Data are shown as mean (SD) and count with $P < 0.05$ as significant.

Results and Discussion: Successful blocks occurred in 97% of procedures. Patients were younger ($P = 0.0024$) in the sitting group. Syncopal episodes ($P < 0.0001$) were significantly more frequent in the sitting position (see Table). Severity of syncope was significantly associated with younger age ($P < 0.0001$), male gender ($P = 0.012$) and Horner's syndrome ($P = 0.036$).

Variable/syncope	Sitting	Supine/lateral
Age (years)	48.8 (17.1)	59.4 (14.8)
Weight (kg)	77.9 (11.9)	75 (21.1)
Levobupivacaine (mg)	223.8 (27.5)	214.8 (33.4)
Lidocaine (mg)	252.3 (50.1)	237.0 (49.2)
No syncope	104	26
Symptomatic alone	30	0
Haemodynamic	61	1

Conclusions: We report a significantly higher incidence ($P < 0.0001$) of vasovagal episodes in the sitting position in patients having similar doses of local anaesthetic drugs for upper limb surgery. The relative risk is 8.4 (95% CI 1.7 to 48.0, $P = 0.0022$) for syncope in the sitting position.

References:

- 1 Maguire S, Columb MO. *Eur J Anaesth* 2000; 19 (suppl 24): A401.
- 2 Kinsella SM, Tuckey JP. *Br J Anaesth* 2001; 86: 859–68.

A-463**A comparison of brachial plexus block by posterior approach with interscalene block in patients with end stage kidney insufficiency**

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Background and Goals: When repeated attempts to identify brachial plexus fail or when none of the commonly used approaches cannot be used, search for new approach to the plexus seems fully justifiable. The authors compare posterior approach [1] to brachial plexus with interscalene block in patients with end stage kidney insufficiency for surgical formation of arteriovenous fistula.

Materials and Methods: In a seating position (group I) the space between process C5 and C6 was identified and the needle insertion point was marked 3 cm laterally from the upper edge of spinous process C6. The needle was inserted perpendicularly to skin deep enough to contact the transverse process of vertebra C6. Next, the needle was withdrawn a few millimetres and directed cranially to bypass the transverse process C6. Stimulator was switched on and current was applied with intensity 0.5–1.8 mA, $f = 1$ Hz. After paraesthesiae covering the shoulder, forearm, and fingers was obtained, the current intensity was decreased, the final position of the needle determined, and after aspiration, a local anaesthesia agent was administered. The analgesia area was compared with second group (interscalene block) after application of 25 ml 0.5% levobupivacaine solution.

Results: In the first group (posterior approach) the analgesia area covering the range of median radial and ulnar nerves was obtained in 10/15 pts (75%). In the second group (interscalene block) the same analgesia area was obtained in 14/15 pts (93%).

Brachial plexus block	No of pts	Analgesia C4–C7	Analgesia C4–Th1
Posterior approach	15	5	10
Interscalene block	15	1	14

Conclusion: The relative high distribution of a block performed by posterior approach was proved in patients with end stage kidney insufficiency, but higher distribution of analgesia was obtained by interscalene technique.

Reference:

- 1 Jack NTM *Ned Tijdschr Anesthesiol* 1998; 11: 50–52.

A-464**Brachial plexus anesthesia for pediatric patient, an alternative for one day surgery**

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Background and Goal of Study: Anesthesia for “one day surgery” represents a challenge in terms of short duration, low rate of complications and good postoperative analgesia. We analyzed the efficiencies of brachial plexus anesthesia by axillary or interscalene route for children underwent upper limb surgery.

Materials and Methods: After informed consent of parents we performed a brachial plexus for 69 children with orthopedic pathology of the upper limb. Under sedation with midazolam (0.05 mg/kg) or light anesthesia with propofol (2.5–3 mg/kg), we localized the brachial plexus using Stimuplex® (Braun) and administered ropivacaine 0.75% (3 mg/kg) combined with lidocaine 0.5% (3–5 mg/kg), willing to achieve a critical volume. We measured the onset time, the quality of sensitive and motor block, the duration of analgesia (until first pain recollection) and any adverse effect. Dates were statistically analyzed and result expressed as mean \pm SD and percent. For correlation we used Pearson's r and “ $p < 0.05$ ” was considered significantly statistic.

Results and Discussions:

Boys	50 (72.4%)
Girls	19 (27.5%)
Age	9.84 \pm 3.96 (0.40–17 years)
Interscalene	7 (10.1%)
Axillary	62 (89.8%)
Onset	17.99 \pm 4.59
Motor block	Good (85.2%)
Sensitive block	Very good (92.7%)
Duration of analgesia	541 \pm 144.79
Failure	4 (5.80%)

There was a strong positive correlation between age and duration of analgesia ($r = 0.695$, $p < 0.0001$), probably due to higher quantity of ropivacaine reported to higher body weight. There was no important adverse effect.

Conclusion(s): Brachial plexus anesthesia represents a very good alternative to general anesthesia for “one day surgery” in pediatric patients with orthopedic pathology of upper limb. Using peripheral nerve stimulator the success rate is very good and the technique becomes safe.

A-465**Local anaesthesia administration by Non-Anaesthetists outside the operating suite**

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Background and Goal of study: Local anaesthesia is widely used in procedures performed, outside the conventional operating suite, namely day theatre, wards, emergency room and outpatient departments. In the majority of cases, they are carried out by Non-Anaesthetists, mainly Surgeons, and Physicians. In our study, we set out to study the extent of such practices, and assess the training and knowledge base of clinicians involved.

Materials and Methods: We circulated a questionnaire to all non-anaesthetic residents, involved in the administration of local anaesthesia in a number of training hospitals. The questionnaire include demographic details, training issues, and a detailed portion on the basic physiology and pharmacology of local anaesthesia.

Results and Discussion: 80 questionnaires out of a total of 120 were returned. Most participants were between 3–5 years post qualification 90% of participants used only local skin infiltration. Plastic surgeons were the likeliest to perform more complex blocks. Although most procedures were performed in the presence of an assistant, <50% of procedures were carried out using appropriate monitoring, only 30% with $O_2 < 30\%$ were ACLS trained, and >40% were unaware of the location of the resuscitation trolley in their operative location. The basic physiology/pharmacology section revealed poor basic knowledge, and more alarmingly lack of knowledge of their toxic doses of local anaesthetic agents.

Conclusions: Local anaesthesia is not without risk [1]. Current recommendations include appropriate monitoring and adequate training in resuscitative techniques by practitioners [2]. This study illustrates such standards are often lacking.

References:

- 1 D'Ecarno EM. *J Oro/Maxillofac Surg* 2003 July; 61(7): 793–800.
- 2 Marten TJ. *Clin Plast Surg* 1991 Oct; 18(4): 877–879.

A-466**Evaluation of paravertebral nerve blockade (PVB), as an element of anaesthesia and postoperative analgesia for different types of surgical procedures, concerning organs with unilateral nerve supply**

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Background and Goal of Study: The unilateral motor, sensory and sympathetic blockade, as well as its regional anaesthetic effect, makes PVB recently more popular for surgical procedures on organs with unilateral innervation.

The goal was to evaluate usefulness of PVB during anaesthesia and postoperative analgesia for operations, concerning organs in the thorax and abdominal cavity related to unilateral innervation.

Material and Method: 60 patients who have been classified for breast surgery, cholecystectomy and nephrectomy, received classical PVB before general anaesthesia was applied. This was done on different levels of the thoracic vertebra, respectively T3, T6 and T8. A perifix set was used (B.Braun). Identification of paravertebral space (PVS) was done on the basis of loss of resistance. A catheter was placed in the PVS 2–3 cm cephal. During 15 min, 30 ml of 0.5% bupivacaine with adrenaline in fractionation dose were applied. The anaesthetic range was tested on the basis of temperature, than GA was performed. After the operation patients received infusion of 0.25% bupivacaine with velocity of 7–9 ml/h to the epidural catheter placed in PVS. The opioids were given only if the analgesic effect was not sufficient.

The efficiency of PVB during and after the operation was judged by the need of opioids. The control group were patients with GA for the same type of operation.

Results and Discussions: The efficiency of PVB was 85%. The obtained range of sensory block was respectively T2 (± 1) to T6 (± 1) for T3 level, T4–T10 (± 1) for T6 and T6–T12 (± 1) for T8. During the surgical procedures in this study, it was apparent that patients required less opioid substances by 50–67% in comparison to the control group for each kind of operation.

85% of the patients in the study were PVB was effective and bupivacaine infusion was used, did not require additional opioids.

Conclusions: 1. PVB gives adequate analgesia during the surgical procedures and postoperative analgesia. 2. The use of PVB allows a drastic reduction in opioid analgesia required for thoracic and abdominal surgical procedures.

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Does lumbar plexus blockade provide less blood loss and better analgesia after total hip replacement surgery?

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Background and Goal of Study: Central regional techniques are known to decrease blood loss during and after total hip replacement operations (THR) as well as providing a high quality of postoperative analgesia. We compared the effects of peripheral plexus blockade with central regional analgesia techniques in THR operations under general anaesthesia.

Materials and Methods: Forty-five ASA I–II patients assigned for THR were enrolled randomly and in equal numbers into one of the 3 groups; Group LPB had lumbar plexus catheterization on the side of operation and received 0.025% bupivacaine 0.4 ml/kg before general anaesthesia. Group GA + E had epidural catheterization and received 0.025% bupivacaine 2 ml/segment until the level of T₁₀ before general anaesthesia. Group GA received standard general anaesthesia. During the operation blood loss, hemodynamic variables, after the operation morphine consumption, pain scores and blood loss were recorded.

Results and Discussions: Blood loss during the operation was the lesser in group LPB than group GA + E, and both were lesser than group GA ($p < 0.05$). Postoperative morphine consumption was lower in group LBP ($p < 0.05$). Time to first analgesic requirement was longest in group LBP ($p < 0.05$). Epidural spread of local anaesthetic were observed in 2 patients in group LPB.

Decreased blood loss and rapid painless recovery are the main advantages of combining regional analgesia with general anaesthesia during THR operations. Mostly epidural analgesia is preferred for this indication. In contrast to epidural block, peripheral plexus blocks constitute limited unilateral sympathectomy, enough to provide decreased blood loss and maintain sufficient postoperative analgesia.

Conclusion(s): Lumbar plexus blockade provides better postoperative analgesia, less blood loss than epidural analgesia during THR operations under general anaesthesia. As peripheral techniques are more easier to perform and have lower complication rates, they may be better alternative to central regional techniques to decrease blood loss and postoperative analgesia.

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Continuous thoracic epidural analgesia compared with intravenous analgesia for postoperative pain management of breast reconstruction with free TRAM flap

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Background and Goals of Study: Epidural analgesia provides better postoperative pain relief and recovery after major surgery in comparison with intravenous opioid analgesia. There are little data about the influence of epidural analgesia on the flap survival.

Material and Methods: After obtaining local Ethic committee approval and informed consent from the patients, 52 patients ASA I–III, were prospectively randomized in two groups: GA (27), who received PCIA with piritramid and TEA (25), who received PCEA with 0,15% ropivacaine for postoperative pain treatment. All patients were operated under general anaesthesia and by the same surgeon. In the TEA group epidural catheter was inserted prior surgery at Th 8–9 and 10 to 15 ml 0,2% ropivacaine and 2 mg of morphine were injected, then a continuous infusion of 0,15% ropivacaine at 6–8 ml/h was set to maintain analgesia during surgery and 48 hours postoperatively. In the GA group postoperative analgesia was provided with piritramid at 2 mg/h. Pain intensity, assessed by VAS, side effects, surgical complications (revisions and flap failure) and patients' satisfaction were compared between both groups. Statistical analysis was performed with SPSS 11.0 software package for Windows. Continuous data were analyzed with the unpaired Student's t-test and chi-square test for 2 × 2 contingency tables was applied. $p < 0,05$ was considered statistically significant.

Results: There were no differences in demographic data, incidence of side effects and pain intensity (except on the day of surgery, when it was lower in the TEA group $p = 0,05$). Patients from the TEA group recovered quicker from surgery ($p = 0,01$). There were less surgical complications in the TEA group and better flap survival ($p = 0,02$). Patients' satisfaction was overall better in the TEA group ($p < 0,001$).

Conclusions: PCEA with 0,15% ropivacaine provides better pain relief on the day of surgery and improves patients's satisfaction with pain treatment. It is also connected with less surgical complication and results in better flap survival.

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Interscalenique blockade with nerve stimulation: effect of electrical pulse duration

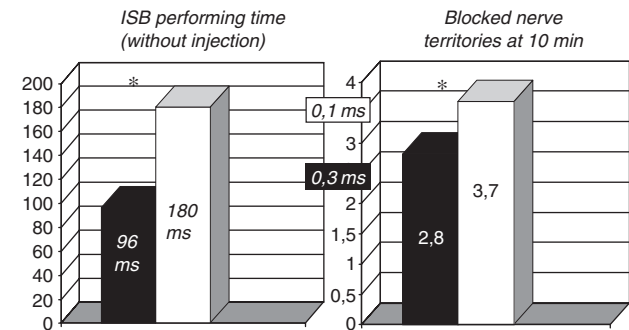
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Background and Goal of Study: Nerve stimulation has helped for peripheral locoregional anesthesia. There are still questions about the electric characteristics needed for optimal peripheral nerve stimulation during block performance. Moreover these characteristics may be different for each block. We conduct a prospective randomized study to compare 2 different pulse duration for interscalenic blockade (ISB) with nerve stimulation.

Materials and Methods: After institutional approval 46 ASA I–III patients undergoing scapular surgery were randomized to receive an ISB using either 0,3 ms or 0,1 ms for the duration of the electrical pulse stimulation. ISB was performed with a 25 mm stimplex needle and a HNS 111 Bräun nerve stimulator, using the Winnie approach. In both groups the intensity of the stimulating current initially set to deliver 2 mA was gradually decreased to 0,5 mA while maintaining appropriate motor response to stimulation. At this point, 20-ml ropivacaine 7,5 mg/ml were slowly injected. Parametric data, anesthesiologist experience with ISB, block performance duration, blocked nerve territories and ISB morbidity were recorded.

Results and Discussions: There was no difference between groups for patient ages, anesthesiologist experience with ISB and ISB morbidity. Circumflex nerve territory was blocked in 100% of patients. Others results are shown in figures:



Conclusion: When the current intensity is the same, increasing the duration of the stimulation pulse increases the current delivery. ISB performance is faster but it seems that anesthesia of nerve territories other than circumflex is less reliable.

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Factors related to patient acceptance of regional anesthesia

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Background and Goals: Regional anesthesia (RA) has been shown to improve the clinically oriented outcome. The goal of this study was to evaluate factors that contribute to patient's decision of having a RA.

Material and Methods: This prospective study was conducted on 651 patients (pts) undergoing a surgery which could be performed under general anesthesia (GA) or RA as spinal (R) or peripheral nerve block (PNB). Pts choose willingly R in 62%, PNB in 17% and GA in 21%. Preoperative anxiety (0–10), predictable pain related to the surgery, history of GA or RA received in the past and the facility to accept a RA (easily, after explanation or accepted with difficulty) were measured preoperatively. Use of sedation and intraoperative success of RA (1–4) were noted. Postoperative pain score (1–4) and satisfaction (S) (0–100) were evaluated at days 1 and 15. Finally pts were asked about the anesthesia they would choose for a similar surgery in the future. Statistical analysis were made with the tests of Mann-Whitney, Kruskal-Wallis and Chi².

Results: The patients mean age was 47 years (13–88) with a sex ratio (F/M) of 0.79. Acceptance of RA was independent of age, sex and predictable

pain. It was related to a low level of preoperative anxiety ($p = 0.000$). RA was easily accepted in 84% and only after explanation in 11%. The mean S was 94% on day 1 and 91% on day 15, but S was higher after RA than GA at day 15 ($p = 0.001$). Acceptance to receive a RA in the future was correlated to an adequate postoperative analgesia, a high level of S and to the success of RA ($p = 0.000$), but it was not related to the use of sedation before RA. The type of anesthesia received in the past contributes significantly with the patient's decision of having a RA in the future. After R or PNB, 90% and 83% respectively will choose RA at day 1 and 74% and 83% at day 15. After GA, 65% at day 1 and 57% at day 15 will choose GA in the future.

Conclusion: Improvement in clinical skill, a better control of anxiety, a good management of postoperative pain and a high level of S would improve the acceptance of RA.

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Assessment of a continuous subclavicular brachial plexus block for shoulder analgesia after open rotator cuff repair

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Background: The aim of this study was to compare the efficiency of a continuous subclavicular block for 48 hours to an intravenous patient-controlled analgesia (PCA) with morphine, for managing postoperative pain after open rotator cuff repair.

Methods: Thirty patients, ASA 1 to 2, scheduled for open rotator cuff repair were prospectively randomized to receive in postoperative period either PCA morphine (group M) or a continuous subclavicular block associated to a PCA morphine (group KT). All patients received general anaesthesia. The puncture for the subclavicular block was performed 1 cm inside the coracoid process and 1 cm under the clavicle, the needle pointed towards in a cephalic direction and looking for a deltoid response. All catheters were controlled on a pulmonary X-ray examination. 30 ml of ropivacaine 0.75% was used for analgesia induction, then ropivacaine 0.2% was delivered with an elastomeric pump at 7 ml/h. Pain relief was regularly assessed using a visual analog scale, morphine doses, patient satisfaction and complications were analysed using Mann-Whitney test or Chi² test.

Results: Both groups ($M = 14$, $KT = 16$) were comparable with regard to demographic and surgical data. Pain relief was significantly better controlled in the KT group till the 36-h ($p < 0.05$). Morphine doses were significantly reduced in the KT group from the 2-h to the 48-h ($p = 0.0002$). Patient satisfaction was greater in the KT group ($p = 0.0025$). No specific complications to subclavicular block were noted.

Conclusion: The 48-h continuous subclavicular block seems to be effective to manage postoperative pain after open rotator cuff repair. It could be an interesting alternative to the interscalene block. Nevertheless, the potential complications of the subclavicular block should be assessed on a greater sample.

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An analysis of the effectiveness and blood pressure stability of nurse controlled epidural top ups in post operative surgical patients

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Background and Goal of Study: Hypotension is a side effect of epidural analgesia in up to 52% of patients post laparotomy (1). The goal of our study was to assess the effectiveness of analgesia and incidence of hypotension nurse controlled epidural top ups.

Materials and Methods: 88 patients with working epidurals were audited. Epidural blockade was established with 0.25% or 0.5% bupivacaine. 43 patients had epidural diamorphine (1–3 mg). An epidural infusion was commenced with 0.125% bupivacaine with diamorphine 0.04 mg/ml. Post surgery the epidural pump was programmed with a bolus facility (5 ml bolus, 60 minutes lockout) to be given by a nurse as required. The blood pressure was monitored every 5 minutes for 20 minutes. Effectiveness of analgesia was assessed by a 6-point verbal rating score, taken prior to, and 20 minutes after a nurse controlled top up. Data were analysed using the paired t-test or Wilcoxon sign rank test.

Results and Discussions: 88 patients with working epidurals (61 thoracic, 27 lumbar) were studied. The mean age of the patients was 63.6 ± 14.8 years. The mean duration of epidural infusion was 67.7 ± 21.6 hours. Top ups resulted in a fall in the verbal rated pain score in 162 (79.4%) of top ups ($P < 0.001$). Compared with pre operative values, 66 patients (75%) had a

greater than 20% drop in systolic blood pressure (136.5 ± 22.7 vs. 97.7 ± 14.6 mmHg. $P < 0.001$, CI 33.6, 44.1). There were 216 nurse controlled top ups in 41 patients. Comparing the pre top up (129.4 ± 21.9 mmHg) to the lowest systolic blood pressure in the 20 minutes post top up (120.9 ± 20.8 mmHg), there was a mean drop of 8.6 mmHg ($P < 0.001$, CI 7, 10.1).

Conclusion(s): The nurse controlled epidural top ups proved effective in reducing pain. The nurse controlled top ups caused a significant drop in systolic blood pressure although this is of questionable clinical significance.

Reference:

- 1 A Comparison of Epidural Ropivacaine Infusion Alone and in Combination with 1, 2, and 4 μ g/mL Fentanyl for Seventy-Two Hours of Postoperative Analgesia After Major Abdominal Surgery. Scott, DA, Blake D, Buckland MMB et al. *Anesth Analg* 1999; 88(4): 857–864.

A-473

Epidural analgesia is safe for selective embolization in patients with carcinoid metastases

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Background and Goal of Study: Carcinoid tumours often produce vasoactive amines that lead to carcinoid syndrome, especially when multiple liver metastases are present. Selective embolization of hepatic arteries leads to destruction of these metastases, sparing the hepatocytes which are mainly supplied by the portal system. This angiographic procedure can be done with local anesthetics, but patients often experience much pain due to swelling of the liver after tumour necrosis occurs. From 2000 onward we decided to offer these patients epidural analgesia, even though experts advise against regional anesthesia in these patients for fear of hemodynamic instability.

Aim was to study if pain was adequately and safely treated with epidural analgesia during and after this procedure. Furthermore we monitored these patients for possible hemodynamic instability or other complications.

Materials and Methods: From April 2000 until November of this year 21 patients were treated with selective liver embolization because of carcinoid metastases. One hour prior to the procedure we placed a thoracic epidural catheter through which was given 25 mcg sufentanil and 40–75 mg bupivacain, and 100 mcg octreotide was given iv to block the somatostatin receptors. EKG, SpO₂, HR and NIBP were monitored. After embolization all patients were observed in the PACU for at least 180 minutes. Epidural analgesia was continued with a mix of 250 mg bupivacain, 10 mg morphine and 500 ml NaCl 0.9%, at 16–20 ml/hr, for at least 3 days. Intravenous octreotide was continued for 48 hours after embolization.

Results: No hemodynamic instability occurred. All patients could return to the ward without admission to the ICU. Pain control during and after the procedure was scored by the patients as sufficient (6) or good (15). There were no complications.

Conclusion: We conclude that epidural analgesia is a safe and effective technique for patients with carcinoid metastases undergoing selective liver embolization.

References:

- Gupta S, et al. *Cancer J* 2003; 9: 261–7.
- Zimmer C, et al. *Anesthesiology* 2003; 98: 1007–11.

A-474

Infiltration of ropivacaine for TVT procedure in the treatment of urinary incontinence.

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Background and Goal of Study: TVT (tension-free vaginal tape) procedure is one of the treatments of urinary incontinence. The advantage of using this technique under local anesthesia (LA) is the absence of motor block permitting a better placement and tension of tapes during surgery. Another advantage is the active participation of the patient to obtain less urinary leaks were compared to general anesthesia or to spinal anesthesia (1). The purpose of this study is to evaluate efficiency and tolerance of this LA as well as the needs of associated intravenous sedation.

Materials and Methods: In this retrospective study, we studied all the patients ($n = 17$) having treated with TVT procedure under LA during a period of 15 months. LA's protocol was the following one: 115 mL of Ropivacaine 0.173% (total of 200 mg) with 0.5 mg epinephrine was infiltrated at the level of 5 sites by the same operator. The parameters studied were: need of sedation, unwanted effects or complication per and postoperative.

Results: 17 patients (age 58.5 ± 10.7 yrs) and weighing 61.3 ± 9.8 kg were included. These patients received on average 3.3 ± 0.5 mg by kg from Ropivacaine weighty.

No patient required general anesthesia because of ineffectiveness of LA, 4 patients received no sedation. The sedation remained moderate.

Table. Consumption of sedative agents during surgery.

N = 17	Midazolam (mg)	Propofol (mg)	Sufentanil (μ g)
Mean \pm EC	0.3 ± 0.5	38 ± 48	4.6 ± 5.0

No systemic complication relating to LA was found. Postoperative course was uneventful.

Conclusions: TVT procedure under LA using Ropivacaine 0.173% seems a sure and effective technique. There is no need for heavy sedation but light sedation is essential to improve patient's comfort.

Reference:

1 Adamiak A. *Eur Urol* 2002; 42: 29–33.

A-475

Spinal anesthesia for ambulatory urologic surgery: mini-dose lidocaine versus mini-dose bupivacaine versus conventional dose bupivacaine

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Background and Goal of Study: The incidence of transient neurological symptoms (TNS) after using clinical doses of intrathecal lidocaine stimulated the search for newer spinal anesthetic techniques. The aim of the study is to compare the quality of spinal anesthesia, the recovery profile and the incidence of side effects using low dose of lidocaine, low dose bupivacaine and traditional dose bupivacaine, all in combination with fentanyl.

Materials and Methods: The prospective, double-blinded, randomized study considered 60 patients scheduled for spinal anesthesia and lower endoscopic urological procedures, ASA I–III, randomly allocated to 3 groups. Each group of 20 patients received 25 μ g fentanyl plus 20 mg lidocaine (A), 5 mg bupivacaine (B), 12.5 mg bupivacaine (C). The criteria evaluated were: the quality of anesthesia, the times to full sensory block regression and to discharge, the episodes of hypotension and/or bradycardia requiring treatment, the incidence of secondary effects (TNS, pruritus, nausea, vomiting). The results were statistically analyzed, with a value of $p < 0.05$ considered significant.

Results and Discussions: There were no statistical differences regarding the demographic data, the type of surgery and patients characteristics. The quality of anesthesia was very good with no statistical differences, between groups. The time to full sensory block regression were significantly shorter in group A (65 ± 9 min) and in group B (112 ± 17 min) compared with group C (211 ± 29 min). The discharge times were also significantly shorter in group A (74 ± 18 min) and B (152 ± 32 min) compared with group C (285 ± 41 min). The comparison of the two criteria between group A and B showed significantly shorter times in group A. Regarding the cardiovascular abnormalities requiring treatment we have noted significant differences between group A (0%) and B (15%) compared with group C (60%). There were no significant differences between groups regarding the incidence of secondary effects, including TNS.

Conclusions: The spinal anesthesia with mini-dose local anesthetics combined with fentanyl improves the recovery profile and cardiovascular stability without decreasing the quality of anesthesia. Mini-doses of lidocaine assure significantly shorter recovery times than bupivacaine, without increasing the incidence of TNS.

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Postoperative pain therapy in children: dorsal sciatic nerve block for lower limb surgery

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Background and Goal of Study: Paediatric regional anaesthesia is used increasingly, because it offers a pain control directly at completion of surgical procedure without opioids. We investigated efficacy of the sciatic nerve block, using a dorsal approach for postoperative pain relief. A further aim was to show a possible relation between circumference of upper leg and depth of inserted needle. At the moment, there is no accepted information referring to such a correlation.

Materials and Methods: 30 children undergoing surgery of lower limb were included. Anaesthesia was induced with sevoflurane and propofol. Following tracheal intubation we performed the dorsal sciatic nerve block

injecting 1 ml/kg of 0.25% bupivacaine (bv), in case of bilateral foot surgery 0.5 ml/kg of 0.25% bv. With the child lying in the supine position hip and knee 90° flexed, heads of semimembranous and biceps femoris muscle were identified. Then the needle was inserted perpendicular to the skin and advanced until a nerve stimulator evoked a supination and spreading of toe. The time needed to perform was noted. Anaesthesia maintained with sevoflurane in oxygen and remifentanyl. Pain intensity was assessed using Visual Analogue Scale (children > 5 yrs, 0–100) and KUSS (children < 5 yrs, 0–10) at 2 h intervals. Duration of motoric blockade and administered analgesic agents as well as side-effects were noted.

Results and Discussions: Average time to perform the block was 11 min (min 8,3; max 14) in bilateral and 8,9 min (min 2; max 20,8) in unilateral surgery. There was a linear relationship between circumference of thigh and depth of inserted needle. Mean postoperative VAS scores were 17 (min 0; max 68); mean KUSS was 3,2 (min 0; max 8).

Conclusion(s): The dorsal sciatic nerve block proved to be an easy to perform and safe technique offering adequate pain relief without serious side-effects.

Reference:

1 Peutrell JM, Holder K, Gregory M. *Br J Anaesth* 1997; 78: 160–2.

A-477

Mortality, risk factors and complications in the dissection of the thoracic aorta

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Background and Goal of Study: Classic aortic dissection is a longitudinal split or partition in the media of the aorta. The mortality rate is very high and increases with a delay in diagnosis, especially for the dissection of the thoracic aorta¹. The aim of this study is to review the aortic dissections cases in our centre during the last three years.

Materials and Methods: This is a retrospective study (January 2000 to October 2003). The patients included in our study were all the patients with Stanford type A aortic dissection with surgical treatment. We achieved our data from their medical histories. We included in our research: sex, age, risk factors, stay into critical cares, complications and mortality.

Results and Discussions: 35 patients have been operated on our hospital of Stanford type A aortic dissection. The sex distribution were: 82'8% men and 17'2% women. The age's distribution was $55 \pm 13'44$ years (m \pm sd). The factors of risk found were: 54'3% hypertension, 31'4% smoking habits, 17'1% of them suffered arteriosclerosis and 8'5% of patients showed some previous type of aortic disorders. Only the 5'7% dissections were traumatic and the 2'8% of them had Marfan Syndrome. The incidence of postoperative complications were 80% of patients. Found complications were: breathing problems (40%), acute renal failure (25'7%), arrhythmias (22'8%), permanent neurologic injury (5'7%). The mean stay into critical cares was 13'6 days. Mortality reached a level of 47% (14% in surgery theatre).

Conclusion(s): The high incidence in our center of surgical dissections of aorta presents a similar population information, of development of complications and of mortality similar to the indexed ones in the literature².

References:

- 1 Ijaz A, Khan, Chandra K, Nair. Clinical, Diagnostic, and Management Perspectives of Aortic Dissection. *Chest*. Vol. 122, No. 1, July 2002.
- 2 Mateo E, Marin JP, Catalá JC y Aguar F. Morbimortalidad perioperatoria de la cirugía de la disección de aorta ascendente. *Rev Esp Anest Reanim*. Vol. 46. No. 8, 333–338.

A-478

An elective surgical procedure after heart transplantation: case report

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Introduction: Heart transplantation as a treatment for end-stage heart disease proved to be an accepted therapeutic modality. The cardiac transplant recipient may return to the operating room for another surgical procedure (1). In this study, we aimed to present the patient who underwent inguinal hernia operation after three years from the heart transplantation.

Case Report: A 55 year-old male (85 kg) presented for a right inguinal hernia repair after three years from the heart transplantation for ischemic cardiomyopathy. The patient underwent inguinal hernia repair under spinal anaesthesia. The PAP of the patient was 25 mmHg, ejection fraction was 65% with echocardiography and coronary artery and ventricular functions were also normal with angiography. Endomyocardial biopsies for graft rejection were Grade 0 (Bramingham Classification) before the surgery. The patient

has been using prednisolone, cilazapril, trimethoprim + sulfamethoxazol, calcitriol, calcium, mycophenolate mofetil, cyclosporine A for medication.

Pulse oxymetry, ECG, invasive blood pressure and heart rate (HR) were monitored. Before the administration of bupivacaine, iv isotonic NaCl infusion was started with a rate of 15 mL kg⁻¹ h⁻¹. After baseline measurements were taken, intrathecal hyperbaric bupivacaine 10 mg 0.5% were injected with spinal catheter (Spinocath, 22G, B Braun) at level L₂-L₃. Measurements of HR, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), arterial O₂ saturation (SpO₂) were taken with 5 minutes intervals for 30 min. After 30 min. measurements were taken every 15 minute. The patient breathed O₂ 5 L min⁻¹ via a facemask. The patient had no hypotension (SBP decrease greater than 30% of baseline value or SBP < 90 mmHg of MAP) and bradycardia (HR < 50 beats min⁻¹) during the procedure.

Conclusion: As a conclusion, with enough hydration and low dose local anaesthetic usage, spinal anaesthesia can be applied safely in patient undergoing elective non-cardiac surgical procedures after heart transplantation.

Reference:

- 1 Kriett A, Kaye MP. *J Heart Transplant* 1994; 13: 561-70.

A-479

The effects of ropivacaine infiltration on post-tonsillectomy pain

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Background and Goal of Study: To investigate the value of preincisional peritonsillar infiltration of ropivacaine before tonsillectomy under general anaesthesia.

Material and Methods: After institutional ethics committee approval, thirty patients aged between 7 and 15 years were recruited into the study. Patients were received standard premedication and general anaesthesia regimen which is free of opioids. Each patient was infiltrated ropivacaine 2% 4 ml with 1/200000 adrenaline solutions to the one side of peritonsillar area and 4 ml saline with 1/200000 adrenaline solution was infiltrated to the other side. Two surgeons performed the procedures using dissection technique in all cases. All adverse effects including bleeding were recorded intraoperatively and postoperatively. Postoperative pain at early and late periods (postoperative first 24 hour and 1st week later) by using VAS during rest and swallowing was evaluated. Otagia was also evaluated. Wilcoxon S Rank test, Mc Nemar test, Cochran's Q and Friedman test were used statistical analyses. P value was accepted < 0.001 for significance.

Results and Discussion: We observed that a remarkable decreases, pain scores during in rest and swallowing, in the ropivacaine side compared to the control side at the 30.min., 4., 6., 24., 72. hours postoperatively (p < 0.001). There were no differences in the otalgia and blood loss recorded between two sides.

There are numerous study with conflicting results concerning the efficacy of local anaesthetic infiltration in post-tonsillectomy pain control (1,2). In a study, Giannoni et al. was determined that infiltrations of ropivacaine with or without clonidine improves pediatric tonsillectomy pain (2).

Conclusion: Preincisional injection of ropivacaine prior to tonsillectomy improves post-tonsillectomy pain both rest and swallowing.

References:

- 1 *Clin. Otolaryngol.* 2000; 25: 413-417.
- 2 *Arch. Otolaryngol. Head Neck Surgery* 2001; 127: 1265-1270.

A-480

The comparison of the effectiveness of bupivacaine 0.375% with ropivacaine 0.75% on combined sciatic and femoral block

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Background and Goal of Study: To compare intraoperative and postoperative clinical efficiency of bupivacaine 0.375% and ropivacaine 0.75% for combined sciatic and femoral block.

Material and Methods: After approval obtained from local ethics committee, thirty ASA class I and II consenting patients undergoing lower extremity surgery were included to the study. Patients were randomly divided into two groups. In ropivacaine group (Group R, n = 15), firstly femoral block was performed by using classic Labat technique with 0.75% ropivacaine 15 ml, after than sciatic block was performed by using classic Labat technique with 0.75% ropivacaine 20 ml. In the bupivacaine group (Group B, n = 15), the same blocks was performed with the same volume bupivacaine 0.375% and same techniques.

An independent blinded observer evaluated the onset time of surgical block, time to recovery of sensory and motor function, intraoperative and postoperative supplementary analgesic consumption ANOVA, Mann-Whitney U and paired t test were used for statistical analyses. P value was considered as 0.05.

Results and Discussion: There was no statistically significant difference in the mean time to onset and quality of the block between the groups. First analgesic requirement time was significantly prolonged in Group B (p = 0.009). Total analgesic consumption in Group B was also significantly lower than the other group (p = 0.023). In addition, 13 patients in Group B and 6 patients in Group R were not required analgesic supplementation in the first 24 hours postoperatively. There were no signs of systemic local anaesthetic toxicity in any patient in either group.

Conclusion: In the previous studies, bupivacaine and ropivacaine were used in different volume and concentrations for sciatic and femoral block (1,2). No studies have compared bupivacaine 0.375% with ropivacaine 0.75% for combined sciatic and femoral block. This study demonstrated that ropivacaine 0.75% provided surgical block as effective as bupivacaine 0.375%. But, postoperative analgesic effect of bupivacaine was higher than ropivacaine.

References:

- 1 *Br J Anaesth* 2001 May;86(5): 674-7.
- 2 *Anesth Analg* 2001 Jan;92(1): 205-8.

A-481

Incidence of sudden and unexpected cardiac arrests during spinal anesthesia. A six-year survey

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Background and Goal of Study: Bradycardia and hypotension are well known side effects during central neuraxial blocks. However, life threatening cardiovascular complications like asystolic cardiac arrests may occur without forgoing signs (1), even in healthy patients. The incidence of such events is unknown; however, unfavourable outcome has been reported (2,3).

Materials and Methods: All anesthetic procedures performed from July 1996 to June 2002 were recorded with ANDOC computer system. After institutional approval records were reviewed regarding cardiac arrests during regional anesthesia. Further, ICU admissions following regional anesthesia and all anesthetic conference records were reviewed.

Results and Discussions: We performed 25,813 central neuraxial blocks in a university hospital setting among those 13,843 were spinal. There were no cardiac arrests during epidurals. During spinal anesthesia 10 cardiac arrests were observed of which 8 were related to anesthesia indicating an incidence of 5.7 per 10,000 procedures. In 2 patients cardiac arrest followed pulmonary embolism during emergency hip surgery. Onset of cardiac arrests varied from 5 to 360 min. In all patients isobaric bupivacaine was used and procedures were carried out in the sitting position. Although appropriate ASA monitors were used cardiac arrests occurred sudden and unexpected without forgoing episodes of bradycardia or hypotension. Patients were treated immediately by chest beat and atropine or ephedrine i.v. and ventilated by mask. In 4 patients cardiac massage was necessary. All patients recovered completely without neurologic deficiency. Particular risk factors associated with cardiac arrests were not detected.

Conclusion(s): Cardiac arrests may occur at any time during spinal anesthesia without any forgoing signs. Immediate and adequate treatment is essential and may result in favourable outcome (2,3). Therefore patients should be monitored carefully until remission of blocks.

References:

- 1 Pollard JB *Anesth Analg* 2001;92:252-6.
- 2 Caplan RA, Ward RJ, Posner K, et al. *Anesthesiology* 1988;68:5-11.
- 3 Auroy Y, Narchi P, Messiah A, et al. *Anesthesiology* 1997;87:479-86.

A-482

Cardiovascular effects of three different local anaesthetics used in thoracic epidurals

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Background and Goal of Study: Hypotension is a well recognized complication of epidural blockade. This may be due to sympathetic blockade and/or myocardial depressant effects of systemically absorbed local anaesthetic (LA). Anecdotally the hypotensive effects of the newer stereoisomer LAs seem to be less than racemic alternatives, which is in keeping with their lower cardiovascular toxicity. We investigated in a randomized, controlled, double blind trial the cardiovascular effects of three different LAs used for thoracic epidural analgesia.

Materials and Methods: 45 patients undergoing cardiac surgery with epidural analgesia were recruited, and randomly allocated to receive bupivacaine, levobupivacaine, or ropivacaine in their epidurals. Pre-operatively the epidural catheter was sited between T1 and T4 (median T2/3). Patients were positioned semi-recumbent, and 5 ml of a 0.5% solution of the relevant LA was injected into the catheter, with a further 5 ml after 5 minutes. Heart rate, non-invasive blood pressure, and oxygen saturation were measured at five minute intervals for 30 minutes, and block assessed every 10 minutes. Metaraminol was administered if mean BP fell more than 40% or the patient was symptomatic. The study was designed with a power of 80% to detect a clinically significant difference of 10% in 'maximum percentage fall in BP' between the groups, with an alpha error of 0.05.

Results and Discussions: Change in BP was calculated by taking the lowest recorded BP for each patient, and expressing this as the percentage fall from baseline. Analysis was by ANOVA or Kruskal-Wallis. Data are mean \pm SD or median (IQR range).

	Bupi (n = 15)	Levo (n = 15)	Ropi (n = 15)	P value
Max % fall in BP	17.7 \pm 13.4	11.1 \pm 9.7	17.1 \pm 11.0	0.23
Segments blocked	12 (10–19)	13 (11–18)	14 (11–16)	0.87
Metaraminol	1	0	2	

Conclusion(s): There is no clinical advantage of the stereoisomer LAs demonstrated in this situation. High thoracic epidural initiated with any of these LAs produces an effective block with good cardiovascular stability, and is a safe technique.

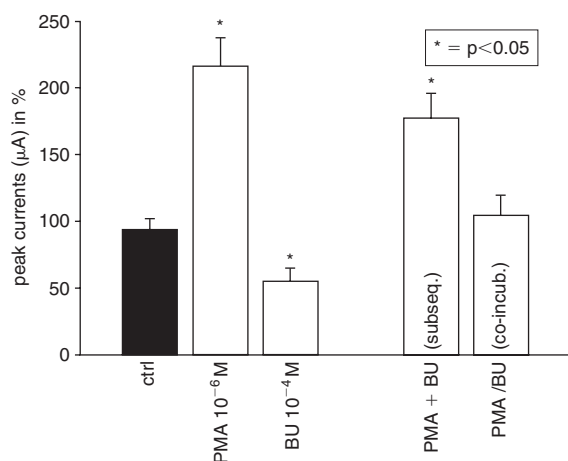
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NMDA receptor inhibition by LA is PKC dependent – bupivacaine inhibits phorbol ester mediated PKC activation

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Background and Goal of Study: Local anesthetics (LA) are effective in the treatment of chronic pain states, but mechanisms remain unclear. N-methyl-D-aspartate (NMDA) signaling is important in the development of chronic pain, and is inhibited by LA¹. This may in part explain the effectiveness of LA in chronic pain. Since (1) NMDA receptors are regulated by protein kinase C (PKC)², (2) interactions between LA and PKC have been suggested², and (3) we demonstrated that LA inhibit NMDA signaling at an intracellular site³ we determined if LA modulation of NMDA signaling is PKC dependent.



Materials and Methods: NR1A/2A NMDA receptors were expressed recombinantly in *Xenopus laevis* oocytes. Inward currents induced by glutamate/glycine (G/G, 10/10 μ M) were measured by 2-electrode voltage clamp, and are reported as μ A (mean \pm SEM). Effects of bupivacaine (BU, 100 μ M, 10 min), the PKC activator phorbol ester (PMA, 1 μ M, 5 min), and the combination of both compounds (applied consecutively or together) were determined.

Results and Discussions: Whereas G/G was without effect on uninjected oocytes, it induced consistent inward currents in oocytes expressing NMDA receptors. G/G currents were inhibited to 55% in the presence of BU. PMA activated responses to 216% of those obtained in control cells. BU did not

reverse PMA activation when added subsequently (178%) but prevented the activating effect of PMA (105%).

Conclusion(s): This strongly suggests that BU and PMA act at the same target, i.e. that BU modulates NMDA signaling by PKC inhibition. In agreement, BU can not reverse the effects of prior activation of PKC.

References:

- 1 Koppert W, Ostermeier N, Sittl R, et al. *Pain* 2000; 85: 217–24.
- 2 Do SH, Fang HY, Ham BM, et al. *Anesthesia and Analgesia* 2002; 95: 1263–83.
- 3 Hahnenkamp K, Halene T, Van Aken H, et al. *Eur J Anaesth* 2002; 19: S 189.

A-484

Postoperative pain following abdominal hysterectomy. A double-blind comparison between placebo or local anesthetic infused intraperitoneally

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Background and Goal of Study: Abdominal hysterectomy is a procedure that is associated with moderate–severe postoperative pain (1). Previous studies have used a single dose of local anesthetic into the wound at the end of the operation and found short-lasting effect (1). This double-blind study compares the infusion of levobupivacaine or placebo intraperitoneally as a method for postoperative pain relief.

Materials and Methods: Forty patients (ASA 1–2) undergoing elective abdominal hysterectomy were randomly divided into two groups: Group P received an infusion of normal saline 5 ml/h via a catheter placed intraperitoneally near the top of the vagina at the end of surgery and Group L received 0.25% levobupivacaine 12.5 mg/h (5 ml/h). Ketobemidone was administered intravenously via a patient controlled analgesia pump as rescue analgesic in all patients. The catheter was removed after 24 h. Pain was assessed after 1, 2, 3, 4, 8, 16 and 24 h at the site of incision, deep pain and pain on coughing using the visual analogue scale (VAS). Ketobemidone consumption during the period 0–72 h was recorded. Time to sit, walk, eat, drink and home discharge and plasma concentration of levobupivacaine were also determined.

Results and Discussion: Pain at the incision site, deep pain and pain on coughing were all found to be significantly less in Group L compared to Group P at 1–2 h postoperatively. Total ketobemidone consumption during the time period 4–24 h was significantly less in Group L. A lower incidence of postoperative nausea was also found during 4–24 h in Group L (Table 1).

	Group P	Group L	P-value
Ketobemidone (mg)	31.3 \pm 18.2	18.8 \pm 10.1	0.012
Nausea n = (%)	10 (50%)	3 (15%)	<0.025

Plasma concentrations of levobupivacaine were far below toxic concentrations found in humans.

Conclusion: We conclude that postoperative pain relief is significantly reduced when levobupivacaine is used as an infusion intraperitoneally following abdominal hysterectomy.

References:

- 1 Ng A, Swami A, Smith G, et al. *Anesth Analg*. 2002;95:158–62.
- 2 Hannibal K, Galatius H, Hansen A, et al. *Anesth Analg*. 1996;83:376–81.

A-486

Bupivacaine, ropivacaine or levobupivacaine to maintain continuous femoral nerve sheath block (CFB) after total hip replacement (THR)?

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Background and Goal of Study: CFB is effective to relieve pain after THR.¹ The aim of the present study was to determine which local anesthetic solution (LA) is the most appropriate to maintain such technique postoperatively.

Materials and Methods: After informed consent and with institutional approval, 90 ASA class 1–3 patients scheduled for elective THR under general anesthesia (GA) were included in this study. Before GA, CFB was performed using a standard technique.² In all patients, a 30 mL bolus dose of 0.5% LA was injected and followed, during the first 48 h, by a continuous infusion of 5 mL h⁻¹ associated with PCA boluses (2.5 mL/30 min).² of 0.125% LA. Patients were randomly divided into 3 groups of 30. Bupivacaine was used in group B, ropivacaine in group R, and levobupivacaine in group L.

Sensory (cold testing) and motor (Bromage scale) blockade was assessed in femoral nerve territory 4, 24, and 48 h after the initial injection. VAS at rest (R) and on movement (M) (0: no pain–100: severe pain) at 4, 24 and 48 h; satisfaction score (0: unsatisfied–100: completely satisfied) at 24 and 48 h; supplemental analgesia (Propacetamol (Propac) and/or Morphine (Morph)); first request of LA, Propac, and Morph; total LA consumption; PCA boluses requested; and side effects were recorded. Statistical analysis was done with ANOVA and Fischer test and χ^2 when appropriate. A p value < 0.05 was considered significant. Results are expressed as mean \pm SD.

Results and Discussions: Population data, pain scores, sensory and motor blockade, total LA consumption, PCA boluses requested, satisfaction score, and side effects were comparable in the 3 groups. When compared with groups B and L, less Propac (B: 11 ± 5 , R: 7 ± 5 , and L: 9 ± 4 g/48 h) and Morph (B: 8 ± 11 , R: 2 ± 4 , and L: 9 ± 12 mg/48 h) was required in group R. In this group, first request of LA (B: 229 ± 62 , R: 275 ± 52 , and L: 230 ± 72 min.) was later.

Conclusion(s): The 3 studied LA are efficient to maintain CFB after THR. As it is associated with less supplemental analgesia, R would be the preferred solution.

References:

- 1 Singelyn FJ, Gouverneur JM. *J Clin Anesth* 1999;11:550–4.
- 2 Singelyn FJ, Vanderelst P, Gouverneur JM. *Anesth Analg* 2001;92:455–9.

A-487

Intrathecal spread of mepivacaine, ropivacaine and levobupivacaine after epidural application in sheep

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Background and Goal of Study: The role of spinal pharmacokinetics as a basis for their pharmacodynamics has not been satisfactory elucidated for epidural anaesthesia. The aim of this study was to compare the disposition of mepivacaine (Mep), ropivacaine (Rop) and levobupivacaine (LBup) in the intrathecal and the epidural space.

Materials and Methods: With institutional approval 8 anesthetized sheep were supplied with an epidural catheter in L₂. Diagnostic microdialysis probes (CMA 20/Sweden) were prepared in the epidural(e) and the intrathecal(i) space at L₃, T₁₁, T₇ and T₃. After joint equimolar application of the 3 local anesthetics (0.3 ml/kg of 12 mM solution, resp.), samples were collected over 150 minutes in 10 minute intervals using microdialysis. The interstitial drug concentration was measured with HPLC.

Results and Discussions: The epidural application yielded high local concentrations (eL₃, eT₁₁) in contrast to the most rostral site (eT₃). The 3 local anaesthetics represented 3 different groups (Friedman Test, $p < 0.05$). Only a small proportion (<5%) of the epidural supply was found to cross the dura mater (iL₃ up to iT₃) and showed a different pattern of craniokaudal distribution. The intrathecal drug concentrations were 10-fold inferior to the halfmaximal concentrations for Na⁺ channel block as it has been described using the patch clamp method (1).

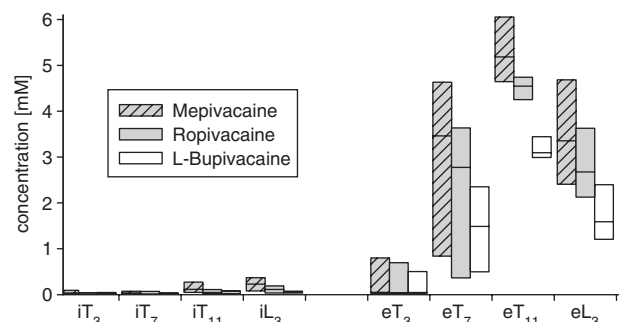


Figure 1. Sum of interstitial drug concentrations over 150 min. Boxplot displays median, lower and upper quartiles.

Conclusions: Mepivacaine, ropivacaine and levobupivacaine given for epidural anaesthesia do not cross the dura mater into the intrathecal space in relevant amounts for a Na⁺ channel block. This leaves the peripheral nerve which is not covered by the dura to be the primary effect site for the molecular action, comparable to a paravertebral block.

Reference:

- 1 Bräu EB et al. *Anesth Analg* 1998; 87: 885–889.

A-488

Thoracic epidural ropivacaine – sufentanil attenuates supraventricular tachyarrhythmias after pulmonary resection

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Background and Goal of Study: Postoperative supraventricular cardiac tachyarrhythmias (SCT) are recognized complications observed in 20 to 40% (1) after pulmonary surgery, increasing post operative morbidity and mortality. The goal of this study is to demonstrate the superiority of the thoracic epidural analgesia (TEA) on reducing the incidence of SCT.

Materials and Methods: After informed consent, 50 patients, scheduled for lung resection by posterolateral thoracotomy, were randomly assigned to general anaesthesia (group 1) or combined general/epidural anaesthesia (group 2). In group 2, TEA was inserted before general anaesthesia at level T4–T5. A continuous infusion of ropivacaine (2 mg ml^{-1}) and sufentanil (1 mcg ml^{-1}) was started during general anaesthesia and prolonged for 3 days. All patients were anesthetized with etomidate-sufentanil – cisatracurium – sevoflurane for surgical procedures. In the first group, PCA morphine is used for postoperative analgesia. ECG monitoring was performed for 3 days in ICU during the study. Data analysis included student's t test and χ^2 ($p < 0,05$ was considered significant).

Results and Discussions: Data (Mean \pm SD)

	Group 1 (N = 25)	Group 2 (N = 25)
Age	64.3 \pm 2.1	58.2 \pm 3.2
ASA	2.1 \pm 1.2	2.1 \pm 0.1
Intraoperative sufentanil (mcg)	123 \pm 1.2	40.2 \pm 4*
STA (patients)	6/25	0/25*

* $p < 0.05$

There was no difference between groups regarding demographic and operative data. Dose of intraoperative sufentanil was significantly reduced in group 2. None event of STA was observed in the epidural group.

Conclusion(s): Sympathotonic blockade by ropivacaine epidural analgesia prevent the occurrence of supraventricular cardiac tachyarrhythmias after pulmonary resection.

Reference:

- 1 Krowka MJ. *Chest* 1987; 91(4):490–5.

A-490

Effects of clonidine added to mepivacaine axillary brachial plexus block for paronychia surgery

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Background and Goal of Study: Addition of clonidine to local anaesthetics in peripheral nerve blocks has not been evaluated in the clinical setting of infected tissue surgery (1). We hypothesised that adding clonidine $100 \mu\text{g}$ to mepivacaine 1% for axillary brachial plexus blocks in patients undergoing incision and drainage of paronychia i) would decrease the sensory block onset time in the infected tissues and ii) would provide better postoperative analgesia.

Materials and Methods: Fifty nine outpatients undergoing incision and drainage of paronychia were randomly assigned to receive in a double-blinded fashion 42 ml of a mixture containing 400 mg mepivacaine plus either $100 \mu\text{g}$ clonidine (Clonidine group, $n = 30$) or 2 ml NaCl 0.9% (Placebo group, $n = 29$). Blocks were evaluated at regular time intervals to determine sensory and motor functions in the six nerve regions of the hand and forearm, adequacy for surgery and postoperative pain.

Results and Discussions: The onset of both sensory and motor blocks in all nerve territories was accelerated and the duration of anaesthesia prolonged in the Clonidine group compared to Placebo. In the region of infection, anaesthesia onset time was decreased in the Clonidine group (whether tested for temperature discrimination 9.5 ± 2.0 vs 21.6 ± 6.4 min, light touch 9.5 ± 2.0 vs 21.6 ± 6.4 min or painful stimulus 9.0 ± 4.6 vs 22.6 ± 6.6 min, $p < 0.0001$ respectively). Time to first analgesic requirement was prolonged (279 ± 87 vs 197 ± 84 min, $p = 0.002$) and visual analogue scale scores at the time of first analgesic requirement were decreased (30 ± 18 vs 70 ± 24 , $p < 0.0001$) in the Clonidine group compared to Placebo. Verbal rating scores in the Clonidine group were also decreased at 24 (1.7 ± 2.2 vs 4.1 ± 3.0 , $p = 0.002$) and 48 hours (0.1 ± 0.5 vs 1.5 ± 2.4 , $p = 0.01$) respectively compared to the Placebo group.

Conclusion(s): Our study findings suggest that clonidine 100 µg added to mepivacaine in axillary brachial plexus block enhances the quality and duration of both anaesthesia and postoperative analgesia in the clinical setting of paronychia surgery.

Reference:

- Murphy DB, McCartney CJL, Chan VWS. *Anesth Analg* 2000; **90**: 1122–8.

A-491

Lidocaine and activated endothelial IL-1β, IL-6 and IL-8 concentrations and ICAM-1 Expression

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Background: Endothelial cells play a key role in ischaemia reperfusion injury, and are important producers of and targets for cytokines (1). Lidocaine has been shown to decrease cytokine release in epithelial cells and neutrophils (2,3). We investigated the effects of lidocaine on endothelial cell HUVEC IL-1β, IL-6, IL-8 concentrations and intercellular adhesion molecule-1 (ICAM-1) expression.

Methods: Human umbilical vein endothelial cells (HUVECs) were pretreated with different concentrations of lidocaine (0 to 0.5 mg ml⁻¹) for 60 minutes, thereafter TNF-α was added at a concentration of 2.5 ng ml⁻¹ and the cells incubated for 4 hours. Supernatants were harvested, and cytokine concentrations were analysed by ELISA. Endothelial ICAM-1 expression was analysed by using flow cytometer. Differences were assessed using ANOVA and unpaired Student t-test where appropriate.

Results: Tumour necrosis factor-α increased IL-1β, IL-6, IL-8 and ICAM-1 expression compared to isolated HUVEC alone. Supernatant IL-1β, IL-6 and IL-8 concentrations in lidocaine (0.005 mg ml⁻¹) treated HUVECs were similar to control. Lidocaine (0.05 mg ml⁻¹) decreased IL-1β (2.22 ± 0.49 vs 4.16 ± 1.27 pg ml⁻¹, p = 0.03), IL-6 (130.97 ± 20.97 vs 161.58 ± 11.47 pg ml⁻¹, p = 0.04) and IL-8 (12237.47 ± 1684.85 vs 14960.67 ± 405.86 pg ml⁻¹, p = 0.02) concentrations compared to control. ICAM-1 expression (252.04 ± 58.84 vs 297.98 ± 50.34 MCF, p = 0.02) on lidocaine (0.005 mg ml⁻¹) treated HUVECs was less than that on controls.

Conclusion: Lidocaine at clinically relevant plasma concentrations decreased endothelial ICAM-1 expression. Lidocaine at concentrations 10 and 100 fold greater than clinically relevant plasma concentrations decreased activated endothelial cytokine IL-1β, IL-6 and IL-8 production. These findings may explain protective effects of lidocaine in ischaemia reperfusion injury.

References:

- Mantovani A, Bussolino F, Dejana E. *FASEB J* 1992; **6**: 591–9.
- Sinclair R, Eriksson AS, Gretzer C, et al. *Acta Anaesthesiol Scand* 1993; **37**: 159–65.
- Lahav M, Levite M, Bassani L. *Clin Exp Immunol* 2002; **127**: 226–33.

A-492

Postoperative magnesium sulphate infusion reduces analgesic requirements in brachial plexus block

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Background and Goal of Study: Magnesium sulphate infusion decreases analgesic requirements after general anaesthesia¹. Aim of this study was to assess the effects of postoperative magnesium infusion for 24 hours on duration of the block, sedation and postoperative analgesic consumption after brachial plexus block.

Materials and Methods: After obtaining approval from local ethic committee, 50 ASA class I and II patients were included to the randomised double blind study. Brachial plexus block was performed using axillary approach with lignocaine 1.25% adrenaline 1/200 000 40 ml. Groups received 5 mg kg⁻¹ bolus and 500 mg h⁻¹ magnesium sulphate infusion or saline controls at the same volume during 24 hour. Analgesia and sedation were assessed while determining time to first pain and rescue analgesic, time to regain motor capability, visual analogue scale and sedation scores for every 4 hour during postoperative 24 h. period. ANOVA and Mann-Whitney U-tests were used for statistical analyses. Data were expressed as mean ± SD and p value was considered significant as 0.05.

Results and Discussions: While time to first pain and rescue analgesic was increased, total analgesic consumption was reduced significantly on magnesium infusion group (Meperidine: C: 39.6 ± 49.7 mg, Mg: 13.2 ± 12.8 mg, p:0.02). Visual analogue scales were also observed to be lower at 4th, 12th and 24th hours. Time to motor block resolution and sedation scores were similar.

Conclusion: Magnesium sulphate infusion is thought as a safe and suitable adjunct for reducing analgesic consumption and possible complications without interfering daily activity in patients undergoing brachial plexus block.

Reference:

- Tramér MR, et al. *Anesthesiology* 1996; **84**: 340–7.

A-493

Comparative neurotoxicity of intrathecal lidocaine and bupivacaine in rats

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Background and Goal of Study: Recent laboratory and clinical evidence shows that local anesthetics are potentially neurotoxic, suggesting that neurologic complication after spinal anesthesia may directly result from local anesthetic toxicity. Although there is a considerable difference in a number of reports of neurological injury in the literature between lidocaine and other local anesthetics, few in vivo animal studies have produced convincing results showing a difference in neurotoxicity among anesthetics partly due to a lack of using appropriate relative dosage (1). In the present study, we compared the functional and morphologic effects of lidocaine and bupivacaine administered intrathecally at a concentration ratio of 5 to 1 in rats.

Materials and Methods: With approval from our animal research committee, male rats were implanted with an intrathecal catheter through L4–5 vertebra in the caudal direction (2) and randomly divided into three groups to receive a single injection (20 µl) of normal saline, 10% lidocaine, or 2% bupivacaine. The ratio of the concentration was chosen based on the relative dosage that has been thought to be equipotent and used for the two anesthetics in a clinical practice. To evaluate neurological function, tail flick (TF) test was performed 4 days after drug administration. Spinal cords were removed and prepared for the light and electron microscopic observation. Quantitative analysis of nerve injury was performed using the injury score. Statistical differences were analyzed with ANOVA followed by Sheffe's test.

Results and Discussions: Rats given 10% intrathecal lidocaine developed significantly higher TF latencies than those in other groups 4 days after injection. Both anesthetic solutions induced injury in spinal nerve roots. Rats given 10% lidocaine incurred more morphologic damage than those given saline or bupivacaine. Electron microscopic examination revealed severer damage in both myelinated and nonmyelinated nerve fibers in rats given 10% lidocaine than the other.

Conclusion: These data suggest that lidocaine is more neurotoxic than bupivacaine when administered intrathecally at a ratio of concentration commonly used for the two anesthetics in a clinical practice.

References:

- Drasner, *Anesthesiology* 1994; **80**, 847–52.
- Kirihara, *Anesthesiology* 2003; **99**, 961–8.

A-494

Comparison of ropivacaine and bupivacaine for thoracic paravertebral blockade for mastectomy

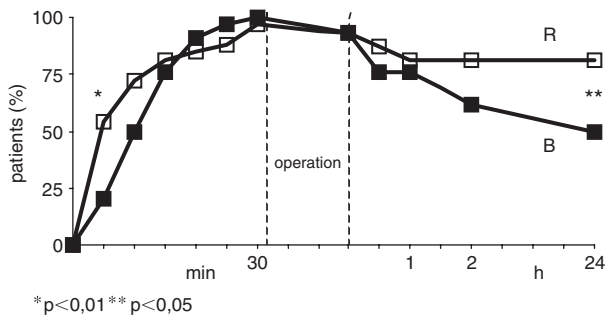
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Background and Goal of Study: No trials comparing the effectiveness of local anaesthetics in thoracic paravertebral blockade (TPVB) have been undertaken previously. The aim of this prospective study was a clinical comparison of ropivacaine (R) and bupivacaine (B) in TPVB for breast cancer patients undergoing modified radical mastectomy (MRM).

Material and Methods: 70 ASA I–II patients, aged 27–80 (mean 57.8 ± 13.1 years) scheduled for MRM due to breast cancer were randomly allocated in a patient-blinded fashion into two groups receiving either a single injection of 0.5% R (n = 35) or 0.5% B (n = 35) for TPVB at T4 level (Eason and Wyatt technique). Total intravenous anaesthesia with propofol and fentanyl allowed spontaneous breathing during the operation. Onset, duration and extent of achieved sensory block, level of postoperative pain, the amount of intravenous anaesthetic and analgesics, as well as the occurrence of complications were investigated. Data were analyzed with t-test and p < 0.05 was considered significant.

Results: R produced significantly shorter onset, wider extent and surprisingly longer duration than B. This was illustrated by a greater percentage of patients with the extent of sensory block wide enough to perform MRM (see figure). No statistical differences in other listed parameters were observed.



Conclusion: R seems to be superior to B for TPVB during breast cancer surgery.

A-495

Comparison of patient-controlled propofol and propofol by continuous infusion during epidural anaesthesia

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Background and Goal: Sedation during epidural anaesthesia reduces anxiety and discomfort of patients. The pharmacokinetic properties of propofol encourage its use for sedation. The aim of this study was the comparative evaluation of two different methods of intravenous propofol infusion: patient-controlled sedation versus continuous infusion.

Material and Methods: We studied 35 patients ASA I–II, aged 25–50 years old undergoing surgical repair of inguinal hernia with epidural anaesthesia (levobupivacaine 0.5%). Once the neural block was established all patients received a bolus dose of 0.5 mg kg⁻¹ propofol and were then randomly allocated in one of the two study groups of propofol infusion: group PCS (Patient-controlled sedation; bolus dose 15 mg, lockout period 5 min) and group CI (continuous infusion 30 µg kg⁻¹ min⁻¹). Blood pressure, heart rate, respiratory rate, oxygen saturation (pulse oximetry-SpO₂) and sedation (Ramsay Scale) were recorded during surgery and in the recovery room. Patient satisfaction (unsatisfied–satisfied–moderately satisfied–very satisfied) was also recorded.

For statistical analysis ANOVA and t-test were used.

Results and Discussion: During the intraoperative period the haemodynamic parameters, Ramsay score and total propofol administered didn't differ between the two groups. In group CI 18% of the patients had respiratory rate < 8 and SpO₂ < 90% while no such event occurred in group PCS ($P < 0.05$). The percentage of very satisfied patients accounted to 83% in group PCS against 41% in group CI ($P < 0.05$).

From the above results patient-control sedation with propofol provides safer sedation and higher patient satisfaction over the continuous infusion of propofol.

Conclusions: Although both methods can be used for sedation during epidural anaesthesia the preference of the patients for self-administered sedation is an important factor, as well as the fact when continuous infusion is used a better choice of dosage could be needed.

A-496

Effect of clonidine mixed with ropivacaine and fentanyl in epidural analgesia after knee arthroplasty

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Background and Goal of Study: Clonidine has been found useful as analgesic adjuvant in various regional anaesthesia techniques (1,2). We studied if its addition to an epidural infusion of ropivacaine and fentanyl improves analgesia and reduces the need for rescue pain medication after total knee arthroplasty.

Materials and Methods: After ethics committee approval, this randomised, controlled, and double blind study was performed in 72 consenting patients (pts) (85 yrs, ASA I–III) undergoing knee arthroplasty. Postoperatively, pts in the clonidine group (RFC, n = 32) received an epidural infusion consisting of ropivacaine 2 mg/ml, fentanyl 5 µg/ml, and clonidine 2 µg/ml. A similar infusion without clonidine was used in the control group (RF, n = 32). Speed of the infusion was adjusted, as needed, to 3–7 ml/h over the 24-hour study period. Rescue pain medication was oxycodone i.m.

Results and Discussion: Average infusion speed was (mean (SD)) 4.7 (0.7) ml/h in RFC vs. 5.2 (0.8) ml/h in RF (t -test, $P = 0.004$). In RFC, 20 pts did not need oxycodone rescue medication, compared to 10 pts in RF. Pts in RFC

received less oxycodone than pts in RF (median (25th and 75th percentile)): 0 (0, 7) vs. 7 (0, 12) mg (MW-U-test, $P = 0.027$). In RFC, 8 pts suffered from breakthrough pain, compared to 15 pts in RF. Blood pressure and pulse were slightly lower in RFC than in RF. The incidence of nausea and degree of sedation were similar in the groups. Patient satisfaction was good in both groups.
Conclusions: Clonidine added to the epidural ropivacaine-fentanyl-infusion reduced significantly the need for rescue medication. The reduced oxycodone requirement did not translate into reduced side effects (e.g. nausea). Increasing the clonidine dose may further improve analgesia, but it may also increase the risk of hypotension.

References:

- 1 Eisenach JC et al. *Anesthesiology* 1996; 85: 655–674.
- 2 Tryba M, Gehling M. *Curr Opin Anaesthesiol* 2002; 15: 511–517.

A-497

Intravenous clonidine prolongs postoperative analgesia after psoas compartment block with 0.5% levobupivacaine for hip fracture surgery

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Background and Goals: Clonidine as an adjunct to local anaesthetic (LA) prolongs brachial plexus blockade (1). However, whether this effect is central or peripherally mediated remains unclear. We evaluated the systemic and local effects of clonidine as an analgesic adjunct to levobupivacaine for psoas compartment block (PCB) in patients undergoing surgical repair of traumatic hip fractures.

Materials and Methods: Following institutional research board approval, 36 patients underwent PCB and general anaesthesia for hip fracture repair in a prospective, double-blinded study. They were randomised into three groups: Group L (LA alone with saline IV), Group C (LA and clonidine 1 µg/kg with saline IV) and Group IC (LA alone with clonidine 1 µg/kg IV). Data was collected 3, 6, 12, 16 and 24 hours after PCB. Student's t -test and Fisher's Exact test were used for analysis. One tailed t -test for p values shown.

Results: Data is presented as Mean ± SD. Patient characteristics were equal in terms of age/sex/weight/ASA grade/operative fentanyl use and sevoflurane requirements for all groups. Time to first analgesia (hours) was significantly prolonged in Group IC compared to Group L (13.4 ± 6.1 vs 7.3 ± 3.6 $p = 0.004$). There was no significant difference between Group C and L (10.3 ± 5.9 vs 7.3 ± 3.6 $p = 0.07$). There were no statistical differences in the 24 hour cumulative morphine or paracetamol consumption between all groups. Verbal rating scores were similar at rest and movement at all timepoints except at rest at 16 and 24 hours where Group IC had lower pain scores than Group C ($p = 0.02$). There were with no significant differences between groups regarding postoperative adverse effects (bradycardia, hypotension, sedation, nausea) although Group C required more ephedrine intraoperatively than Group L (17.7 ± 15.8 vs 8.0 ± 8.6 $p = 0.04$).
Conclusion: IV clonidine significantly prolonged the time to first analgesia following PCB with levobupivacaine in patients undergoing surgical repair of traumatic hip fractures.

Reference:

- 1 Singelyn FJ, Gouverneur JM, Robert A. *Anesth Analg*. 1996;83:1046–50.

A-498

Pre-spinal anaesthesia volume loading blunts the haemodynamic effects of clonidine

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Background and Goal of study: The usefulness of intrathecal clonidine (C) is limited by causing bradycardia and hypotension. In the present study we tested the hypothesis whether volume loading prior to lumbar anaesthesia can ameliorate the haemodynamic side effects of C. Haemodynamic responses were recorded with pulse contour cardiac output (PCCO) measurements (1).

Materials and Methods: 23 ASA 3–4 patients scheduled for lower extremity or hip surgery under spinal anaesthesia between 31 and 95 yrs of age were studied. In this prospective, double blind study the patients were randomly assigned to one of three groups. Control: 3.2 ml bupivacaine (B) isobaric and physiological saline, C low: 3.2 ml B and 0.5 µg/kg C and C high: 3.2 ml B and 1.0 µg/kg C, respectively. Cardiac index CI, heart rate HR and arterial pressures (MAP) were recorded continuously and global end diastolic index (GEDI) was measured at 10 minutes intervals. The patients received 6% HES IV until GEDI reached 680–800 ml/m² indicative of normovolemia.

After dural puncture haemodynamic responses were recorded for 30 minutes. Statistical analysis was performed with ANOVA.

Results and Discussion: Before administering 6% HES IV, mean, GEDI from all 23 patients was 560 ± 143 ml/m² indicative of hypovolemia. After 6% HES, GEDI increased significantly to 722 ± 73 ml/m², ($p < 0,05$) reflecting normovolemia. Following intrathecal anaesthesia CI, HR and MAP decreased, but there was no significant difference between the three groups (Table).

	Control	C low	C high
CI l/min/m ²	2.5 ± 0.5	3.5 ± 0.5	2.6 ± 0.6
HR bpm	95 ± 0	83 ± 12	78 ± 21
MAP mmHg	97 ± 25	94 ± 21	97 ± 14

Conclusion: In contrast to previous studies (2), we could not detect significantly different haemodynamic responses after addition of C to spinal anaesthesia. Thus, adequate cardiac volumes seem to be a prerequisite in order to exploit the beneficial effects of intrathecal C.

References:

- 1 Spiegel T, Wietasch G, Bürsch J, et al. *Anaesthesist*. 1996;45:1045–1050.
- 2 Niemi N. *Acta Anaesth Scand*. 1994;38:724–728.

A-499

Intrathecal fentanyl added to hyperbaric ropivacaine for urological surgery

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Background and Objectives: The addition of fentanyl to hyperbaric ropivacaine increases the intraoperative quality of subaracnoid block and synergistic antinociceptive effects with local anesthetics have been confirmed in animal studies. The addition of fentanyl to hyperbaric bupivacaine increased the intraoperative and early postoperative quality of subaracnoid block for urological operations. The purpose of our study was to examine the analgesic effect of intrathecal administration of fentanyl with hyperbaric ropivacaine in patients undergoing urological procedures.

Material and Methods: A randomized double-blind controlled study was conducted in 32 adult males scheduled for minor urological procedures. Patients were randomly assigned into two groups to receive an intrathecal injection of either fentanyl 25 µg in Group I ($n = 15$) or normal saline 0.5 ml in Group II ($n = 17$) in addition to 18 mg% 0.1 hyperbaric ropivacaine in a total volume of 3.5 mL. Characteristics of spinal block, intraoperative quality of spinal anaesthesia, side effects, complete analgesia (time to first feeling of pain), and effective analgesia (time to first request of analgesics) were assessed. Data were expressed as the mean \pm standard deviation. A value of $P < 0.05$ was regarded as a statistically significant difference.

Results and Discussion: The mean age, weight, height and duration of surgery were comparable between the groups. There was no significant difference between the two groups achieving to the highest level of sensory block and or in time to reach the peak level. Regression to L1 was significantly prolonged in the fentanyl group compared with the saline group ($P = 0.004$). Time to maximum motor block and degree of motor block were also similar between the two groups. Recovery of complete motor block was significantly longer in fentanyl group ($P = 0.019$). The overall quality of spinal anaesthesia was similar in the both groups. Time to the first feeling of pain and the first analgesic requirement were significantly earlier in the saline group compared with the fentanyl group (0.011 and 0.016; respectively). The addition of small-dose intrathecal fentanyl (10–25 µg) to local anesthetics during spinal anaesthesia enhances and increases the duration of sensory analgesia without intensifying the motor block or prolonging recovery.

Conclusion: Our study shows that the addition of fentanyl, 25 µg, to hyperbaric ropivacaine, 18 mg, for spinal anaesthesia improved the quality of intraoperative analgesia and increased the duration of analgesia in the early postoperative period in patients undergoing urological procedures.

A-500

Postoperative analgesia for arthroscopic knee surgery with intraarticular levobupivacaine and/or parecoxib

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Background and Goal of Study: Intraarticular local anaesthetics (LA) and nonsteroidal antiinflammatory drugs (NSAID) have been found to be effective in the relief of postoperative pain. The goal of this study was to determine whether intraarticular parecoxib alone or in combination with levobupivacaine would result in the most effective analgesic benefit.

Materials and Methods: We studied 60 ASA I–II patients were allocated randomly to one of three groups to receive intraarticular 30 ml of a solution containing 0.25% levobupivacaine (group L), 40 mg parecoxib sodium with 0.9% saline (group P) and 40 mg parecoxib sodium with 0.25% levobupivacaine (group PL). The injection was made into the knee joint at the end of surgery, 10 min before tourniquet deflation. Visual analogue scale (VAS) pain scores at rest (0–100 mm) were measured preoperative and 1, 2, 4, 8, 16 and 24 hours postoperative. The duration of analgesia and the total number of analgesic tablets consumed during the 24 hours postoperative were recorded.

Results and Discussion: Significant differences in VAS pain scores were seen between the groups ($p < 0.1$). The group PL had lower 1, 2, 4 hour pain score ($0.7 \pm 0.4, 0.9 \pm 0.6, 1.1 \pm 0.5$) than the group L ($1.8 \pm 1.2, 2.1 \pm 1.4, 2.5 \pm 1.3 - p < 0.5$) and the group P ($2.6 \pm 1.4, 2.5 \pm 1.1, 2.8 \pm 1.5 - p < 0.1$). The group PL had significant longer time for the first analgesic request – 532 \pm 169 min, the group P – 289 \pm 145 and the group L – 453 \pm 187 min. The 24 hours consumption of paracetamol was different among the groups ($p < 0.1$). The group PL consumed fewer tablets 1.6 ± 1.0 than the group L $2.7 \pm 2.1 - p < 0.1$ and group P $4.2 \pm 1.6 - p < 0.1$.

Conclusion(s): The intraarticular administration of 0.25% levobupivacaine and parecoxib sodium provided significantly better analgesia than either solution alone and reduced oral analgesic requirements during the first postoperative day. This result could be a synergistic effect.

References:

- Cook TM, Tuckey JP, Nolan JP. Analgesia after day-case knee arthroscopy: double-blind study of intra-articular tenoxicam, intra-articular bupivacaine and placebo. *Br J Anaesth* 1997;78:163–8.
- Colbert ST, Curran E, O'Hanlon DM, Moran R, McCarroll M. Intra-articular tenoxicam improves postoperative analgesia in knee arthroscopy. *Can J Anaesth* 1999;46:653–7.

A-501

Hypobaric levobupivacaine in spinal anaesthesia for minor orthopedic surgery: comparison with hypobaric and hyperbaric racemic bupivacaine

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Background and Goal of Study: In this work we compare two diluted hypobaric local anesthetics 0,18% (levobupivacaine and racemic bupivacaine) with hyperbaric racemic bupivacaine 0,5% in minor orthopedic surgery.

Materials and Methods: We study 45 patients, ASA I–II, submitted to minor orthopedic surgery. We use spinal anaesthesia with Withacre needle 27G, medial access, space L3–4, lateral position (20 min), operated side up for hypobaric and down for hyperbaric anesthetic. Group A:15 patients, hypobaric racemic bupivacaine 0,18%; GroupB: 15 patients, hypobaric levobupivacaine 0,18%; GroupC: 15 patients: hyperbaric racemic bupivacaine 0,5%. 6,3 mg is the dosage used in each group. We record motor block degree (Bromage scale) and sensitive level (pin prick test) at different time (see below). We record intra and postoperative side effects.

Results and Discussions:

	10 min	20 min	1 hr	2 hr	3 hr	4 hr
Bromage						
A1	$1 \pm 1,1^*$	$2,5 \pm 0,8^*$	$2,3 \pm 1$	$1,5 \pm 1,3$	$0,4 \pm 0,7$	0
A2	$0,1 \pm 0,5$	$0,4 \pm 0,9$	$0,5 \pm 0,8$	$0,5 \pm 1$	$1,2 \pm 2,6$	0
B1	$1,2 \pm 1,1$	$1,8 \pm 1$	$1,7 \pm 1,2$	$1 \pm 1,2$	$0,3 \pm 0,6$	0
B2	$0,3 \pm 0,8$	$0,1 \pm 0,3$	$0,9 \pm 0,9$	$0,2 \pm 0,6$	$0,1 \pm 0,3$	0
C1	$2,3 \pm 0,9^*$	$2,9 \pm 0,3^*$	$2,7 \pm 0,5^*$	$2,7 \pm 0,5^*$	$0,7 \pm 0,6$	0
C2	$1,1 \pm 1,3$	$1,3 \pm 1,2$	$1,2 \pm 1,2$	$1,2 \pm 1,2$	$1,5 \pm 3,2$	0
Sensitive						
A1	$6,5 \pm 5,9$	$10,8 \pm 2,9$	$7,9 \pm 2,7$	$5,1 \pm 3,6$	$1,2 \pm 2,6$	0,3
A2	$1,8 \pm 4,7$	$2,3 \pm 5,1^*$	$1,5 \pm 3,2^*$	$0,3 \pm 1,3^*$	0*	0
B1	$7,7 \pm 5,6$	$10,7 \pm 2,7$	$10,1 \pm 2,3$	$5,5 \pm 4,3$	$1,9 \pm 3,3$	0
B2	$0,8 \pm 2,3$	$1,5 \pm 4,7^*$	$1,7 \pm 4,6^*$	$0,9 \pm 2,4^*$	0*	0
C1	$9,7 \pm 4,1^*$	$10,9 \pm 3,7$	$10,7 \pm 2,5$	$8,3 \pm 3^*$	$4,9 \pm 4,1^*$	0,5
C2	$1,1 \pm 1,3$	$5,8 \pm 6,2$	$7,1 \pm 5,5$	$4,9 \pm 4,7$	$1,5 \pm 3,2$	0,5

* $p < 0,05$; no serious side effects recorded

A1, B1, C1 = operated side; A2, B2, C2 = opposite side

Conclusion(s): Our data demonstrate that the use of hypobaric levobupivacaine and racemic bupivacaine for spinal anaesthesia is more selective and with a shorter time action than widely used hyperbaric racemic bupivacaine.

References:

- 1 Kuusniemi KS, Pihlajamaki KK, Dirvela OA. *Reg. Anesth. Pain Med*. 2001; 26: 30–4.
- 2 Kuusniemi KS, Pihlajamaki KK, Pitkanen MT. *Reg. Anesth. Pain Med*. 2000; 25: 605–10.

Pharmacology

A-502

Recovery after desflurane or sevoflurane maintenance of anesthesia in geriatric urologic patients

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Background and Goal of Study: The newer, less soluble, volatile anesthetics desflurane and sevoflurane provide rapid emergence from anesthesia, although there are only few data concerning their comparison in the geriatric population. We evaluated the recovery profiles when using desflurane or sevoflurane for the maintenance of general anesthesia in geriatric urologic patients.

Materials and Methods: Following institutional approval 45 patients of 65 years and over, ASA I-III, undergoing transurethral procedures, were randomly assigned to receive one of the tested treatments. After a standardized induction regimen, anesthesia was maintained with desflurane (3–6% end tidal: group D) or sevoflurane (1.1–1.9% end tidal: group S) in 70% N₂O. In each group the volatile anesthetic was titrated to maintain an EEG bispectral index value of 60–65. From discontinuation of the maintenance anesthetics, recovery times and the time to achieve a modified Aldrete's score of 10, indicating fitness for discharge from recovery room (1), were recorded. Data were analyzed with Student's t-test and χ^2 test as appropriate. Statistical significance was accepted for $p < 0.05$.

Results and Discussions: The study groups were comparable regarding demographics, procedural characteristics and anesthetic times.

Table. Results of recovery profiles.

Recovery times (min)	D (n = 23)	S (n = 22)	p
Extubation	6.2 ± 2.9	9.7 ± 3.8	<0.01
Awakening	6.9 ± 2.8	10.4 ± 3.2	<0.001
Obey commands	8.5 ± 3.0	13.9 ± 4.5	<0.001
Orientation	10.7 ± 3.6	16.8 ± 5.2	<0.001
Aldrete's score 10	13.2 ± 4.6	18.2 ± 5.8	<0.01

= mean ± SD.

Conclusion(s): Desflurane for the maintenance of general anesthesia in geriatric patients is associated with faster early recovery end points and more rapid discharge from recovery room compared to sevoflurane.

Reference:

1 Aldrete JA. *J Clin Anesth* 1995; 7:89–91.

A-503

Equipotent doses of sevoflurane and propofol during N₂O/remifentanyl anesthesia at various BIS index values

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Background and Goal of Study: To describe equipotency in anaesthetic doses between Sevoflurane and Propofol, at two different BIS index values.

Materials and Methods: After ethics committee approval and patient's informed consent, 80 young patients, ASA I were assigned to a prospective, randomised study, divided in 4 groups. In SEVO (SEVO-40, SEVO-50) groups, anesthesia was induced and maintained with variable concentrations of Sevoflurane in order to achieve a BIS index of 40 or 50 respectively. In PROP (PROP-40, PROP-50) groups anesthesia was induced and maintained with Propofol at variable infusion rates in order to achieve a BIS index of 40 or 50 respectively. All patients were breathing 50% N₂O in O₂ and received a standard remifentanyl infusion of 0.5 µg/kg/min during anesthesia. Observation period lasted 60 minutes while BIS index values, systolic and diastolic blood pressure (SAP, DAP), heart rate (HR), end-tidal Sevoflurane (S_{ET}) as well as Propofol infusion rates (P_{MIR}) were recorded at 5 min intervals. Statistics implemented one way ANOVA test.

Results and Discussions: Results are shown on Table 1. Demographic and hemodynamic data were comparable in all groups.

Table 1. Age in years, P_{MIR} = Propofol Mean Rate of Infusion in µg/kg/min. Values presented as mean ± SD.

Group	n	Age	S _{ET} %	P _{MIR}	BIS
SEVO-40	20	32 ± 8	1.3 ± 0.4		41 ± 4
PROP-40	20	30 ± 7		105 ± 22	40 ± 3
SEVO-50	20	31 ± 7	0.9 ± 0.3		50 ± 1
PROP-50	20	32 ± 6		90 ± 10	51 ± 3

Conclusion(s): We found that in young, ASA I patients, Sevoflurane end-tidal concentrations of 0.9% and 1.3% are equivalent to Propofol infusions of 90 and 103 µg/kg/min respectively and produce anaesthesia, corresponding to BIS index values of 50 and 40 respectively.

References:

H Röpkcke et al: Propofol and remifentanyl pharmacodynamic interaction during orthopedic surgical procedures as measured by effects on bispectral index *J Clin Anesth* 2001; 13(3): 198–207.

KK Kaisti et al: Effects of Sevoflurane, Propofol, and Adjunct Nitrous Oxide on Regional Cerebral Blood Flow, Oxygen Consumption, and Blood Volume in Humans *Anesthesiology* 2003; 99(3): 603–13.

A-504

Recovery from anaesthesia with desflurane or with sevoflurane in major abdominal surgery, in elderly patients

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Background and Goal of Study: Fast recovery from anaesthesia is desirable in elderly patients. Desflurane (DES) and Sevoflurane (SEV) show lower solubility, lower accumulation in fat tissues and faster emergence times after anaesthesia than other inhaled anaesthetics. The aim of the study was to compare the recovery from DES or SEV anaesthesia in elderly patients.

Materials and Methods: 60 patients ≥65 years, ASA I-III scheduled for elective major lower abdominal surgery were randomly assigned to receive either DES (n = 30) or SEV (n = 30) as inhalation agents for maintenance of anaesthesia (0.6–0.8 MAC) in 40% of oxygen/air. Induction of anaesthesia was performed with remifentanyl (1 µg/kg), thiopental, rocuronium and maintained with remifentanyl infusion (0.2–0.5 µg/kg/min) and with selected inhaled anaesthetic (DES or SEV). At the end of the surgery, anaesthetics were discontinued and fresh gas flow was maintained with oxygen 100%. The times to spontaneous ventilation, eye opening, extubation and orientation to name and date of birth were recorded. Student t test was used for statistical analysis. Data are expressed as mean ± SD and $p < 0.05$ was considered significant.

Results and Discussion: Both groups were comparable in respect of demographic data, anaesthetic dosages and duration of anaesthesia, also BP and HR remained within 20% of baseline value. Recovery times were significantly shorter for desflurane than for sevoflurane.

	DES (n = 30)	SEV (n = 30)	p (values)
Age (years)	72,27 ± 3,67	71,37 ± 3,95	NS
Surgical time (min)	92,67 ± 13,6	93,17 ± 14,8	NS
Spt.Ventilation (min)	5,98 ± 1,05	6,37 ± 0,93	NS
Eye opening (min)	6,33 ± 0,93	9,15 ± 1,03	<0,001*
Extubation (min)	7,67 ± 0,94	10,12 ± 1,02	<0,001*
Orientation (min)	10,73 ± 0,88	15,21 ± 0,73	<0,001*

Conclusion: Desflurane was associated with a faster recovery than sevoflurane after anaesthesia for major lower abdominal surgery in elderly patients.

References:

Heavner JE, et al. *Br J Anaesth* 2003; 91:502–6.

Chen X, et al. *Anesth Analg* 2001; 93:1489–94.

A-505

Xenon: clinical experience

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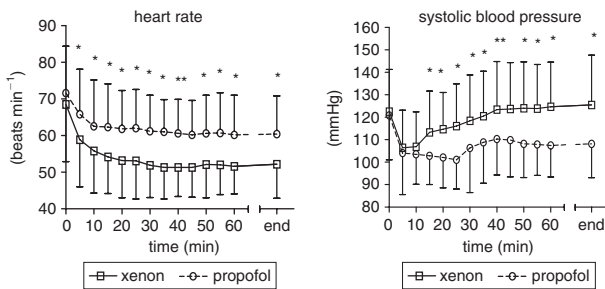
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Background and Goal of Study: Xenon has proven its cardioprotective effects¹. Nevertheless clinical experience with xenon is rare. Therefore, we present the hemodynamic data as a secondary outcome measure from a clinical trial analyzing neuromuscular effects of xenon.

Materials and Methods: After approval of the local ethics committee, 160 patients were included in this prospective randomized controlled trial after they gave their written informed consent. Anaesthesia was induced with propofol and remifentanyl and was maintained with xenon at 60% (MAC of 0.85) or with propofol 0.08–0.17 mg kg⁻¹ min⁻¹. Remifentanyl was adapted to clinical needs in both groups. Heart rate and systolic blood pressure were

tested with the two-tailed Wilcoxon's test and are shown as mean values with standard deviation.

Results and Discussions: The two study groups were comparable with respect to age, weight, length, gender and ASA classification.



Baseline in heart rate and systolic blood pressure were comparable in both groups. After induction systolic blood pressure increased after 15 min to baseline values in the xenon group and differed significantly to the propofol group. Heart rate decreased in the xenon group significantly and remained at stable values.

Conclusions: The results from this trial support the data from the first multicentre xenon study by Rossaint and co-workers². Our data emphasize that xenon leads to a hemodynamically stable anaesthesia. After induction it keeps systolic blood pressure at baseline levels and maintains an effective low heart rate.

References:

- Schroth SC, Schotten U, Alkanoglu O, et al. *Anesthesiology* 2002; 96: 422–7.
- Rossaint R, Reyle-Hahn M, Schulte am Esch J, et al. *Anesthesiology* 2003; 98: 6–13.

Acknowledgements: The study was supported in part by GlaxoSmithKline, Organon and Messer Griesheim.

A-506

Closed circle anaesthesia by mean of a syringe pump injection of inhalation agents – a valid alternative?

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Background: Ecological, economical reasons to avoid any unnecessary waste of anaesthetic gases can already be met by use of low flow techniques. Maximal advantage is reached by rebreathing method. Closed system anaesthesia can easily be realized in daily clinical practice with conventional equipment by abandoning the use of nitrous oxide. The greatest problem involved in the early reduction of the FGF is the supply of a sufficient amount of anaesthetic vapor. This could be solved by the use of injection of liquid volatile agent directly into breathing system. Though the idea is rather old (Lowe, Ernst) and still remain the challenge of enthusiasts (Nunn), we initiate the study on the clinical validity of syringe injection of inhalation agents.

Methods: 73 pts (24 m/59 f; median age 54 yrs; range 17–87 yrs, ASA 2–4), were enrolled into the study. Informed consent obtained. Conventional anaesthesia machines equipped with multigas analyses satisfied the requirements for low flow technique. Pre-medication and intravenous induction conducted in a routine manner. Oxygen was the only gas carrier in the study group. Oxygen supply was reduced immediately after endotracheal intubation to the level of calculated uptake (Brody's formula) and $F_i/F_{EE}O_2$ controlled by gas analyzer. Enflurane/isoflurane injected into the exhalation part of breathing system by mean of a syringe pump in 62/11 cases, respectively. The rate of syringe pump was calculated according to Lin ratio. The rate was then changed to maintain the required exhalation concentration of the agent. Intra-operative monitoring implemented according to ASA & EN740 guidelines.

Results: VO_2 was nearly stable at the adequate metabolic rate. No one in research group developed hypoxemia ($SpO_2 \geq 95\%$, $F_iO_2 = 0.7–0.85$). F_{EE} of the agent maintained at the level of 0.8–1MAC and could be easily corrected by pump rate without flow change. No incidence of intra-operative awareness was reported. 93% of pts were completely satisfied as assessed by lowa scale. X-ray lung abnormality registered by the expert in 7 pts from study group and not statistically differed from control ($p = 0.05$).

Conclusion(s): Closed circle anaesthesia by mean of a syringe pump injection of volatile anaesthetics can be a valid alternative in daily clinical practice with conventional equipment. We found no contraindication to the use of carrier gas containing only oxygen.

A-507

Sevoflurane and desflurane alter selectin and integrin expression in neutrophils

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Background and Goal of Study: Anaesthetics have been reported to reduce ischemia-reperfusion injury (1). In a previous study we could show that isoflurane attenuates the expression of selectins and β_2 -integrins involved in the multiple step process of neutrophil adhesion to vascular endothelium (2). Now we assessed whether sevoflurane and desflurane affect also the activation of neutrophil selectins and integrins.

Materials and Methods: Whole blood was incubated for 60 min. with 1 or 2 minimum alveolar anaesthetic concentration (MAC) of sevoflurane or desflurane. After incubation the expression of the adhesion molecules (CD11b, CD11a, L-selectin, PSGL-1) in unstimulated and phorbol-12-myristate-13-acetate (PMA) stimulated neutrophils was evaluated via flow cytometry. Results are expressed as mean fluorescence intensity of control samples vs. anaesthetic exposed samples.

Results and Discussions: The expression of CD11b was enhanced by sevoflurane 1 MAC (unstimulated: 332 vs. 409) and 2 MAC (unstimulated: 455 vs. 631, PMA: 2621 vs. 3545). 2 MAC sevoflurane did also increase the expression of CD11a (unstimulated: 751 vs. 786, PMA: 929 vs. 980). Desflurane did not alter CD11b or CD11a expression, but reduced PSGL-1 expression at 1 MAC (unstimulated: 301 vs. 226, PMA: 600 vs. 455) and 2 MAC (unstimulated: 486 vs. 377, PMA: 485 vs. 331). Incubation with 2 MAC desflurane enhanced also L-selectin shedding (unstimulated: 1316 vs. 1054, PMA: 929 vs. 737).

Conclusion(s): This study indicates, that sevoflurane enhances β_2 -integrin expression, whereas desflurane attenuates especially PSGL-1 expression. However further studies are required to identify if the modified adhesion molecule expression also influences the ischemia-reperfusion injury through an altered neutrophil adherence to vascular endothelium.

References:

- Mobert J. *Anesthesiology* 1999; 90:1372–1381.
- De Rossi. *Anesth Analg* 2002; 95:583–587.

A-508

The sensitivity of GIRK channels towards halothane is essentially determined by the C-terminus

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Background and Goal of the Study: GIRK channels (G protein activated inwardly rectifying K^+) are widely expressed in the central nervous system and believed to mediate analgesic effects of opioids. We have shown that GIRK channels are targets for the volatile anaesthetic halothane (1). The modulation by halothane of channels coexpressed with the m_2 acetylcholine (ACh) receptor is characterized by inhibition of agonist activated GIRK1* (=GIRK1^{F137S}) and GIRK2 mediated currents. In contrast, at high concentrations halothane induced GIRK1* but not GIRK2 mediated currents in the absence of ACh. To elucidate the molecular mechanism of GIRK channel modulation we constructed deletion mutants of GIRK1* (GIRK1 Δ^{363}) and GIRK2 (GIRK2 Δ^{356}) channels lacking the C-terminal ends. In addition a chimeric GIRK channel composed of the GIRK2 transmembrane domain and the unique C-terminus of GIRK1 (GIRK2/1³⁵⁶) was investigated.

Materials and Methods: For expression of channels we used the Xenopus oocyte expression system. GIRK mediated currents were measured with the two electrode voltage clamp technique.

Results and Discussion: All chimeras and mutations of GIRK channels showed normal currents when activated by ACh but exhibited different pharmacological properties towards halothane. The deletion mutant of GIRK2 (GIRK2 Δ^{356}) showed no sensitivity against the inhibitory action of halothane. Quite the contrary, GIRK2 Δ^{356} was now activated by halothane in the absence of an agonist. Compared to GIRK1* channels, GIRK1 Δ^{363} channels were less sensitive against halothane induced inhibition of the agonist induced current but in the absence of ACh, currents were activated by halothane more efficiently. Currents mediated by chimeric GIRK2/1³⁵⁶ channels were inhibited by anaesthetic concentrations that were 30 fold lower than those necessary to decrease GIRK2 wild type currents. GST-pull down experiments did not show displacement of bound $G_{\beta\gamma}$ to the channel due to wash with halothane containing solutions.

Conclusion: A direct interaction of halothane with the channel has to be assumed with the C-terminus being critical for the modulation of GIRK currents.

Reference:

- Weigl LG and Schreibmayer W, *Mol. Pharmacol.* 2001 **60**: 282–289.

A-509

Minimal flow sevoflurane anesthesia for long term surgery

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Background and Goal of Study: Sevoflurane gained popularity mainly for day-case and pediatric surgery, its most incriminated disadvantages being compound A toxicity and higher cost than isoflurane. Our study goal is to assess cost/benefit of sevoflurane versus isoflurane anesthesia for long-term surgical procedures.

Materials and Methods: After Ethics Committee approval and patient informed consent, 64 patients scheduled for long abdominal interventions (duration >2 hs.) were prospectively randomized to receive general anesthesia with either sevoflurane (group S, n = 34) or isoflurane (group I, n = 30). All patients received midazolam for premedication and induction with fentanyl, thiopental and rocuronium. Maintenance was done in 0.5 l/min O₂ 100%, with Fet sevoflurane 2.0–2.4 in group S and Fet isoflurane 1.0–1.2 in group I and if necessary, boluses of 100 mcg fentanyl and 10 mg rocuronium. At end-surgery, vaporizers were turned off and all patients received 10 mg of morphine s.c. A blind monitor recorded all recovery times, quality of awakeness, ml of anesthetic gas consumed, analgesic consumption within next 24 hs, postoperative nausea and vomiting; renal function was assessed up to discharge and at 4 weeks postdischarge. Statistics included 2-tailed t-test and one-way ANOVA (p < 0.05).

Results and Discussions: There was no difference between groups in demographics, length of surgery, intra- and post operative analgesic consumption, incidence of PONV. 3 patients in group S and 4 patients in group I had early postoperative transient increase in BUN and serum creatinine in correlation with intraoperative hypotension, but on discharge and at 4 weeks no patient had differences from the preoperative levels.

Parameter	Group S (mins)	Group I (mins)	P
Extubation	5.32 ± 1.57	10.71 ± 1.73	0.000
Eyes open	5.77 ± 1.59	11.43 ± 1.90	0.000
Obeys	6.81 ± 1.99	12.67 ± 2.51	0.000
MI/h	13.24 ± 2.64	16.47 ± 2.73	0.008
Euros/h	5.56 ± 1.11	8.23 ± 1.36	0.026

Conclusion: Sevoflurane has a better cost/benefit ratio than isoflurane and can be safely used for maintenance of long-term minimal flow anesthesia.

A-510

Minimum anesthetic concentration (MAC) of desflurane with different xenon concentrations in swine

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Background and Goal of Study: We have described a partial antagonism of xenon (Xe) with isoflurane (1), but a linear interaction between Xe and sevoflurane (2). As it cannot be predicted from available data, we investigated the influence of Xe on the MAC of desflurane (MAC_{des}).

Materials and Methods: The study was performed in 10 swine (weight 30.1 ± 1.1 mean ± SD) ventilated with Xe concentrations of 15–65% in oxygen. With each Xe concentration, various concentrations of desflurane were administered in a step-wise design. Each time a supramaximal pain stimulus (claw clamp) was applied. The appearance of a withdrawal reaction was recorded. The MAC_{des} was defined as the end-tidal concentration required to produce a 50% response rate. A logistic regression model was fitted to the results to determine MAC_{des}.

Results and Discussions: MAC was decreased by inhalation of Xe in a linear way. Results of logistic regression and MAC_{des} are shown in Table 1 and 2.

Table 1.

Parameter	Estimate	95% CL	P
Intercept	-14.9706	-16.8345; -13.1068	<0.0001
Desflurane	1.4630	1.2635; 1.6626	<0.0001
Xenon	0.1070	0.0155; 0.1984	0.0219
Des*Xe	-0.0060	-0.0178; 0.0058	0.3223

Table 2.

Xe [Vol.%]	MAC _{des}	95%CL
0	10.4	9.7; 11.1
15	9.8	9.1; 10.5
30	9.3	8.6; 9.9
40	8.9	8.2; 9.5
50	8.5	7.8; 9.2
65	7.9	7.2; 8.6

Conclusion(s): In contrast to Xe and isoflurane, yet similar to Xe and sevoflurane, the anesthetic effects of Xe and desflurane appear to interact in a linear way.

References:

- 1 Hecker KE et al. Minimum Anesthetic Concentration (MAC) of Isoflurane with Different Xenon Concentrations in Swine. *Anesth Analg* 2003; 96:119–24.
- 2 Hecker KE et al. Minimum Anesthetic Concentration of Sevoflurane with Different Xenon Concentrations in Swine. *Anesth Analg* 2003; 97:1364–9.

A-511

Haemodynamic effect and cost analyse of dexmedetomidine in BIS-guided desflurane anaesthesia

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Background and Goal of Study: Dexmedetomidine (DEX) was reported to reduce anaesthetic requirements when used as adjuvant to general anaesthesia. In previous studies (1,2), we were, however, not able to confirm this reduction when bispectral index (BIS, version 3.3, Aspect, USA), and not cardiac parameters, were used as a guide to anaesthetic requirements. Therefore, in a double blind study we investigated the effect of infusion of DEX on anaesthetic requirements, per-operative haemodynamic stability, recovery and cost analyses.

Materials and Methods: With ethics Committee approval and patient consent, 40 patients undergoing lumbar discectomy were studied. Patients were randomly allocated to receive either DEX (n = 20) (1 µg.kg⁻¹ initial loading dose for 10 min; maintenance 0.2 µg.kg⁻¹ h⁻¹) or normal saline (NS) (n = 20). In all patients anaesthesia was induced with thiopentone and rocuronium and was maintained with desflurane in a mixture of N₂O/O₂ titrated to maintain a BIS between 45–60. HR, MAP, CO (NICO, Novametrics Medical systems Inc., Conn, USA) and BIS were recorded. Recovery characteristics, postoperative pain, and total cost were determined. Results were presented as means ± SD and were compared using one-way ANOVA.

Results and Discussions: The groups were demographically similar. During the 10 min DEX loading period and after the skin incision MAP decreased in the DEX group, but stayed at the baseline level in the NS group (p < 0.05). One minute after the tracheal intubation, MAP and HR increased in the NS group, but not changed in the DEX group (p < 0.05). HR and CO values stayed approximately at baseline levels in both groups. The mean time of awakening, extubation, and orientation were shorter in the DEX group (p < 0.05). The total cost was significantly lower in the DEX group than in the NS group (p < 0.05).

Conclusion(s): In patients undergoing lumbar spinal surgery using BIS-guided desflurane anaesthesia, we found blunted pressure response to intubation, decreased the intraoperative blood pressure and decreased the desflurane requirements and total cost, when applying a continuous infusion of dexmedetomidine.

References:

- 1 Aantaa R, Jaakola ML, Kallio A, et al. *Anesthesiology* 1997; 86:1055–60.
- 2 Lawrence CJ and De Lange S. *Anaesthesia* 1997; 52:736–44.

A-512

Volatile anesthetic inhibition of neuronal sodium–calcium exchange

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Background and Goal of Study: Na⁺/Ca²⁺ exchange (NCX), especially in Ca²⁺ influx mode, is important for neuronal synaptic transmission.¹ There is relatively little data on mechanisms of anesthetic action on neuronal Ca²⁺ regulation. We examined the effect of clinically-relevant concentrations of halothane, isoflurane and sevoflurane on NCX in rat pheochromocytoma (PC12) cells.

Materials and Methods: Differentiated PC12 cells loaded with the ratiometric fluorescent Ca²⁺ indicator fura-2 were imaged using real time video microscopy. Cells were initially perfused with normal Tyrode's solution (2.5 mM Ca²⁺), and then "Na⁺-loaded" with 0 Ca²⁺, 145 mM Na⁺ Tyrode's and 5 µM CPA + 10 µM ryanodine (functionally isolating the plasma membrane).² After 2 min, 0 Na⁺, 2.5 mM Ca²⁺ was rapidly reintroduced selectively activating influx mode NCX and increasing [Ca²⁺]_i. Influx via NCX was verified using inhibitors of N- and P/Q type Ca²⁺ channels (agatoxin and ω-conotoxin) and NCX (KBR-7943). Cells were then washed and the protocol repeated in the presence of volatile anesthetics (introduced prior to NCX re-activation).

Anesthetic effects on relationships between Na^+ gradient and NCX activity was examined by Na^+ loading with 35 mM, 70 mM, or 145 mM Na^+ .

Results and Discussions: Ca^{2+} influx following reintroduction of 0 Na, 2.5 mM Ca^{2+} was not significantly affected by agatoxin or conotoxin, while KBR7943 produced ~90% inhibition demonstrating NCX. Compared to controls, 0.5–1.5 MAC halothane and isoflurane both significantly inhibited NCX in a concentration dependent fashion ($p < 0.05$; paired comparisons), while sevoflurane < 1.5 MAC did not inhibit NCX. Decreasing Na^+ concentration significantly slowed NCX, with both halothane and isoflurane potentiating this effect, thus demonstrating interference with Na^+ regulation of NCX.

Conclusions: Volatile anesthetics interfere with neuronal $[\text{Ca}^{2+}]_i$ regulation by inhibiting Ca^{2+} influx via NCX, thus preventing Ca^{2+} -mediated neurotransmitter release.

References:

- Zucker RS. *J Physiol Paris* 1993; 87:25–36.
- Seckin I, Sieck GC, Prakash YS. *J Physiol* 2001; 531:92–104.

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A-514

Effect of intravenously administered dexmedetomidine premedication on hemodynamics, intubating condition and sevoflurane requirement during minor surgical procedures

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Background and Goal of Study: This prospective, randomized, double-blind, controlled study was designed to test the effect of single dose intravenous (IV) dexmedetomidine premedication on hemodynamics, intubating condition and sevoflurane requirements in minor surgical procedures.

Material and Methods: Sixty patients were allocated randomly to receive IV dexmedetomidine (1 microgram kg^{-1}) (D), or saline (S) 10 minutes before induction of anaesthesia. Anaesthesia was induced by thiopental 5 mg kg^{-1} and maintained with sevoflurane plus 70% $\text{N}_2\text{O}/30\%$ O_2 in both group. Following laryngoscopy and intubation, intubating conditions were assessed using Goldberg scale. Haemodynamic parameters and sevoflurane requirements (volume %) were recorded at preoperatively, after anaesthesia induction and at 5, 15, 30, 60 minutes after endotracheal intubation.

Results and Discussion: Mean Goldberg scores were 1.36 [SD 0.4] and 1.26 [SD 0.5] in the D and S group respectively. There were no significant difference in intubation conditions between two groups. Mean arterial blood pressure and heart rate increased after endotracheal intubation and during laryngoscopy in both groups, but the mean arterial pressures after tracheal intubation were similar between two groups. Although mean heart rate decreased in D group after intubation (82 [SD 14] beats/min) compared to S group (86 [SD 14] beats/min), there was no significant difference between two groups. Sevoflurane concentration (volume %) decreased with time in both groups. However there was no significant difference in sevoflurane concentration (volume %) between two groups at any study periods.

Conclusion: Preoperatively administered IV dexmedetomidine (1 microgram kg^{-1}) did not decrease sevoflurane requirements and reduce heart rate, systolic and diastolic arterial pressures. Dexmedetomidine premedication did not appear to influence the pharmacokinetics of sevoflurane.

A-515

Oxidative damage in patients undergoing pulmonary resection

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Background and Goal of Study: Lung resection may be complicated by post-pneumonectomy pulmonary oedema or acute respiratory distress syndrome. The aim of present study was to determine during operative period the time course of the glutathione oxidation and lipid peroxidation as markers of redox status, possible antioxidant effect of propofol.

Materials and Methods: Two groups ($n = 20$ each) of patients undergoing lobectomy were investigated. Group 1, anesthetized with sevoflurane (induction with penthotal); and Group 2, anesthetized with propofol (TIVA, 2 mg/kg/h). Controlled mechanical ventilation, FiO_2 : 35% (group 1) and FiO_2 : 80% (group 2). Four arterial blood samples were taken from the radial artery

at four times: 1°) immediately after anesthesia induction, 2°) 5 min. before pulmonary artery ligation, 3°) 5 min. after lung reexpansion, 4°) 60 min. after lung reexpansion. Levels of reduced glutathione (GSH, main intracellular), and oxidized glutathione (GSSG) and lipid peroxidation (malondialdehyde, MDA) were measured. We used T test, with a confidence interval of 95%.

Results and Discussions: means (nmol/mL) \pm SD

		MDA	GSH	GSSG
Group 1:	1°)	1.0 \pm 0.46	528 \pm 137	23.6 \pm 10.0
	2°)	1.2 \pm 0.36	483 \pm 152	27.5 \pm 6.9
	3°)	1.6 \pm 0.83	462 \pm 118	29.2 \pm 7.6
	4°)	1.0 \pm 0.45	562 \pm 164	22.5 \pm 8.5
Group 2:	1°)	0.71 \pm 0.23	562 \pm 87	10.0 \pm 4.4
	2°)	0.69 \pm 0.19	528 \pm 96	11.0 \pm 5.1
	3°)	0.75 \pm 0.17	528 \pm 125	7.1 \pm 2.7
	4°)	0.88 \pm 0.36	531 \pm 621	13.0 \pm 2.7

In group 1, GSH is decreased by oxidation at 3° and 4° times; GSSG and MDA were increased at 2° and 3° times. In group 2, no changes in GSH, GSSG and MDA levels were observed.

Conclusion: Oxidative damage occurs during lobectomy in blood. The relevant lung is completely collapsed and potentially suffer ischemia-reperfusion by following re-expansion of collapsed lung after lobar resection. The propofol and FiO_2 80% may be good choice of anesthetic in this surgery due to its antioxidant properties.

A-516

Volatile anesthetics interfere with regulation of store-operated calcium channels in airway smooth muscle

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Background and Goal of Study: Volatile anesthetics deplete sarcoplasmic reticulum (SR) Ca^{2+} stores in airway smooth muscle (ASM), producing bronchodilation.¹ Depletion of SR Ca^{2+} stores triggers Ca^{2+} influx via store-operated Ca^{2+} channels (SOCC) for SR replenishment, a recently identified mechanism.² We hypothesized that volatile anesthetics interfere with regulation of SOCC triggered by increased SR Ca^{2+} depletion, thus enhancing ASM relaxation. We focused on agonist stimulation and cyclic nucleotides which usually modulate ASM.

Materials and Methods: SR Ca^{2+} was depleted in porcine ASM cells by 5 mM caffeine in 0 extracellular Ca^{2+} , nifedipine and KCl (preventing Ca^{2+} influx through L-type and SOCC channels).² Extracellular Ca^{2+} was rapidly introduced to selectively activate SOCC in the presence or absence of 1 or 2 MAC halothane, isoflurane or sevoflurane. SOCC was characterized using previously-described techniques.² Anesthetic interference with SOCC regulation was examined by activating SOCC in the presence of a) 10 nM, 100 nM or 1 μM ACh; b) 1 μM isoproterenol; c) 1 μM dibutyl cAMP; d) 1 μM DEANO (nitric oxide donor) and e) 1 μM 8-Br-cGMP.

Results and Discussions: Following SR Ca^{2+} depletion, reintroduction of extracellular Ca^{2+} rapidly elevated intracellular Ca^{2+} . This influx was enhanced by ACh (concentration-dependent), but potently inhibited by cAMP or cGMP activation. Pre-exposure to 1 or 2 MAC anesthetic (halothane $>$ isoflurane $>$ sevoflurane) inhibited SOCC-mediated Ca^{2+} influx. Only halothane and isoflurane inhibited ACh-induced augmentation of Ca^{2+} influx, and potentiated cyclic nucleotide inhibition, even at 1 MAC.

Conclusions: Volatile anesthetics prevent SR refilling by inhibiting SOCC and interfering with agonist- and cyclic nucleotide regulation of SOCC in ASM. This will likely lead to further relaxation of ASM in the presence of anesthetics.

References:

- Pabelick CM, Prakash YS, Kannan MS, Warner DO, Sieck GC. *Anesthesiology* 2001; 95:207–215.
- Ay B, Prakash YS, Pabelick CM, Sieck GC. *Am J Physiol* 2003; in press.

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A-517

Sevoflurane kinetics in children: comparison with adults

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Background and Goal of Study: Neither the wash-in of Sevoflurane in children nor a comparison of Sevoflurane kinetics between children and adults have been reported (1). This trial characterizes and compares the wash-in

and wash-out periods of Sevoflurane in children and adults, during the course of ordinary anaesthetic.

Materials and Methods: 7 children (2–10 years) and 8 adults (28–43 years), ASA I, under remifentanyl/propofol anaesthesia were studied. Hemodynamics was maintained within 20% of basal values and minute ventilation controlled to obtain normocapnea. Once stable, Sevoflurane 1% was administered for 30 minutes and then stopped. End-tidal Sevoflurane concentration was measured during wash-in and for 30 minutes of the wash-out period. FA/VI defined the wash-in and FA/FAO defined wash-out. Compartmental models were fitted separately for the wash-in and the wash-out periods in each individual using least-square analysis. Time constants for each compartment were calculated. Statistics were with unpaired t-test; a p value < 0.05 was considered significant.

Results and Discussions: FA/VI ratio increased more rapid in children than in adults. A two compartmental model better characterized the wash-in and wash-out periods in children and adults.

Time constants (minutes)

Period	Compartment	Children	Adults
Wash-in	1	0.27 ± 0.07*	0.40 ± 0.07
	2	5.6 ± 2.1	5.8 ± 3.4
Wash-out	1	0.31 ± 0.07	0.34 ± 0.08
	2	8.9 ± 1.7	11.9 ± 3.7

Values are mean ± SD. *different from adults (P < 0.05)

Conclusion(s): In daily anaesthetic practice, a two compartment model adequately described wash-in and wash-out of Sevoflurane in both populations. Only the initial part of the wash-in period is faster in children than adults. This difference is probably not clinically important, since a poorly soluble agent such as Sevoflurane is scarcely affected by alveolar ventilation. Wash-out of Sevoflurane is similar in both populations.

Reference:

- 1 Lerman J. *Anesth Analg* 1995;81:S4–10.

A-518

Desflurane and sevoflurane – the influence on the selected components of the microsomal monooxygenases system

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Background and Goal of Study: Desflurane and sevoflurane are partially metabolized (Des. 0.02%; Sev. 3–5%) by cytochrome P450. We compared the influence of both on the selected components of the microsomal monooxygenases system of rabbit's liver.

Materials and Methods: An experiment was conducted on 56 male grey Chinchilla rabbits – they were divided into control (C) and experimental groups (I–III) (tab. 1) – the point of division was the duration of exposure to desflurane or sevoflurane respectively and the time after what the experimental rabbits were killed. After decapitation the liver was excised to assess the level of cytochrome P450 and b5 and the activities of NADPH-cytochrome P450 reductase and NADH-cytochrome b5 reductase.

Table 1

CD/CS	Control groups
I D/I S	Induction 5' (3,0 MAC), intubation, decapitation
II D/II S	Induction 5' (3,0 MAC), intubation, maintenance 60' (1,0 MAC), decapitation
III D/III S	Induction 5' (3,0 MAC), intubation, maintenance 60' (1,0 MAC), decapitation 24 h after termination of anesthesia

Results and Discussions:

Table 2

Groups	Cytochrome P450		Cytochrome b5		NADPH-cytochrome P450 reductase		NADH-cytochrome b5 reductase	
	Median	SD	Median	SD	Median	SD	Median	SD
CD	0,548	0,023	0,532	0,032	0,093	0,007	0,586	0,049
I D	0,601*	0,054	0,577*	0,045	0,109**	0,010	0,650*	0,059
II D	0,506**	0,029	0,483*	0,050	0,111**	0,012	0,606	0,046
III D	0,580	0,057	0,481*	0,058	0,126***	0,008	0,689**	0,055
CS	0,495	0,052	0,587	0,067	0,067	0,011	0,545	0,105
I S	0,653**	0,107	0,577	0,046	0,098***	0,008	0,614	0,120
II S	0,489	0,047	0,428***	0,031	0,065	0,006	0,492	0,077
III S	0,474	0,063	0,487**	0,065	0,059	0,008	0,561	0,037

(*p < 0,05; **p < 0,01; *** < 0,001)

Conclusion(s): Sevoflurane is more potent cytochrome b5 inhibitor than desflurane. Desflurane activates both reductases stronger than sevoflurane.

The influence of both anesthetics on cytochrome P450 is unclear with inhibitory tendency.

References:

- 1 Eger El et al., *Anesthesiology* 1997; 87:517–526.
- 2 Khrasch ED et al., *Anesthesiology* 1993; 79:795–807.
- 3 Njoku D et al., *Anesth. Analg.* 1997; 84:173–178.

A-519

Xenon does not influence post-ischaemia recovery of left ventricular function

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Background and Goal of Study: The hypothesis that xenon positively influenced post-ischaemic recovery of left ventricular (LV) function, as compared to control (thiopental) or isoflurane, was tested in a pig model.

Materials and Methods: 24 pigs (weight 30–35 kg) were anaesthetised with thiopental. Pulmonary artery (Edwards) and LV pressure-volume catheters (CD Leycom) were inserted. After sternotomy, a tourniquet was placed around the left anterior descending artery (LAD) distal to the first diagonal branch. End-systolic pressure–volume relationship (ESPVR) was determined by short preload reduction (balloon occlusion of inferior caval vein). ESPVR was compared in three groups (control: thiopental alone; xenon: 0.5 MAC added; isoflurane: 0.5 MAC added to inspired gas mix) at four stages: 1. prior to ischaemia, 2. after 5 intervals of 5 min LAD occlusion and 5 min reperfusion, resp., 3. 60 min later, 4. 120 min later.

Results and Discussions: While global haemodynamics are comparable between groups, ESPVR is unchanged in the control group throughout. With xenon, there is a trend towards an increase shortly after ischaemia and again at 120 min. However, this is not significantly different from control. Increased ESPVR after ischaemia is also found with isoflurane and becomes significant after 60 and 120 min (fig. 1).

Conclusion: Although intermittent ischaemia does not affect global contractility as determined by ESPVR, reperfusion appears to produce an increase in ESPVR. While isoflurane significantly increases this effect, xenon has no influence different from control.

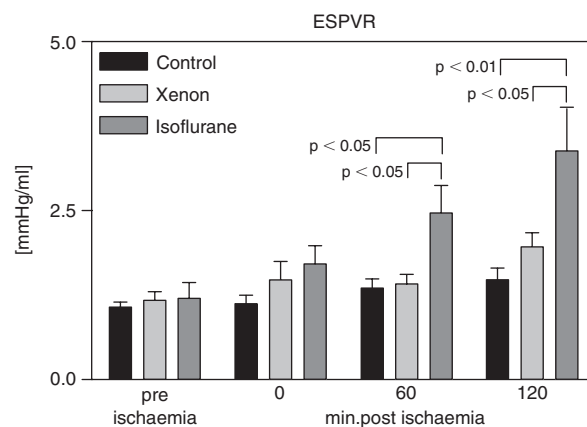


Figure 1. ESPVR (mean, SD) from n = 8 in each group.

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Influence of temperature on the negative inotropic effect of volatile anesthetics

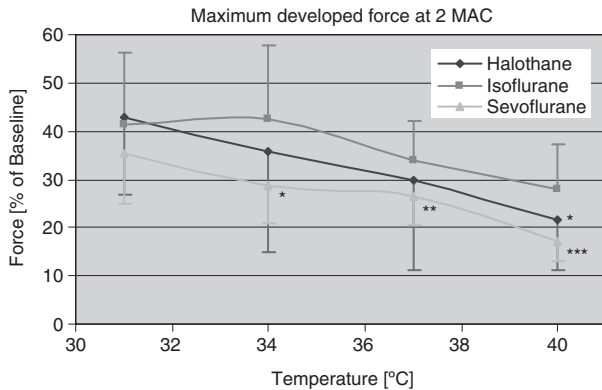
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Background and Goal of Study: The negative inotropic effect of volatile anesthetics in normothermia is well established. However, the inotropic response to halothane, isoflurane and sevoflurane was not investigated during hypo- and hyperthermia. Therefore, we studied the influence of temperature on the negative inotropic effect of halothane, isoflurane and sevoflurane.

Materials and Methods: 120 ventricular trabeculae, 40 for each volatile anesthetic, from 41 female New Zealand White Rabbits were placed in an oxygenated HEPES-Buffer and stimulated at a frequency of 1 Hz. At 40°C, 37°C, 34°C and 31°C, the anesthetic concentrations were stepwise increased to 2 MAC. Maximum developed force was continuously recorded.

Results are presented as mean \pm SD. For statistical analysis, MANOVA was performed. A level of $p < 0.05$ was considered statistically significant.

Results and Discussions: Hypothermia partially abolished the negative inotropic effects of sevoflurane and halothane, whereas no change in developed force was found for isoflurane. Developed force in trabeculae gassed with halothane was significantly more decreased at 40°C compared to 31°C ($p < 0.05$). Administration of Sevoflurane caused more depression at 40°C compared to 37°C ($p < 0.05$), 34°C ($p < 0.01$) and 31°C ($p < 0.001$).



* $p < 0.05$; * $p < 0.01$; *** $p < 0.001$; compared to 40°C

Conclusion(s): The depression of developed force induced by halothane and sevoflurane is less pronounced during mild hypothermia than during hyperthermia.

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Antihypertensive multitherapy including angiotensin converting enzyme inhibitors and cardiovascular response to anaesthetic induction

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Background and Goal of Study: Angiotensin Converting Enzyme inhibitors (ACEI) are increasingly used in the treatment of hypertensive disease, usually in combination with other antihypertensive drugs rather than monotherapy. Recent studies have demonstrated ACEI's haemodynamic effect associated with anaesthesia induction.^{1,2} In this study the cardiovascular response to anaesthetic induction in patients treated with a combination of antihypertensives including or not ACEI is investigated.

Materials and Methods: Fifty-six consecutive hypertensive adults (ASA II-III) receiving multitherapy and presented for surgery under general anaesthesia were included in the study. Patients were divided into two groups: those with an ACEI included in their therapy (Group ACEI, $n = 34$) and those without (Group nonACEI, $n = 22$). ACEI were stopped at least 12 hours before anaesthesia. Blood pressure and heart rate were recorded a) in the preoperative visit b) before anaesthesia induction c) after anaesthesia induction d) after tracheal intubation. Statistical comparisons were performed with Two-Way ANOVA and t-test as appropriate. A $p < 0.05$ level was considered statistically significant.

Results and Discussion: The overall variance of SAP was greater in ACEI group (Two-Way ANOVA, $p < 0.05$). No difference in DAP was found. HR was lower in nonACEI group ($p < 0.05$). There was greater reduction of SAP after anaesthesia induction ($p < 0.01$) and greater increase after intubation ($p < 0.001$) in ACEI group.

		Preop visit	Pre induct	Post induct	Post intub
Group ACEI $n = 34$	SAP	148 \pm 18	159 \pm 23	106 \pm 21	144 \pm 22
	HR	76 \pm 12	81 \pm 18	72 \pm 14	76 \pm 13
Group nonACEI $n = 22$	SAP	144 \pm 17	150 \pm 16	120 \pm 25	127 \pm 28
	HR	76 \pm 9	74 \pm 9	68 \pm 11	74 \pm 11

Values in the table are mean \pm SD

Conclusion(s): Hypertensive patients with an ACEI included in their multitherapy are more sensitive to induction of anaesthesia, and intubation of the

trachea (in relation to those without an ACEI included), as it is shown by the SAP response.

References:

- 1 Brabant SM, Bertrand M, Eyraud D, et al. *Anesth Analg* 1999; 88:1388-92.
- 2 Licker M, Schweizer A, Hohn L, et al. *Can J Anesth* 2000; 47:433-40.

A-524

A novel ultra short acting beta-blocker, landiolol suppress the central sympathetic nerve activity directory and exerts a more potent negative chronotropic effect and less effect on blood pressure than esmolol

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Background and Goal of Study: Landiolol, a recently developed ultra-short acting β -blocker¹. The purpose of this study was to measure and compare the effects of bolus administration of landiolol and esmolol on heart rate (HR), mean arterial pressure (MAP) and renal sympathetic nerve activity (SNA).

Materials and Methods: Baroreceptor-denervated New Zealand white rabbits (3.2-3.8 kg) were used. Landiolol group (LAN; $n = 8$): landiolol 0.3, 1.0, 3.0 and 10 mg iv, esmolol group (ESM; $n = 8$): esmolol 0.5, 1.5 and 5.0 mg iv. HR, MAP and SNA were recorded and values before each bolus injection were defined as 100% control values for comparison. Statistical analysis was performed using repeated measures ANOVA, followed by Duncan's new multiple range method. Differences with a statistical probability of less than 0.05 were considered significant.

Results and Discussions:

LAN	0.3 mg/kg	1.0 mg/kg	3.0 mg/kg	10 mg/kg
HR %	-4.4 \pm 0.8*	-10.1 \pm 1.9*	-13.3 \pm 2.6*	-12.1 \pm 2.7*
MAP%	-1.8 \pm 0.9	-4.3 \pm 1.9	-13.8 \pm 2.8*	-23.8 \pm 3.9*
SNA %	-7.6 \pm 4.0	-4.1 \pm 3.9	-10.6 \pm 4.4	-6.4 \pm 4.2*
ESM	0.5 mg/kg	1.5 mg/kg	5.0 mg/kg	
HR%	-8.8 \pm 2.5*	-11.6 \pm 2.4*	-12.1 \pm 1.9*	
MAP%	-22.6 \pm 1.8*	-33.9 \pm 3.9*	-55.9 \pm 6.6*	
SNA %	-8.8 \pm 3.6	-6.1 \pm 3.1*	-17.4 \pm 6.0*	

Maximum reduction rate in each group (mean \pm SE). * $P < 0.05$ vs baseline values. In LAN, the maximum reduction of HR and MAP observed at 40 seconds after the iv injection and in ESM, those observed 60 seconds after injection.

Conclusion(s): Landiolol has more potent negative chronotropic effects than esmolol. The tendency of the decreased RSNA suggests that landiolol and esmolol may suppress the central sympathetic nerve activity directly if the dose is highest enough.

Reference:

- 1 Chem Pharm Bull 40: 1462-9, 1992.

A-527

Tropisetron given before induction of anaesthesia prevents shivering after gynecological laparotomies

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Background and Goals: Tropisetron is a serotonin (5-HT) antagonist used to treat postoperative nausea and vomiting. Aim of this study was to investigate the effect of tropisetron on intraoperative core temperature and post-anaesthetic shivering (PAS).

Materials and Methods: 90 patients scheduled for elective gynecological laparotomies were randomly separated into three groups: GROUP A ($n = 30$) received 0.2 mg/kg of tropisetron intravenously (iv), just before the onset of operation. GROUP B ($n = 30$) received iv 0.5 mg/kg of tropisetron, and GROUP C ($n = 30$) which was the control group received iv only saline. Patients with muscle diseases, Parkinson disease, fever (temp $> 37.5^\circ\text{C}$), needing vasoconstrictors perioperatively and having received α_2 -adrenergic agonists for long-term treatment were excluded from the study.

General anaesthesia was induced with fentanyl 5 $\mu\text{g}/\text{kg}$ and thiopentone 5 mg/kg followed by rocuronium 0.8 mg/kg for endotracheal intubation. After induction all the patients received sevoflurane 1% in 50% N_2O + 50% O_2 for maintaining anaesthesia. Ambient temperature was maintained at 20°-22°C with constant humidity. Baseline core temperature was recorded by using an esophageal thermometer. Hemodynamic parameters (noninvasive blood pressure and heart rate) were recorded every 3 minutes. Shivering was

documented visually in the recovery room. It was defined as readily detectable fasciculations or tremors of the face, trunk or limbs of a minimum of 15 sec duration. Incidence of shivering was analyzed by using χ^2 test.

Results: Tropisetron (0.5 mg/kg) given intravenously just before the onset of anaesthesia reduce the incidence of postoperative shivering although there was no statistical difference in core temperature between the three groups. There was also no statistical difference in demographic data, the duration of anaesthesia and the hemodynamic parameters between the groups. Tropisetron 0.2 mg/kg given intravenously as a normal dose for preventing postoperative nausea and vomiting did not reduce significantly the incidence of shivering.

	GROUP C (n = 30)	GROUP A (n = 30)	GROUP B (n = 30)
Shivering	16 (54%)*	13 (43,3%)	8 (26,6%)*
No shivering	14 (46%)	17 (56,6%)	22 (73,3%)

Conclusion: Serotonin (5-HT₂) antagonists used to treat postoperative nausea and shivering seems to have also a useful role on preventing post-anaesthetic shivering, although the dose required for this effect is significantly increased.

References:

- Powell RM, Buggy DJ: *Anesth Analg* 2000; 90: 1423–7.
- Piper SN, Röhm KD et al: *Anesth Analg* 2002; 94: 106–11.

A-528

Dexmedetomidine prevents postanesthetic shivering as does meperidine

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Background and Goals: Shivering is a frequent complication in the post-operative period and may be very distressing. Meperidine, a combined μ - and κ -receptor agonist, is frequently recommended for the treatment and prevention of postanesthetic shivering (1,2). This placebo-controlled study was performed to evaluate the efficacy of dexmedetomidine compared with meperidine in preventing postanesthetic shivering.

Materials and Methods: We studied 120 patients undergoing elective abdominal or orthopedic surgery under standardized general anesthesia. At the time of wound closure patients were randomly assigned to one of three groups (each group n = 30). Group D received 1 μ g/kg dexmedetomidine; group M, 0.5 mg/kg meperidine; group P, saline 0.9% as placebo. Post-anaesthetic shivering and sedation were assessed during recovery. Arousal state was assessed by response of the patient to verbal command.

Results: Shivering and sedation data are shown in the table. Both dexmedetomidine and meperidine caused a significantly prolonged emergence time (4.28 \pm 2.00 and 5.20 \pm 2.01 min, respectively) compared with placebo (3.22 \pm 1.52 min). Dexmedetomidine caused a significantly prolonged arousal state time (16.42 \pm 7.49 min) compared with meperidine and placebo (9.85 \pm 4.29 and 7.30 \pm 3.45 min., respectively).

min	Shivering Score			Sedation Score		
	Group D	Group M	Group P	Group D	Group M	Group P
0.	0 (0–3)*	0 (0–3)*	0 (0–3)	4.5 (2–5)**	3 (1–5)*	2.5 (1–5)
5.	0 (0–3)*	0 (0–3)*	0 (0–3)	4 (2–5)**	3 (1–5)*	2 (1–5)
10.	0 (0–3)*	0 (0–2)*	0 (0–3)	3 (1–5)**	2 (1–5)	2 (1–4)
15.	0 (0–3)*	0 (0–3)*	0 (0–3)	3 (1–5)**	2 (1–4)*	2 (1–3)
30.	0 (0–3)	0 (0–2)	0 (0–3)	2 (1–4)**	1 (1–3)	1 (1–2)
60.	0 (0–1)	0 (0–1)	0 (0–1)	1 (1–2)	1 (1–2)	1 (1–2)

Data are presented Median (min–max)

*p < 0.05 when compared with placebo group

+p < 0.05 when compared with meperidine group

Conclusions: Dexmedetomidine may be an suitable alternative to meperidine for preventing postanesthetic shivering.

References:

- Macintyre P.E., et al. *Anesth Analg* 1987; 66:751–755.
- Alfonsi P., et al. *Anesthesiology* 1998; 89:43–48.

A-529

Haemodynamic response to magnesium sulphate (MgSO₄) during infusion of norepinephrine in piglets

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Background and Goal of Study: Magnesium sulphate has been proposed to control adrenergic crisis during phaeochromocytoma surgery (1). The aim

of our study was to assess the haemodynamic responses to MgSO₄ in norepinephrine induced-hyperadrenergic state in pigs.

Materials and Methods: 17 Large-White pigs were studied during general anaesthesia using 1.7% expired fraction isoflurane, in N₂O/O₂ mixture. An arterial and a Swan-Ganz catheters were inserted. After equilibration period and baseline haemodynamic measurements (T0), animals received an increasing infusion of norepinephrine begun at the rate of 0.5–3.5 μ g kg⁻¹ min⁻¹ by steps of 0.5 μ g kg⁻¹ min⁻¹ (T1). Norepinephrine was then maintained during 60 min (T2). Animals were divided into 2 groups. Control group C (n = 9) received norepinephrine alone. After T0, group M (n = 8) received prophylactic MgSO₄: 20 mg kg⁻¹ bolus followed by a 40 mg kg⁻¹ h⁻¹ infusion. Bolus of 20 mg kg⁻¹ MgSO₄ were then repeated up to 7 times and infusion was increased up to 100 mg kg⁻¹ h⁻¹, as necessary, with the aim to return haemodynamics to baseline or as closely as possible (T2). Anova for repeated measurements was used (p < 0.05).

Results and Discussions: Results are expressed as mean (SD)

		HRV b·min	MAP mmHg	CO l·min ⁻¹	SVR dynes·s·cm ⁻⁵
T0	C	110 (7)	65 (9)	4.1 (0.7)	1231 (176)
	M	121 (22)	62 (5)	4.3 (0.7)	1144 (186)
T1	C	241 (18)*	103 (13)*	7.4 (2.1)*	1136 (242)
	M	210 (9)*	74 (4)*	7.8 (2.0)*	805 (239)*
T2	C	253 (15)*	90 (10)* [§]	6.8 (1.2)*	1011 (143)
	M	205 (13)*	64 (5) [§]	7.8 (2.0)*	665 (149) [§]
Interaction Group x time					
		p < 0.05	p > 0.05	NS	p < 0.05

Intragroup comparison: *vs T0, [§] vs T1

In group M, full dose of MgSO₄ was used for each animal.

Conclusion(s): During norepinephrine induced-hyperadrenergic state in pigs, MgSO₄ allowed to normalize MAP and to slightly decrease HR, but CO remained unchanged. Cardiac arrhythmia was not observed. Association with β -blockers and interaction with muscle relaxant need to be investigated in phaeochromocytoma.

Reference:

- James MF. *Br J Anaesth* 1989; 62:616–623.

A-530

Influence of premedication and smoking on fentanyl-induced coughing during induction in anaesthesia

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Background and Goal of Study: Intravenous (IV) administration of fentanyl is a common practice to reduce the hyperdynamic response to tracheal intubation during induction on anaesthesia. However, this is commonly accompanied by cough (1,2). In the present study we evaluated the influence of smoking and premedication on fentanyl-induced coughing during induction in anaesthesia.

Material and Methods: After IRB approval, 50 patients (M/F: 22/28), ASA I–II, scheduled to undergo elective surgery were included. Patients were randomly allocated in two groups. In group A (n = 24) patients received oral premedication with temazepam 20 mg two hours before induction and in group B (n = 26) patients without premedication. In both groups IV fentanyl 2–3 mcg/kg was administered as first agent during induction in anaesthesia. Parameters recorded included presence or absence of cough and presence of smoking (>10 cigarettes/day) on history.

Results: There were no demographic differences between groups. Fentanyl-induced coughing on induction of anaesthesia presented in 5/24 (21%) of premedicated patients, and in 6/26 (23%) of non premedicated patients, two-tailed p = 0.27 (non statistical significant, Fisher's exact test). The smokers were totally 23/50 (46%) of patients, 12/25 (48%) in group A and 11/25 (44%) in group B. Concerning the influence of smoking on history, fentanyl-induced coughing on induction of anaesthesia presented in 6/23 (26%) of smokers and in 6/27 (22.2%) of non smokers (non statistical significant, Fisher's exact test).

Conclusion: There was found no influence of smoking and premedication on fentanyl-induced coughing during induction in anaesthesia.

References:

- Baily P. *Anesthesiology* 1999; 90:335.
- Ping-Wing L et al. *Can J Anaesth* 1996; 43:1217–19.

A-531

Enhancement of LV-arterial coupling induced by levosimendan

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Background and Goal of Study: Catecholamines exert inotropic action through a receptor-based mechanism. A new class of drugs, calcium sensitiser, increases troponin affinity to calcium. The purpose of the present study was to evaluate the effect of levosimendan on heart-arterial coupling.

Materials and Methods: 15 patients (13 males and 2 females), age 64 ± 7 , BSA 1.9 ± 0.1 , undergoing OPCAB for obstructive coronary artery disease were enrolled. All patients showed a basal EF higher than 30%. Patients were monitored with the Swan Ganz catheter and 5 MHz TEE probe (Philips-Omniplane II). All the following parameters were determined: HR, MAP, ESV, EDV, CO, PCWP, SVR, EF. We used left ventricular elastance ($E_{es} = ESP \times (ESV - Vo)$) to quantify cardiac contractility, and arterial elastance ($E_a = ESP - SV$) to describe vascular systemic resistance. We used heart-arterial coupling (E_a/E_{es}) to assess heart and vascular interactions.

Results and Discussions: MAP and SVR decreased significantly respectively from 2068 ± 740 to 1632 ± 595 , ($p < 0.001$) and from 105 ± 13 to 97 ± 14 mmHg ($p < 0.01$). ESV decreased significantly (from 25 ± 12 , to 22 ± 11 mm³/m², $p < 0.01$), CO and EF% increased significantly, respectively from 3.8 ± 1.0 to 4.4 ± 1.1 l/min ($p = 0.01$), and from $42 \pm 12\%$ to $48 \pm 14\%$ ($p = 0.02$). PCWP decreased not significantly (from 17 ± 4 , to 16 ± 3 mmHg). E_a decreased significantly (from 7.9 ± 2.6 , to 5.9 ± 2.6 mmHg/ml/m², $p = 0.07$); E_{es} increased significantly (from 7.19 ± 3.4 , to 8.68 ± 4.7 mmHg/ml/m², $p < 0.01$); E_a/E_{es} decreased significantly (from 1.1 ± 0.5 , to 0.8 ± 0.5 , $p = 0.02$).

Conclusion(s): The administration of levosimendan improves cardiac contractility, reduces arterial load, and increases cardiac output in patients with CAD. The administration of the calcium sensitiser improved the heart-arterial coupling (E_a/E_{es}), leading it to values between 0.5 e 1 with a significant shift (from mean values >1 to 0.83). This shift has been mostly due to a reduction of E_a and to an increase of E_{es} .

A-532

Why do women wake up faster than men after propofol anaesthesia?

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Background and Goal of Study: It has been shown that women wake up faster than men after propofol anaesthesia (1,2). We wanted to study if the faster emergence is caused by pharmacokinetic differences, stating that female patients have a more rapid decline in serum propofol after termination of the infusion.

Materials and Methods: After approval of The Regional Ethical Committee and written informed consent, 30 female and 30 male young patients in ASA class I-II were enrolled in an open study. They were all admitted for surgery in the lower limb in regional anaesthesia. Propofol was given as the only sedative drug, titrated by a target control system (Diptifusor®) to sleep with a BIS value between 40 and 60. Blood samples for serum-propofol measurements (S-prop) were taken just before the TCI-infusion was stopped (T1), and when the patients woke up (T2). The decline in s-propofol concentration, k_e , was calculated as $\Delta(\ln(s-prop T2) - \ln(s-prop T1)) / \text{emergence time}$.

Results:

	Men	Women	P
Emergence time, min	8.2 ± 3.7	5.6 ± 2.4	0.003
BIS T1	45 ± 10	45 ± 7	0.88
BIS T2	79 ± 5	76 ± 8	0.20
TCI prop T1, µg/ml	3.6 ± 0.9	4.0 ± 0.9	0.07
TCI prop T2, µg/ml	1.8 ± 0.5	2.3 ± 0.6	0.001
s-prop T1, µg/ml	4.8 ± 1.4	4.2 ± 1.3	0.06
s-prop T2, µg/ml	3.1 ± 1.3	2.5 ± 0.8	0.05
k_e^*	0.052 ± 0.072	0.097 ± 0.077	0.02

*median, otherwise mean \pm SD

Conclusions: The female patients had a more rapid decline in s-propofol concentration, indicating that pharmacokinetic differences at least partly explain the faster emergence. The TCI algorithm fitted better for the females. Pharmacodynamic differences between the genders may also exist, as women had lower values of propofol both at termination of infusion and at awakening, despite similar BIS values.

References:

- Gan TJ, Glass PS, Sigl J, et al. *Anesthesiology* 1999; 90:1283–87.
- Hoymork SC, Raeder J, Grimsbo B, et al. *Acta Anaesthesiol Scand* 2000; 44:1138–44.

A-533

Pharmacodynamics of propofol in children and adults – comparison using the Alaris AEP index

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Background and Goal of Study: The so called *effective concentrations* (EC) are useful guides for the administration of intravenous anaesthetics. To our knowledge no EC for surgical degree of hypnosis has been determined in children. Thus, the aim of this study was to estimate the EC of propofol to reduce the AAI value to 30 (EC30), considered adequate for surgery, in children and adults.

Materials and Methods: After IRB approval, unpremedicated ASA I adult patients, from 20 to 60 years and children from 3 to 11 years undergoing surgery under general anaesthesia were studied. The EEG was recorded continuously in all patients with the Alaris AEP monitor (version 1.4). After the signal was stable, patients received a submaximal dose of propofol as a bolus, and the time from injection of propofol until the minimal AAI value was recorded (Tpeak). Using the pharmacokinetic parameters determined by Schnider for adults [1] and by Kataria for children [2], Tpeak was used to calculate the Keo according to the method proposed by Minto [3]. With the Keo and a sigmoidal Emax model, the values of EC50% and the Hill coefficient (λ) were obtained. Using these parameters the EC30 was estimated. Results were compared with Mann-Whitney and unpaired Student's t test. A $p < 0.05$ was considered significant. Values are median (range) or mean (CI95%).

Results: 10 children (3 to 11 yr) and 10 adults (20 to 51 yr) were studied. λ was 6.3 (1.6–53.6) in children and 7.8 (5.8–123.1) in adults (NS). EC50% ($\mu\text{g ml}^{-1}$) was 2.0 (CI95%: 1.3–2.7) in children and 4.7 (CI95%: 3.9–5.5) in adults ($p < 0.001$) and the EC30 ($\mu\text{g ml}^{-1}$) was 2.1 (CI95%: 1.4–2.8) in children and 4.7 (CI95%: 4.0–5.4) in adults ($p < 0.001$).

Conclusion(s): These results suggest that higher requirements of propofol in children are secondary to pharmacokinetic rather than pharmacodynamic differences with adults.

References:

- Schnider TW, Minto CF, Shafer SL, et al. *Anesthesiology* 1999; 90:1502–16.
- Kataria BK, Ved SA, Nicodemus HF, et al. *Anesthesiology* 1994; 80:104–22.
- Minto CF, Schnider TW, Gregg KM, et al. *Anesthesiology* 2003; 99:324–33.

A-534

Estimation of the Keo of propofol in children – comparison with adults

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Background and Goal of Study: Several pharmacokinetic studies allow the development of TCI systems for propofol in children, however, none has determined Keo. Its inclusion might improve the clinical effectiveness of the TCI system. In addition, since this parameter might be different from adults because of different cardiocirculatory characteristics, the adult Keo should not be used in children. The objective of this study is to determine the Keo of propofol in children and to compare this value with that of adults.

Materials and Methods: After IRB approval, unpremedicated ASA I adult patients, from 20 to 60 years and children from 3 to 11 years undergoing surgery under general anaesthesia were studied. The EEG was recorded continuously in all patients with the Alaris AEP monitor (version 1.4). After the signal was stable, patients received a submaximal dose of propofol as a bolus, and the time from injection of propofol until the minimal AAI value was recorded (Tpeak). Using the pharmacokinetic parameters determined by Schnider for adults [1] and by Kataria for children [2], Tpeak was used to calculate the Keo according to the method proposed by Minto [3]. Results were compared with Mann-Whitney and unpaired Student's t test. A $p < 0.05$ was considered significant. Values are mean \pm SD or median (range).

Results: 10 children (7.4 ± 2.8 yr) and 10 adults (40 ± 8 yr) were studied. The bolus of propofol (mg kg^{-1}) was 2.4 ± 0.4 in children and 1.5 ± 0.3 in adults ($p < 0.001$). Tpeak (s) was 152 ± 57 in children and 96 ± 18 in adults ($p < 0.01$). Keo (min^{-1}) was 0.35 (0.11–1.55) in children and 0.37 (0.27–0.93) in adults (NS). T1/2 Keo (min) was 2.0 (0.5–6.4) in children and 1.9 (0.7–2.6) in adults (NS).

Conclusion(s): Despite similar Keo and T1/2 Keo of propofol in children and adults, Tpeak is significantly longer in children. This is probably secondary to the much slower decrease of plasma concentrations after a bolus in children compared with adults [1,2].

References:

- Schnider TW, Minto CF, Shafer SL, et al. *Anesthesiology* 1999; 90:1502–16.
- Kataria BK, Ved SA, Nicodemus HF, et al. *Anesthesiology* 1994; 80:104–22.
- Minto CF, Schnider TW, Gregg KM, et al. *Anesthesiology* 2003; 99:324–33.

A-535

Pain on injection: a double-blind comparison of propofol 1% with iv lidocaine pre-treatment versus Propofol-Lipuro 1%

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Background and Goals: Propofol is widely used for intravenous induction; however, pain on injection is a major disadvantage with a 70% incidence when used without any intervention to reduce pain¹. Propofol-Lipuro® 1% (Bbraun, Germany) is a new formulation with a 10% fat emulsion of long and medium-chain triglycerides, with similar pharmacokinetics and efficacy as propofol², associated with less pain on injection³. Our goal was to compare the effect of Propofol-Lipuro® 1% on the incidence of pain, versus propofol with lidocaine 40 mg iv pre-treatment injected as a Bier's block, the most effective technique in reducing pain on injection¹.

Material and Methods: With IRB approval and informed written consent, 200 healthy women (ASA 1–2) scheduled for ambulatory gynecological procedures requiring general anesthesia were recruited. Women were allocated to one of two groups in a randomized double-blind fashion. Group PROP received lidocaine 2% 2 ml (40 mg) injected with a tourniquet 1 min before Propofol-Fresenius® 1% 2 mg/kg iv; group LIP received NaCl 0.9% 2 ml with tourniquet 1 min before Propofol-Lipuro® 1% 2 mg/kg iv. Spontaneous verbal expression of pain, movement of hand, frowning and moaning during injection were recorded. Women were asked for recall of pain (VAS 0–10), 30 min and 6 h post-operatively.

Results: 187 women completed the study (13 protocol violations: premedication with midazolam or missing data)

	LIP (n = 92)	PROP (n = 95)	P
Verbal expression of pain	47% *	24%	<0.001
Movement of hand	16%	11%	NS
Frowning	34%	23%	NS
Moaning	19%	11%	NS
Recall of pain @ 30' (VAS > 0)	36%	25%	NS
VAS @ 30 min (mean ± SD)	3.1 ± 2.8	2.3 ± 2.7	<0.05

*RR 1.61 (95%CI 1.22–2.13)

Conclusions: Contrary to our expectations, Propofol-Lipuro® results in a higher incidence of pain upon injection than propofol with iv lidocaine pre-treatment. This may be due to the diversity of pain definitions used in studies, or to the lack of premedication in our study. Studies on the effect on pain of new propofol formulations with iv lidocaine pre-treatment may be of interest.

References:

- 1 Picard P, *Anesth Analg* 2000; 90: 963–9.
- 2 Doenicke, *Anesth Analg* 1997; 85: 1399–403.
- 3 Rau J, *Anesth Analg* 2001; 93: 382–4.

A-536

Target controlled infusion (TCI) of propofol in paediatrics: a comparison of two pharmacokinetic models, Marsh and Paediatric age adjusted model with a simulator

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Background and Goal of Study: Diprifusor is a widely available for TCI delivery of propofol that doesn't accept weight and age below 30 Kg and 16 years, making it unsuitable for paediatric anaesthesia. The Paediatric Age Adjusted Model (PAAM) for TCI isn't available in an approved medical device. The availability of Diprifusor may tempt its use in children. We simulated the infusion of propofol using Marsh and PAAM to investigate if the use Diprifusor below its limits would result in an insufficient or excessive infused amount of propofol.

Materials and Methods: Simulations were performed with Rugloop I. We used 2 pharmacokinetic models: Marsh and PAAM with target plasma concentration of 4 µg/ml, comparing the amount of propofol infused after 60 min by the models. For ages between 10 and 16 years, we used the weight of the 50th percentile. Since the lowest weight accepted by Diprifusor is 30 Kg, the 50th percentile for a 10 year old child, for ages under 10 we compared data of PAAM and Diprifusor set to its limits.

Results and Discussions: Results are presented in table. Infused amount of propofol (mg) in 60 minutes

Age; Weight	Marsh	PAAM	Age; Weight	Diprifusor	Age; Weight	PAAM
16 Y; 62 Kg	699	1282	16 Y; 30 Kg	338	16 Y; 25 Kg	503
14 Y; 51 Kg	575	1057	14 Y; 30 Kg	338	14 Y; 21 Kg	405
12 Y; 40 Kg	451	829	12 Y; 30 Kg	338	12 Y; 17 Kg	306
10 Y; 31 Kg	350	638	10 Y; 30 Kg	338	10 Y; 12 Kg	188

Conclusion(s): If one was to use Diprifusor to administer propofol by TCI to children below 16 years, the amount of propofol infused would be lower, at least until 6 years, than the amount infused using the PAAM.

Reference:

Paediatric Anaesthesia 1999;9(3) 209–216.

A-537

Pharmacodynamics of AQUAVAN® bolus injection: A Phase I, dose escalation comparison with DIPRIVAN®

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Background and Goal of Study: AQUAVA® (AQ) (GPI 15715, Guilford Pharma., Baltimore, MD) is a water-soluble prodrug of propofol (1). This Phase I, open label, single bolus, dose escalation study compares the pharmacodynamics (PD) of propofol derived from AQ with those of DIPRIVAN® (DI) (Astra Zeneca, UK).

Materials and Methods: After IRB approval, 36 ASA I volunteers were randomized into 6 cohorts (male/female: 3/3) and given a single bolus dose of AQ (5, 10, 15, 20, 25, 30 mg/kg) within 30 s. BIS™-XP monitor (Aspect Medical Systems, Natick, MA) measured the hypnotic effect. Lowest BIS™ level (BIS_{peak}) was recorded. One week later, DI was given to the same subjects at 50 mg/min to reach a similar BIS_{peak}. Heart rate (HR), SpO₂, and blood pressure (BP) were monitored. Incidence and duration of apnea, loss (LOC) and return (ROC) of consciousness were measured with the OAA/S score. Side effects were recorded. Statistic analysis used (un)paired non-parametric tests and Pearson correlation.

Results and Discussions: In the 5 and 10 mg/kg AQ cohorts, no LOC was observed. In the 15 mg/kg AQ cohort, 5/6 subjects reached LOC. In the 20, 25 and 30 mg/kg AQ cohorts, LOC was observed in all subjects. Similar times until LOC were seen for AQ and DI. A dose related increase in duration of unconsciousness was longer when using AQ than DI. AQ BIS_{peak} occurred later than with DI (AQ: 623 ± 225 s; DI: 364 ± 273, p < 0.05). Pain on injection was only present with DI (12/36). With AQ, all subjects experienced a dose independent tingling sensation for 60 s after injection. Simultaneously, an initial increase in HR > 90 bpm (AQ: 33/36; DI: 13/36; p < 0.05) and BP was noted. With DI, early increases in BP were less pronounced with a less clear onset time. After the initial increase, a similar decrease in BP without clinically relevant hypotension was found with both drugs. Dose dependent apnea was more pronounced with DI than with AQ (AQ: 14/36; DI: 18/36).

Conclusion(s): Bolus administration of AQ achieves LOC at a similar time as an equipotent amount of DI, but shows a slower PD. Hemodynamics were similar in both groups, except for an initial tachycardia in the AQ group. DI showed more pain on injection and apnea than AQ.

Reference:

- 1 Anesthesiology 2003, 99, 303–13.

A-538

Pharmacokinetics and accuracy of target controlled infusion (TCI) of two different propofol formulations

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Background and Goal of Study: Target controlled infusion (TCI) of propofol was initially realized as a device (Diprifusor®) for prefilled syringes of Diprivan®. New TCI systems can be used with any propofol formulation but do also apply the pharmacokinetic model of the Diprifusor®. We compared two different propofol formulations with respect to pharmacokinetics and accuracy of TCI.

Materials and Methods: After institutional approval and written consent, 10 male volunteers (24–33 yrs, 69–90 kg) received Diprivan® 1% (Prop-D) and Propofol 1% Fresenius® (Prop-F) in a crossover study. Infusions of 150 min were computer-controlled using the pharmacokinetic model of the Diprifusor® (1), and targeting concentrations up to 7 µg/ml. Propofol plasma concentrations were determined from arterial samples until 6 h after stop of infusion. The prediction error PE = (Cm – Cp)/Cp was calculated from the measured (Cm) and predicted (Cp) concentrations. The accuracy of TCI was assessed by the median prediction error (MDPE) and the median absolute prediction error (MDAPE). A three-compartment model was fitted to the concentration data.

Results and Discussions: MDPE was –0.2% (SE: 2.2%) for Prop-D and –3.5% (SE: 1.8%) for Prop-F. MDAPE was 21.8% (SE: 1.5%) for Prop-D and 18.3% (SE: 1.1%) for Prop-F. The drugs did not differ in pharmacokinetics

but showed a smaller central volume of distribution than used for infusion control (table).

	TCI model	Prop-D	Prop-F
Vc (L kg ⁻¹)	0.23	0.11 ± 0.05*	0.09 ± 0.05*
Cl (ml min ⁻¹ kg ⁻¹)	27	25 ± 4	25 ± 5
T1/2α (min)	2.3	1.4 ± 0.9*	1.2 ± 0.7*
T1/2β (min)	23	27 ± 10	26 ± 9
T1/2γ (min)	289	296 ± 188	320 ± 177

mean ± sd *: P < 0.05 study drug vs. TCI model, t-test

Conclusions: The pharmacokinetic model of Diprifusor® can also be applied for TCI of Propofol Fresenius®. The large Vc in this model may cause an overshoot when the target is increased.

Reference:

1 Marsh B, White M, Morton N, et al. *Br J Anaesth* 1991; 67: 41–48.

Acknowledgements: Study was supported by Zeneca, UK.

A-539

Pharmacokinetics of ketamine and S(+)-ketamine in cerebrospinal fluid: comparing epidural and I.V. administration

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Background and Goal of Study: Despite of wide and popular use of ketamine, its pharmacokinetics about the epidural space and systemic circulation to cerebrospinal fluid across the dura matter and blood brain barrier has been unclear. We measured the CSF concentrations of both racemic and S (+)-Ketamine after systemic and epidural administration and aimed to demonstrate the pharmacokinetics.

Materials and Methods: This study was approved by the Institutional Animal Care Committee of Tottori Medical University. Thirty-two white Japanese rabbits weights 2.6–3.5 kg were studied. Anesthesia was established by injecting pentobarbital and maintained with sevoflurane in oxygen. Ketamine or S (+)-Ketamine 2 mg/kg was administered from the epidural catheter in epidural groups and injected from the jugular venous line in the I.V. group. Blood samples and cerebrospinal samples were simultaneously collected at 1, 3, 5, 10, 15, 30, 60, 120 minute after Ketamine or S (+)-Ketamine injecting. All samples were measured by using high-speed liquid chromatography. Data was analyzed by one-way ANOVA. A P value < 0.05 was considered statistical significant.

Results and Discussions: Pharmacokinetic parameters in CSF Racemic Ketamine

	Epi group	I.V. group	P value
Cmax (μg/ml)	0.5 ± 0.2	1.1 ± 0.4	0.001
Tmax (min)	8.3 ± 2.7	2.2 ± 1.1	0.0001
T1/2β (min)	130.7 ± 86.4	98.3 ± 16.2	0.406
AUC (μg · min/ml)	57.5 ± 22.0	49.3 ± 16.2	0.44

S (+)-Ketamine

	Epi group	I.V. group	P value
Cmax (μg/ml)	0.5 ± 0.2	1.1 ± 0.2	<0.0001
Tmax (min)	8.7 ± 6.2	1.9 ± 1.0	0.002
T1/2β (min)	95.4 ± 26.0	44.2 ± 17.1	0.008
AUC (μg · min/ml)	55.7 ± 10.2	40.1 ± 16.7	0.035

Conclusion(s): This study revealed that Ketamine passed across the blood brain barrier easily even when it was administered epidurally.

A-540

Modeling and testing the pharmacodynamics of propofol: a parametric vs nonparametric approach

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Background and Goal of Study: Pharmacokinetic–pharmacodynamic (PKPD) modeling of EEG variables during propofol infusion with non-steady state blood concentrations describes insufficiently the electroencephalographic effect (1). Therefore, we investigated the adequacy of parametric PKPD – vs. nonparametric cubic spline modeling of median power frequency (MPF) as the effect EEG variable in response to two consecutive propofol infusions.

Materials and Methods: We analysed 95 hr EEG recorded before, during and after application of propofol to 9 healthy volunteers (male, age 27 ± 3 y, weight 82 ± 7 kg, height 184 ± 6 cm) at three different time sessions. The

infusion protocol followed an induction period with linear increase of predicted propofol plasma concentration until burst suppressions of 2 s occurred, followed by a 30 min closed-loop feed back control anesthesia (2). During this period, the propofol infusion was controlled in order to maintain a MPF of 2 ± 0.5 Hz. After complete recovery, the same infusion regimen was repeated once. The PKPD model used to fit the MPF calculated from artifact-free EEG epochs (8 s, 1024 points) was the sigmoid E_{max} model. This was compared to the fit computed by a cubic spline interpolant. The level of interpolant smoothing was automatically extracted due to the akaike information criterion. The quality of fit was expressed as the coefficient of determination, R² (1). R²-values comparison between parametric and nonparametric model was made with use of the Kruskal-Wallis nonparametric test.

Results: Data are shown in the table:

	R ² E _{max}	R ² spline
Mean	0.860	0.995*
SD	0.092	0.002

*P < 0.05 vs E_{max}

Conclusion(s): The nonparametric spline interpolant shows a higher adequacy of pharmacodynamic modeling during consecutive propofol infusions than parametric PKPD model. A possible explanation could be, that the EEG is not only a simple function of propofol blood concentration, as within the context of a PKPD model.

References:

- 1 Kuizenga et al. *Anesthesiology* 2001; 95:607–615.
- 2 Schwilden et al. *Br J Anaesth* 1989; 62(3):290–296.

A-541

A method to reduce the data size of TCI dosing histories for pharmacokinetic analysis

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Background and Goal of Study: Target controlled infusion (TCI) systems are frequently applied clinically and in clinical research. However, the pharmacokinetic (PK) analysis of data obtained with TCI systems is difficult, since the recorded dosing histories are far too long to be handled by the standard PK analysis software (e.g. NONMEM or WinNonMix), which allows a maximum of 80 to 250 entries per patient only. We investigated how to reduce the size of TCI dosing histories and to which extent a reduction of the data sets is possible without compromising the validity of the results.

Materials and Methods: Data of 54 patients scheduled for abdominal surgery who received TIVA using a combined target controlled infusion (TCI) for propofol and remifentanyl (1) were analysed retrospectively. A new algorithm was developed to reduce the size of the dosing history of the TCI system. Instead of recording each change of the infusion rate, a virtual mean infusion rate was calculated and changed only if the difference between the actual and the virtual infusion rate exceeded a predefined threshold (ΔVA). Different virtual dosing histories with decreasing resolutions were generated by systematic increase of ΔVA. These data were analysed by non-linear fitting to a mamillary 3-compartment model (NONMEM) and compared with respect to the PK parameters and goodness of the fit (objective function).

Results and Discussions: The original dosing history had 2847 maximum entries per patient. We tested a range of resolutions from ΔVA 0.35 mg/min (250 entries) to 51.2 mg/min (31 entries). The PK parameters calculated with these dosing histories remained mainly unchanged up to a ΔVA of 6.4 mg/min, a value in the range of the overall mean infusion rate of 8.92 mg/min. Above this ΔVA the values of the objective function increased, the Volume of the rapid peripheral compartment (V₂) and the clearances (Cl₁, Cl₂) tended to higher values. At the ΔVA of 6.4 mg/min size of the data set was reduced to 0.3 percent of the initial size (85 vs. 2847 maximum entries per patient).

Conclusion(s): It is possible to substantially reduce the size of the dosing history for PK analysis without compromising the validity of the results.

Reference:

- 1 Wietasch G, Scholz M, Zinserling et al. *Anesthesiology* 1999, 91 (Suppl): A443.

A-542

A comparison of intravenous magnesium sulphate and lidocaine for the prevention of pain on injection of propofol

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Background and Goals: Approximately 70% of patients will report pain on injection of propofol¹. A systematic review identified lidocaine 40 mg, with venous tourniquet, as the most efficacious technique in preventing this². Magnesium sulphate (MgSO₄) has also been shown to be effective compared

to placebo³. Is MgSO₄ as effective as lidocaine in preventing pain on injection of propofol?

Methods: Prospective randomised controlled double blind trial. With local ethics approval 120 ASA 1 or 2 patients undergoing GA for elective surgery were recruited. Group L = lidocaine 40 mg and venous tourniquet for 30 sec, Group M = MgSO₄ 2.5 mmols, Group S = 5 mls Saline. Pain on injection of study drug and propofol were measured with modified verbal rating score. Data were analysed with Students t-test, Kruskal-Wallis ANOVA on ranks and Mann-Whitney rank sum test.

Results: Groups were similar in age, weight, and sex.

Table 1. Pain scores after injection of propofol.

Pain score	0N (%)	1N (%)	2N (%)	3N (%)
Group S (n = 40)	17 (42.5)	15 (37.5)	7 (17.5)	1 (2.5)
Group L* (n = 40)	24 (60)	6 (15)	7 (17.5)	3 (7.5)
Group M† (n = 40)	33 (82.5)	5 (12.5)	2 (5)	0 (0)

*The difference in pain scores between Group L and Group S did not reach statistical significance. †The distribution of pain scores was significantly different between Group M and Group S ($p < 0.05$) and Group M and Group L ($p < 0.05$). If you consider pain on injection of study drug and propofol combined, for Group M and Group L, the difference seen in Table 1 is no longer significant ($p = 0.84$).

Conclusions: In this study MgSO₄ 2.5 mmols given before IV propofol is more effective than either lidocaine or saline in preventing pain on injection of propofol. However pain on injection of the MgSO₄ itself may limit its clinical usefulness.

References:

- 1 Tan CH, Onsiong MK. *Anaesthesia* 1998; 53:468–476.
- 2 Picard P, Tramer MR. *Anesth Analg* 2000; 09:963–969.
- 3 Memis D, Turan A, Maramanlioglu B et al. *Anesth Analg* 2002; 95:606–608.

A-543

Pain on propofol injection: comparison of a reformulated propofol emulsion to standard propofol with premixed lidocaine

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Background and Goal of Study: The most commonly used method to reduce pain on injection is premixture of propofol with lidocaine (1). Recently, a reformulated lipid emulsion of propofol containing medium-chain triglycerides (MCT) and long-chain triglycerides (LCT) in equal proportions was found to cause less pain on injection than standard propofol LCT (2). The goal of this study was to investigate whether propofol MCT/LCT caused less pain on injection than propofol LCT with premixed lidocaine.

Materials and Methods: In a randomised, prospective, controlled, double-blinded study, 222 surgical patients received either propofol MCT/LCT (Group M, n = 109) or standard propofol LCT with premixed lidocaine (20 mg in 200 mg propofol) (Group L, n = 113). Pain scores were assessed using a Verbal Analogue Scale (VAS) ranging from 0–10. Post-operatively, patients were asked to what extent (VAS 0–10) they recalled pain on injection.

Results and Discussions: Group L was found to have significantly less pain on propofol injection (mean VAS 2.5 ± 0.3) than Group M (mean VAS 3.8 ± 0.3), $*P = 0.002$. Also did patients in Group L recall significantly less pain on injection than Group M (see Figure 1).

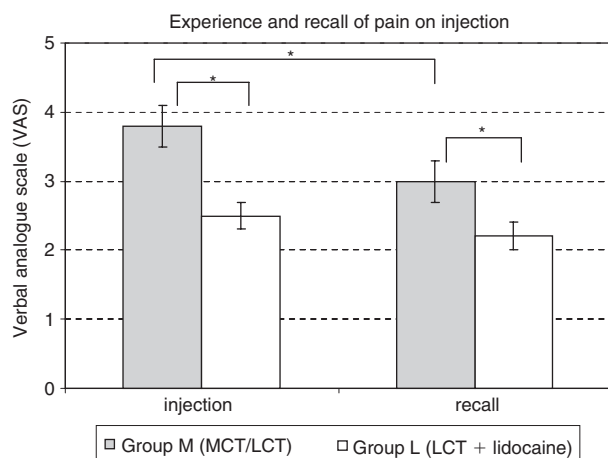


Figure 1. VAS of pain on injection and recall of pain; Group M: propofol MCT/LCT, Group L: propofol LCT with premixed lidocaine. Data: mean \pm SEM, $*P < 0.05$.

Conclusion: Premixing 20 mg of lidocaine to 200 mg of standard propofol LCT causes less pain on injection than propofol MCT/LCT without any addition of lidocaine.

References:

- 1 Tan C.H. *Anaesthesia* 1998; 53: 468–76.
- 2 Rau J. *Anesth Analg* 2001; 93: 382–4.

A-544

The prevention of pain from injection of propofol by dexmedetomidine and comparison with lidocaine

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Background and Goal of Study: Dexmedetomidine is a α_2 -adrenoreceptor agonist with supraspinal, spinal, and peripheral actions. The α_2 receptors are located on blood vessels where they inhibit nor epinephrine release. Several studies have determined lidocaine as the drug most efficiently diminishing and eliminating pain from propofol injection. We have conducted our study, to determine the efficacy of dexmedetomidine and compare it with lidocaine in decreasing pain due to injection of propofol.

Materials and Methods: Following ethic committee approval and written informed consent, 90 patients were randomly divided into three groups. The patients were then taken into the operation room where at the dorsum of both hands were catheterized with a 20G catheter and the mean arterial pressure, oxygen saturation, and heart rate were monitored. With the aim of keeping the drug within the vein, the forearm was squeezed with a tourniquet up to 70 mmHg; the patients were administered; saline (5 mL) in Group I (n = 30), 0.25 μ g/kg dexmedetomidine in Group II (n = 30), 0.5 mg/kg lidocaine in Group III (n = 30), diluted into a 5 mL with saline at ambient operating room's temperature (20–22°C). After 20 seconds occlusion was released, 5 mL propofol was administered at a rate of 20 mg in 5 s by a mechanical syringe. The patients were asked if they had pain in the arm and the response was assessed. The patients were asked a standard question about the comfort of the injection, the verbal response and behavioral signs, such as facial grimacing, arm withdrawal, or tears were noted.

Results and Discussions: Patients with no pain are 4,20,23 according to groups respectively. Light pain was seen in 5,9,6 according to groups respectively. Moderate pain was seen in 9,1,1 according to groups respectively. Severe pain was seen in only in 12 patients of Group I. Correlation determined with log linear analysis, significant difference were found pain score 0 in group I ($p < 0.05$).

Conclusion(s): As a result; this is the first clinical study showing that the dexmedetomidine may be useful in prevention of propofol injection pain. When compared with lidocaine, dexmedetomidine was equally effective in reducing the pain associated with the i.v. injection of propofol.

A-545

Development of acute tolerance to the EEG effect of propofol in rats

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Background and Goal of Study: Previous studies with propofol in rats suggested development of acute tolerance to the EEG effect (1). The aim of this study was to evaluate acute tolerance by means of EEG controlled closed loop anaesthesia as this approach allows precise determination of drug requirement to maintain a defined drug effect.

Materials and Methods: Two days before starting the experiments ten male Sprague-Dawley rats (402 ± 40 g bw, mean \pm SD) were anaesthetized with ketamine (76 ± 7 mg ip) and a jugular vein catheter was placed for drug infusion. The catheter was tunneled under the pelt and externalized on the dorsal surface of the neck. At the day of experiment rats were anaesthetized with propofol, the femoral artery was catheterized and needle electrodes were placed occipito-occipitally for EEG recording. Subsequently, closed loop control of propofol was started. The median frequency (MEF) of the EEG power spectrum was used as pharmacodynamic control parameter. Infusion rate was controlled by a model based adaptive algorithm to maintain a setpoint of $MEF = 3 \pm 0.5$ Hz for 90 min. The performance of the feedback system was characterized by the prediction error $PE = (MEF - \text{setpoint}) / \text{setpoint}$. Propofol plasma concentrations were determined from arterial samples by HPLC and tested for differences using the t-test for paired samples.

Results and Discussions: The chosen setpoint was successfully maintained in all rats. The median and the absolute median value of PE

were -5.0% (SE: 0.3%) and 11.3% (SE: 0.2%). The cumulative dose increased linearly. The mean infusion rate was 0.24 mg/min. The propofol concentration increased from 2.9 ± 2.2 $\mu\text{g/ml}$ at the beginning to 5.8 ± 3.8 $\mu\text{g/ml}$ at 90 min (mean \pm SD, $p < 0.05$). Mean arterial pressure dropped from initially 141 ± 12 mmHg to a minimum of 128 ± 24 mmHg during closed loop administration.

Conclusion: The increase of the propofol concentration at constant EEG median frequency indicates development of acute tolerance to the hypnotic effect of propofol.

The finding of increasing propofol concentrations in combination with constant infusion rates indicates nonlinear pharmacokinetics.

Reference:

1 Ihmsen H, Tzabazis A, Schywalsky M, et al. *Eur J Anaesthesiol.* 2002; 19: 177–188.

A-546

$\Delta 9$ Tetrahydrocannabinol as a possible co agent during anesthesia with propofol?

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Background and Goal of Study: $\Delta 9$ -tetrahydrocannabinol (THC) is a long known substance with a wide range of in vivo effects. Among these are analgesic effects and alterations of the state of alertness from euphoria to drowsiness. However, the effects of THC on the action of intravenous anaesthetics is not known.

Materials and Methods: Twenty male mice (type: SV 129) received propofol or THC i.p. or both. Sedation was monitored employing a rotating rod with a cut-off time at 60 s. Analgesic effects were determined by tail flick with a cut-off time after 10 s.

Results and Discussion: After injection of 50 $\mu\text{g/g}$ propofol a rapid onset of sedation was seen with a mean of 52.4 s on the rota-rod one min. post injection. Maximum sedation was reached after 2.5 min with 27 s on the rota rod. Thereafter sedation constantly diminished until 15 min post injection when the mice stayed 60 s on the rota-rod. Propofol had no analgesic effect. THC (50 $\mu\text{g/g}$) showed first analgesic effects after 2.5 min with 4.4 s tail flick (baseline: 3.2 s). A maximum was achieved after 12.5 min with 9.5 s tail flick and this level was maintained until the 45 min. Thereafter a decrease in the analgesic effect until day three with 4.7 s tail flick occurred. THC had no sedative effect. The combination of both substances propofol and THC showed no influence in analgesic effects of THC however the sedative effect of propofol was reduced. After a stepwise increase of the dose of propofol to 100 $\mu\text{g/g}$ sedation in combination with THC was equipotent to 50 $\mu\text{g/g}$ propofol as a mono substrate. An onset of the combination was registered after 1 min with 48.9 s, a maximum after 2.5 min with 27.9 s and an offset after 12.5 min.

Conclusions: THC is an effective analgesic drug in mice with long term effects lasting for days. When combined with propofol THC reduces sedation. The exact mechanism is not yet studied, but a possible depression of GABA mediated receptors through THC is known from studies related to memory (1).

Reference:

1 Marsicano G, Wotjak CT, Azad SC, et al. *Nature* 2002; 418:530–534.

A-547

Effect of propofol on formation of lipid peroxides in ischaemia reperfusion injury following lower limb revascularisation surgery

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Background and Goals: Free oxygen radicals play a vital role in ischaemia and reperfusion injury (1), especially in major vascular surgery involving clamping of aorta. Antioxidants may limit such injuries. We planned to observe the antioxidant property of propofol which is known to combine with free radicals converting them to less toxic phenoxy radicals (2).

Materials and Methods: We studied 20 adult ASA I patients undergoing lower limb revascularisation surgery for peripheral vascular disease. Ten patients (propofol group) were induced with propofol and fentanyl and maintained with continuous infusion of propofol. The other 10 patients (control group) were induced with thiopentone and fentanyl and maintained with isoflurane and vecuronium. Free radicals release was measured as the amount of lipid peroxides before and after 5, 15, 30 and 45 minutes following

declamping of aorta. Concentration of plasma lipid peroxides were measured as thiobarbituric acid-reacting substances (TBARS).

Results: Plasma TBRAS concentration ($\mu\text{mol litre}^{-1}$) increased significantly in the control group at 30 and 45 minutes after declamping of aorta, as shown in the table.

Time (min)	Propofol group		Control group	
	Mean \pm SD	p-value	Mean \pm SD	p-value
0	1.76 ± 0.92		1.95 ± 1.13	
5	1.35 ± 0.54	0.21	2.45 ± 1.42	0.187
15	1.66 ± 0.76	0.76	2.32 ± 1.62	0.411
30	1.46 ± 0.79	0.12	3.32 ± 2.06	0.005**
45	1.90 ± 0.88	0.64	4.10 ± 3.03	0.05*

*Significant; **Highly significant

Conclusion: Propofol attenuated the ischaemia reperfusion – induced lipid peroxidation in therapeutic doses.

References:

- 1 Bao YP, Williamson G, Tew D et al. Antioxidant effects of propofol in human hepatic microsomes: concentration effects and clinical relevance. *Br J Anaesth* 1998; 81: 584–589.
- 2 Green TR, Bennett SR, Nelson VM. Specificity and properties of propofol as an antioxidant free radical scavenger. *Toxicol Appl Pharmacol* 1994; 129: 163–169.

A-548

Intraoperative management of acute right ventricular failure during orthotopic heart transplantation with inhaled iloprost

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Background and Goal of Study: Heart transplantation has become established as the definitive therapy for patients with end-stage cardiomyopathy. However, perioperative management of heart transplant candidates remains an anaesthetic challenge because of their compromised clinical status. Even after an uneventful surgical procedure, weaning from cardiopulmonary bypass may be particularly laborious, due to superimposed acute right ventricular failure (RVF) in the setting of preexisting pulmonary hypertension (PH). Research in recent years has focused towards inhaled vasodilatory treatment modalities, which selectively target the pulmonary circulation.

Materials and Methods: We present case reports of five patients in whom inhaled iloprost, a synthetic prostacyclin analogue, was used to treat PH and acute RVF during a heart transplantation procedure. In all patients standard haemodynamic monitoring was used. Inhaled iloprost was administered via nebulized aerosol at a cumulative dose of 0.2 $\mu\text{g kg}^{-1}$ for a 20-min period, in addition to conventional inotropic support. Complete sets of haemodynamic measurements were performed before inhalation (baseline) and at two 10-min intervals thereafter (T1 and T2 respectively). Statistical analysis was performed by ANOVA for repeated measures.

Results: (*: $p < 0.05$ in comparison to baseline)

	Baseline	T1	T2
MPAP/MAP ratio	0.48 ± 0.03	$0.36 \pm 0.02^*$	$0.33 \pm 0.03^*$
PVR/SVR ratio	0.22 ± 0.01	$0.18 \pm 0.02^*$	$0.15 \pm 0.01^*$
CI ($\text{lt} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$)	2.23 ± 0.48	2.76 ± 0.39	2.79 ± 0.68

All five patients were weaned from CPB and transferred to the Intensive Care Unit (ICU). Further episodes of PH in ICU were successfully treated by use of the same therapeutic regime. Their ultimate postoperative course was uneventful and they were all discharged from hospital.

Conclusion: During a heart transplantation procedure, episodes of RVF due to PH can be successfully treated with iloprost administration, which lacks untoward side-effects and significant systemic action.

Reference:

Haraldsson A et al. *Anest Analg* 2001; 93: 1439–45.

A-549

Small-dose ketamine does not reduce morphine consumption after elective CABG surgery

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Background and Goal of Study: Pain or excess morphine may induce post CABG atelectasis. As ketamine has shown the potential of reducing opioid

consumption after abdominal surgery⁽¹⁾ we examined its effect on morphine demand in a PCA system after CABG surgery where it might optimise the PaO₂/FiO₂ relation while providing adequate pain relief.

Materials and Methods: After hospital Ethics Committee approval and written informed consent was obtained, 50 patients with an ejection fraction superior to 50% and no concurrent pathology entered this double blind study. The anesthesia protocol consisted in lorazepam 2.5 mg for premedication and remifentanyl and propofol for induction and maintenance. Postoperatively, propofol sedation (2 mg/kg/h) was maintained till hemodynamic stability and minimal chest tube drainage was attained. At this moment a bolus of 50 µg/kg morphine (group M) or 50 µg/kg morphine with 50 µg/kg ketamine (group MK) was administered. This was followed by a PCA system containing either morphine 1 mg/ml or morphine + ketamine both 1 mg/ml. 4, 8, 12 and 24 hours later pain intensity was assessed using a VAS ruler. Other observations were cumulative PCA use, signs of respiratory depression (PaO₂/FiO₂), respiratory rate or other side effects (itching, nausea, alertness).

Results and Discussion: First day cumulative opioid consumption was low and similar for both groups (0.25 mg/kg grMK vs 0.28 mg/kg grM, $P = 0.76$), with similar evolution over time. There was no difference in VAS scores between groups (mean 2,3/10 grMK vs 2,5/10 grM, $P = 0.8$). As expected side effect were not observed in both groups. The relation PaO₂/FiO₂ was consistently higher in the MK group, without reaching statistical significance (minimal $P = 0.15$ at 4 hours). Total dose of ketamine (mean 0.26 mg/kg) may have been too small (i.e. < 1 mg/kg/d⁽¹⁾) to significantly potentiate opioid action or to prove its positive effect on oxygenation by bronchodilation or even by an anti-inflammatory action.

Conclusion(s): After CABG surgery, morphine consumption using a PCA system is already low. Therefore, ketamine cannot demonstrate a reduction nor significantly increase the PaO₂/FiO₂ ratio while providing adequate pain relief.

Reference:

- 1 N. Guilloit et al, *Anesth Analg* 2003; 97:843–847.

A-550

Role of propofol and its solvent, intralipid, in rats challenged with LPS

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Background and Goal of Study: Propofol, which is mostly lipid soluble is available in an intralipid solution. Although Hageman et al. (1) reported that intralipid itself produced pulmonary vasodilatation, the cardiac hemodynamic properties of intralipid remained unknown in the presence and in the absence of LPS.

Materials and Methods: After approval from the animal welfare committee, animals were instrumented to continuously record arterial blood pressure (MAP), heart rate (HR) and cardiac output (CO). Group 1 animals received propofol anesthesia, IV, in the presence and absence of LPS (20 mg/kg, IV) and N-methyl-L-arginine (L-NMA; 20 mg/kg, IV), a nitric oxide synthase inhibitor. Group 2 animals received intralipid, IV, in the presence and absence of LPS and L-NMA. Data were analysed using an analysis of variance (ANOVA).

Results: MAP decreased by 40% with propofol alone, by 60% in the presence of LPS, and by 50% in the presence of LPS + L-NMA. In contrast, MAP remained unchanged in the presence of intralipid. MAP decreased by 16% in the presence of LPS and remained unchanged in the presence of L-NMA. In both groups, CO decreased significantly, but did not vary following L-NMA administration.

Conclusion: As compared to propofol, our data suggest that intralipid plays an important role in the maintenance of blood pressure in rats challenged with LPS. Our results also demonstrate that propofol and intralipid-induced cardiac depression is not mediated through the nitric oxide pathway.

Reference:

- 1 Hageman JR, McCulloch K, Gora P, et al. *Crit Care Med* 1983; 11:794–798.

A-551

The impact of esmolol on bacterial growth in vitro

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Background and Goal of Study: Infusions administered during and following surgery may contribute to postoperative infections if contaminated.

Esmolol is a selective beta-1 blocker and may be administered in the peri-operative period as an infusion (1). In this study we examined the *in vitro* effect of esmolol on bacterial growth.

Materials and Methods: Bacterial strains were isolates of *Pseudomonas aeruginosa* (ATCC 27853), *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 23923). The tested pharmaceutical preparation was Brevibloc (esmolol 10 mg mL⁻¹) (Torrex Pharma, Wien, Austria). Bacterial suspensions were prepared to give approximately 10⁴ colony forming units (cfu) mL⁻¹. Ten µL of this suspension (5×10^1 cfu) was added to 1 mL esmolol (diluted to 1 mg mL⁻¹ in saline 0.9%) and was incubated at room temperature for 1, 2, 3, 4, 6 or 24 hours. After the incubation time 10 µL was plated on dried Mueller Hinton (MH) agar and incubated for 24 h at 37°C. The cfu was counted. Saline 0.9% and Mueller-Hinton broth controls were also applied. The method is described in details elsewhere (2).

Results and Discussions: All of the strains grew in the control saline 0.9% and in MH broth. The diluted esmolol did not influence the growth of *E. coli*, and *P. aeruginosa*. The effect of esmolol is bacteriostatic on the above strains. The cfu number of the *S. aureus* strain did not change during the first 6 hours, but was killed by 24 h.

Conclusion(s): Our results suggest that esmolol if diluted to 1 mg mL⁻¹ is bacteriostatic on *E. coli* and *P. aeruginosa*. Although it does not let the multiplication of these strains it may pose an infection risk if contaminated during its preparation. The iatrogenic infection with *S. aureus* is less likely as esmolol kills this bacteria after 6 hours.

References:

- 1 Lim YJ, et al. *Acta Anaesthesiol Scand* 2003; 47: 74–78.
- 2 *Anesth Analg* 1999; 89: 1570–1572.

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A-552

Effects of chronic exposure to ethanol on glutamate transporter EAAT3 expressed in *Xenopus* oocytes: implication with anaesthetics in chronic alcoholism

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Background and Goal of Study: Glutamate transporters play a key role of removing extracellular glutamate which is the major excitatory neurotransmitter. Increased activity of glutamate transporters by volatile anaesthetics has been suggested one of the possible mechanisms of anaesthesia (1). Acute and chronic alcoholism cause opposite changes in the MAC of volatile anaesthetics. In this study, we investigated the effects of chronic ethanol exposure on the activity of EAAT3, a neuronal subtype of glutamate transporters.

Materials and Methods: EAAT3 was expressed in *Xenopus* oocytes by injection of EAAT3 mRNA. After 3 day-incubation, *Xenopus* oocytes were exposed to 10, 25, 50, and 100 mM of ethanol for 48 h, 72, and 96 h. Using two-electrode voltage clamp, membrane currents were recorded after the application of L-glutamate (30 µM). Responses were quantified by integration of the current trace and compared with control.

Results and Discussions:

Table 1. Effects of ethanol exposure on EAAT3 activity.

Ethanol	48 h	72 h	96 h
Control	1.00 ± 0.09	1.00 ± 0.04	1.00 ± 0.04
10 mM	0.96 ± 0.08	0.82 ± 0.05*	0.71 ± 0.05*
25 mM	0.98 ± 0.07	0.88 ± 0.04	0.72 ± 0.05*
50 mM	1.02 ± 0.06	0.86 ± 0.06	0.76 ± 0.05*
100 mM	0.93 ± 0.07	0.91 ± 0.07	0.73 ± 0.06*

Each set of data has been normalized by using the mean value of the control group from the same batch. Units are folds of controls. Data are mean ± SEM (n = 14–18). * $P < 0.05$ compared with control.

The activities of EAAT3 were significantly decreased 96 h after exposure to ethanol (10–100 mM), which is the opposite results with those under volatile anaesthetics or acute ethanol exposure (2).

Conclusion(s): Chronic ethanol exposure up to 96 h decreased the activities of EAAT3 in a time-dependent manner. Decreases in EAAT3 activity might explain the increases in the MAC of volatile anaesthetics in patients with chronic alcoholism.

References:

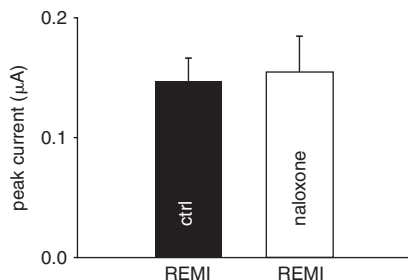
- 1 Do SH, Kamatchi GL, Washington JM, et al. *Anesthesiology* 2002; 96:1492–1497.
- 2 Kim JH, Lim YJ, Ro YJ, et al. *Alcohol Clin Exp Res* 2003; 27:1548–1553.

A-553

Activation of NMDA receptors by remifentanyl is not mediated by opiate receptors

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Background and Goal of Study: Intraoperative administration of remifentanyl has been shown to be associated with increased postoperative opiate analgesic requirements.¹ As N-methyl-D-aspartate (NMDA) receptors are involved in the development of opiate tolerance, increased NMDA signaling might explain this effect of remifentanyl. We previously demonstrated that remifentanyl activates NMDA receptors expressed in *Xenopus* oocytes.² However, we did not rule out the possibility that the action of remifentanyl would be indirect, and mediated through activation of μ opiate receptors. Therefore, we now studied the role of opiate receptor signalling in remifentanyl activation of NMDA receptors, by determining the effect of an opiate receptor antagonist on remifentanyl-induced currents.



Materials and Methods: NR1A/2A NMDA receptors were expressed recombinantly in *Xenopus laevis* oocytes. Inward currents were measured using 2-electrode voltage clamp and expressed as μ A (mean \pm SEM). Ba^{2+} was used as charge carrier. The clinical formulation of remifentanyl (Ultiva) was used as agonist.

Results and Discussions: Ultiva (10^{-4} M) induced inward currents ($0.15 \pm 0.02 \mu$ A) in oocytes expressing NMDA receptors, but not in control cells. In the presence of the μ opiate receptor antagonist naloxone (10^{-4} M) responses to Ultiva were $0.16 \pm 0.03 \mu$ A, similar to those obtained in the absence of the antagonist ($p = 0.82$, Fig). The presence of a saturating concentration of naloxone did not affect inward currents induced by Ultiva in oocytes expressing NMDA receptors.

Conclusion(s): These findings strongly suggest that Ultiva directly activates NMDA receptors, rather than acting in an indirect manner through opiate receptor signalling. Direct activation of NMDA signalling by remifentanyl may explain in part the increased opiate requirements observed after use of this compound in the clinical setting.

References:

- Guignard B, Bossard AE, Coste C, et al. *Anesthesiology* 2000; 93: 409–417.
- Hahnenkamp K, Nollet J, Van Aken H, et al. *Anesth Analg* 2002; 94: S211.

A-554

The roles of ketamine and propofol on gut mucosal epithelial apoptosis in burned rats

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Background and Goal of Study: It has been also well known that burn increases gut epithelial cell death by apoptosis (1). The aim of the study was to search the effect of ketamine and propofol on gut apoptosis after burn injury.

Material and Method: We used 30 male adult Wistar Albino rats weighing between 195–257 g (mean 210 ± 15 g) and they assigned into 3 groups. Before burn injury, ketamine was administered in Group 1 ($n = 10$), propofol in Group 2 ($n = 10$), and inhalation anesthesia in Group 3 ($n = 10$). Thirty percent of total body surface area (TBSA) was burned. While subjects in group 1 and 2 received ketamine and propofol infusion for 24 hours, subjects in group 3 did not received any anesthetics throughout 24 hour. Twenty-four hours after the burn injury, ileal biopsy and blood sample were collected from each rat. Serum tumor necrosis factor alpha (TNF-alpha)

levels were measured by ELISA method. Apoptosis was assessed based on an immunohistochemical TUNEL index expressed as the number of positive cells/the total number of cells. Immunohistochemical staining for proliferating cell nuclear antigen (PCNA) was also assessed. Kruskal-Wallis one way ANOVA and Mann-Whitney U tests were used for analysis of the results, $p < 0.05$ values were accepted as significant.

Results and Discussion: At 24 hours, the mean serum TNF-alpha level in Group 2 (178 pg/ml) was significantly lower than the levels in Groups 1 (256 pg/ml) and 3 (321 pg/ml) ($p = 0.03$). The Group 3 PCNA-labeling index (85%) was the highest of all the other groups, and the PCNA index values for Groups 2 (55%) was the lowest of all groups ($p = 0.01$). The mean apoptotic index of Group 3 (40%) was the highest of all groups, however the lowest in Group 2 (19%) ($p = 0.01$). Additionally, TNF alpha, PCNA labeling and apoptosis indices of Group 2 were lower than those of Group 1.

Conclusion: We concluded that propofol may have antiapoptotic features on gut mucosal epithelium after severe burn injury. However ketamine may induce apoptosis in gut mucosal epithelium.

Reference:

- Ramzy PI, Wolf SE, Irtun O et al. *Am Coll Surg* 2000; 190: 281–7.

A-556

The effect of ketamine on acute muscular ischemia reperfusion injury in rats

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Background and Goal of Study: The role of ketamine in rats after cerebral ischemia and reperfusion model has been demonstrated (1). Ketamine may have a beneficial effect in acute muscular ischemia and reperfusion injury. The study was aimed to investigate the possible beneficial effect of ketamine in acute muscle ischemia and reperfusion injury by measuring malondialdehyde (MDA).

Materials and Methods: After animal ethics committee approval, 12 female Wistar albino rats weighing 200–250 gr were studied. Rats were anesthetized by chloral hydrate 400 mg kg^{-1} i.p. Both internal jugular veins and one carotid artery were catheterized. Rats were randomly assigned into two groups (Group K and S) in order to receive ketamine $1 \text{ mg}^{-1} \text{ kg}^{-1} \text{ min}$ or saline infusion via internal jugular veins. Invasive blood pressure was monitored. Blood and gastrocnemius muscle tissue samples were obtained at 10th minute of infusion and before ischemia. Femoral artery was clamped for 30 minutes. Blood and muscle samples were repeated at the 30th minute of ischemia and 10 minutes after the reperfusion. MDA was measured in blood and tissue samples. Repeated measures variance analysis and Mann-Whitney U tests were performed. $P < 0.05$ were considered as significant.

Results and Discussions: Plasma MDA levels were 3.77 ± 0.16 , 3.78 ± 0.18 before ischemia, 3.81 ± 0.25 , 4.00 ± 0.86 at the 30th min. of ischemia, 4.00 ± 0.53 , 3.94 ± 0.95 after reperfusion respectively, in groups S and K ($\mu\text{mol L}^{-1}$, Mean \pm SD). Tissue MDA levels were 27.88 ± 2.45 , 27.62 ± 3.98 before ischemia, 32.10 ± 4.19 , 30.77 ± 2.73 in the 30th min. of ischemia, 44.34 ± 2.45 , 34.83 ± 2.78 after reperfusion respectively, in groups S and K (nmol L^{-1} , Mean \pm SD). The tissue MDA level after reperfusion was significantly lower in Group K compared to Group S ($p < 0.01$). The decrease in tissue MDA after reperfusion in the Group K was not accompanied by a decrease in the concurrent serum MDA levels. This might be due to lack of time required for MDA to increase in serum samples.

Conclusion: Ketamine decreases acute ischemia-reperfusion induced lipid peroxidation in muscle tissue. Further investigation is required in order to find out the mechanism of this effect.

Reference:

- Chang ML, Yang J, et al. *Neurosci Lett*. 2002; 322:137–40.

A-558

Elucidating the response of the microcirculation to novel nociceptin agonists and antagonists: a new therapeutic target?

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Background and Goals: Nociceptin (N/OFG) is the endogenous ligand for the nociceptin receptor (NOP). Activation of NOP modulates pain transmission, produces bradycardia, hypotension and inflammation¹. Its effects on

the microcirculation are unclear. We aim to determine the role of N/OFQ-NOP in small arterioles and venules (<50 μm), which receive little neural control².

Materials and Methods: Male Wistar rats (220–300 g) were anaesthetised with thiopental (30 mg/kg bolus, 40–90 mg/kg/hr infusion, i.v.). The carotid artery was cannulated (blood pressure, mmHg) and also the jugular vein for administration of FITC-BSA (0.25 ml/100 g), N/OFQ (0.6, 3, 15 and 60 ng/kg) and N/OFQ antagonist UFP101 (60, 150 nmol/kg). The mesentery was exteriorised and images recorded using *in vivo* microscopy to measure changes in diameter (μm), macromolecular leak (ML, interstitial grey level, white: 255, black: 0) and leukocyte activation (adherent leukocytes/100 μm venule) using computerised image analysis.

Results: Compared to baseline (BL) N/OFQ caused a dose-dependent decrease in blood pressure (SAP, BL: 154 ± 11 , 15 nmol/kg N/OFQ: 112 ± 10), vasodilation (venules, BL: 23.9 ± 1.2 , 15 nmol/kg N/OFQ: 26.7 ± 1.2) and ML (103.7 ± 3.4 , 15 nmol/kg N/OFQ: 123.5 ± 11.8) ($P < 0.05$), responses that were abolished by 150 nmol/kg UFP101. N-OFQ increased leukocyte adhesion (BL: 2 ± 0.9 , 15 nmol/kg: 5.2 ± 0.9) ($P < 0.05$).

Conclusions: N/OFQ causes dilation of microvessels (<50 μm) and thus affects local control mechanisms. N/OFQ also increases leukocyte activation and compromises endothelial cell integrity. In addition to possible known analgesic properties, we also report here anti-inflammatory actions of UFP101, a combination with enormous therapeutic potential.

References:

- 1 Furness JB, Marshall JM. *J Physiol*. 1974 May; 239(1):75–88.
- 2 Kapusta DR. *Peptides*. 2000 Jul; 21(7):1081–99.

A-559

Utilising proteomics to elucidate signalling pathways in the formation of platelet thrombin

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Background: The May-Hegglin disorder and Sebastian syndrome arising from mutations in the MYH9 gene are characterised by giant platelets, thrombocytopenia and variable expression of Alport-like abnormalities (1). To identify novel proteins involved in platelet signalling, we used immunoprecipitation to capture the dynamic phosphotyrosine events occurring in the platelet following thrombin-activation.

Methods: Platelets were stimulated with thrombin (0.1 U/ml) over a time course of 0, 15, 30, 60, 90 and 180 seconds and the resulting phosphotyrosine proteome was separated by one-dimensional gel electrophoresis (2).

Results: An increase in phosphorylation was noted at 15, 30 and 60 seconds for a protein of apparent molecular weight 226 kDa, which had diminished by 180 seconds. The protein band was excised, enzymatically digested and identified unequivocally using both MALDI-TOF mass spectrometry (MS) and electrospray Q-TOF MS analysis as the non-muscle myosin heavy chain IIA (NMMHC-IIA). NMMHC-IIA contains at least 9 putative tyrosine phosphorylation sites. Confocal microscopy and western blotting with an antibody to NMMHC-IIA confirmed platelet expression of the protein. Immunoprecipitation with NMMHC-IIA and probing with an anti-phosphotyrosine antibody demonstrated that NMMHC-IIA was phosphorylated within 15 s of thrombin stimulation and that the phosphorylation markedly diminished by 3 min. Treatment of platelets with abciximab, a GPIIb/IIIa antagonist at a concentration that blocked platelet aggregation, prevented the dephosphorylation of NMMHC-IIA.

Conclusion: Thrombin stimulation induces the phosphorylation of NMMHC-IIA, engagement of GPIIb/IIIa triggers its dephosphorylation, suggesting that NMMHC-IIA plays a role in the reorganisation of the cytoskeleton that arises as a consequence of outside-out signalling. The May hegglin gene may also play a role in the function of adult platelets. This proteomics approach to understanding the signalling events following platelet activation may elucidate potential drug targets for the treatment of coronary thrombosis.

References:

- 1 Di Pumbo M, *Haematologica* 2002; 87(9):943–7.
- 2 Maguire P, *Proteomics* 2002; (6):642–8.

A-560

A potential model for the investigation of anaesthetic drug allergies

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Background and Goal of Study: A number of laboratory tests are available to diagnose drug allergy in routine practice including skin prick tests, intradermal

tests and RAST assays but these can be unreliable. There is extensive review of the above laboratory tests in literature (1). We attempted to passively sensitize KU-812 cells (a basophil cell line) with the serum of two patients with known allergy to wasp and measure basophil activation using CD203c. CD203c is a new marker isolated on basophils and mast cells (2).

Materials and Methods: Increasing volumes (0, 25, 75, 100 μl) of serum from a patient with known allergy to wasp was mixed with decreasing volumes (100, 75, 25, 0 μl) of serum from a normal volunteer and incubated with KU-812 cells. These cell suspensions (10^{-6} cells ml^{-1}) were then challenged with 3 different concentrations of wasp venom (50, 5, 0.5 ng ml^{-1}). Challenged cells were then incubated for 12 hours in a humidified incubator at 37°C, followed by wash and then stained with CD203c PE and kept at 4°C for 15 minutes. Cells were washed again three times and analysed in a flow cytometer.

Results and Discussions: KU-812 cells demonstrated increased expression on challenge with the allergen. Figure 1 demonstrates an example.

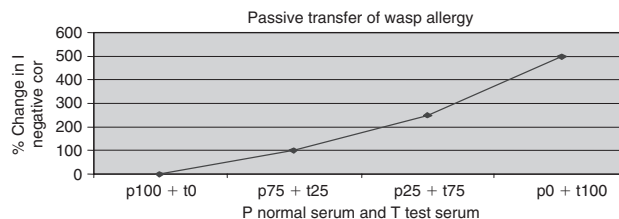


Figure 1.

Conclusion(s): Our study demonstrates basophil activation using the cell line KU-812 with the serum of patients with a known allergy. This gives us a model to study patients with a history of an adverse event to anaesthetic drugs and help us study the mechanisms of such reactions.

References:

- 1 Fisher et al. *Eur J Anaesthesiol*. 1994; 11:263–284.
- 2 Buhning et al. *Blood*. 1999; 94:2343–56.

A-561

Single dose intravenous cephazolin prophylaxis rapidly reduces normal skin flora

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Background and Goal of Study: Preoperative antibiotic administration has been demonstrated to prevent postoperative wound infection after clean surgery (1). This prophylaxis also changes skin flora and helps emerging resistant bacterial strains. There is no published study investigating the time needed for altering skin flora following a single dose intravenous antibiotic. In this study we examined the effect of a single dose cephazolin on human skin flora.

Materials and Methods: Thirty ASA I and II patients scheduled for clean orthopaedic surgery were included in the study. Samples were collected from the skin of the chest with contact Rodac Petri plates (tryptic soya agar, diameter 60 mm) (Neomed, Italy). The first sample was obtained before the intravenous administration of 1 g cephazolin (Totacef®, Bristol-Myers Squibb, USA). Other samples were taken 15, 30, 45, 60, and 120 min following the administration of the antibiotic. The plates were incubated for 24 hours at 37°C and the colony forming units (cfu) were counted. This method allows quantitative and qualitative bacterial evaluation and is described in details elsewhere (2).

Results and Discussions: The results show average \pm SD. Before cephazolin administration the bacterial count was 10.1 ± 5.97 cfu/cm² that represented the normal flora. It significantly decreased to 3.68 ± 3.14 cfu/cm² after 45 minutes following antibiotic prophylaxis.

Conclusion(s): To the best of our knowledge this is the first study investigating the onset of skin effects of an intravenously administered antibiotic. Our results suggest that bacterial count on skin rapidly decreases following systemic cephazolin administration. As normal flora is an important host defence mechanism this effect of systemic antibiotic prophylaxis may influence the adherence of pathogens on skin.

References:

- 1 New Horiz 1998; 6: S53–7.
- 2 Follea G. *Transfus Clin Biol* 1997; 4: 523–31.

Acknowledgements: Grant ETT 385/2000 of the Ministry of Health and Bolyai scholarship supported this study.

A-562**Xenon does not prolong neuromuscular block of vecuronium bromide**

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Background and Goal of Study: To investigate the influence of the noble gas xenon on the neuromuscular blocking effects of vecuronium bromide we compared these effects during xenon and with those during a total intravenous anaesthesia (TIVA) with propofol.

Materials and Methods: With approval by the local ethics committee, 40 patients were included in this prospective randomized trial after they gave their written informed consent. The study design is based on the "Good Clinical Research Practice Guidelines" (1). Anaesthesia was induced with propofol and remifentanyl in both groups. Then xenon was administered via face mask until an endexpiratory concentration of 60% was reached for one minute. Calibration of the acceleromyograph (TOF-Watch SX[®]) and a train of four stimulation every 15 seconds was started. A single bolus of vecuronium bromide (0.1 mg kg⁻¹ = 2xED95) was injected after stabilisation of the TOF-Watch SX[®] signal. Anaesthesia was maintained with Xenon or propofol and remifentanyl. Statistical analysis was done with the wilcoxon rank sum test.

Results and Discussion: Data are shown in the table: X = xenon-group, P = propofol-group, T5 = onset-time, T25 = duration, T25-0.8 = recovery, SD = standard deviation and Q = quartile; All data are in seconds.

	T5X	T5P	T25X	T25P	T25-0.8X	T25-0.8P
Mean	140	153	2064	2248	1518	1626
± SD	27	38	502	610	679	581
Median	135	150	2025	2107	1793	1459
Q 25	120	125	1785	1958	1110	1209
Q 75	165	187	2433	2380	1793	1996

Conclusion: As we could show for mivacurium (2) xenon does not influence onset-time, duration and recovery from neuromuscular block induced by a single dose of vecuronium bromide compared to a TIVA.

References:

- 1 Viby-Mogensen J, Ostergaard D, Donati F, et al. *Acta Anaesthesiol Scand* 2000; 44: 1169-1190.
- 2 Kunitz O, Baumert J-H, Hecker K, et al. *EJA* 2003; 20 Suppl. 30: 124-125.

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A-563**Onset and duration of neuromuscular blockade of 0.6 mg/kg rocuronium is markedly prolonged in children with Duchenne's muscular dystrophy (DMD)**

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Background and Goal of Study: There are conflicting reports about the sensitivity of patients with Duchenne's muscular dystrophy (DMD) to non-depolarising neuromuscular blocking agents^{1,2}. The aim of this study was to evaluate the response to a standard dosage of rocuronium (0.6 mg/kg) in children with DMD.

Materials and Methods: After approval of the local Ethics Committee and signed consent, 12 children with DMD and 12 healthy children were investigated. Total intravenous anaesthesia was done using propofol and remifentanyl. Neuromuscular blockade was monitored at the adductor pollicis muscle using acceleromyography according to a standard protocol³. After administration of rocuronium 0.6 mg/kg we measured the following: Onset time, peak effect, recovery of first twitch to 10, 25 and 90%, recovery index, recovery time and recovery of TOF ratio to 90%. Data are shown as mean ± SD.

Results and Discussions: Demographic data of both groups were comparable. Complete neuromuscular blockade was achieved in all children. Time course data of response to rocuronium 0.6 mg/kg are presented in the table. Recorded times of DMD children were significantly longer compared to times of healthy subjects (** = p < 0.01, Mann-Whitney-U test). While recovery was partially very long in these children indicating increased sensitivity against rocuronium, the surprisingly found delayed onset time apparently contradicts such an interpretation.

Mean ± SD (min)	DMD	Control
Onset time	3.5 ± 1.57**	1.8 ± 0.62
Recovery index	36.7 ± 19.73**	8.1 ± 2.90
T90	129.4 ± 50.03**	37.6 ± 10.09

Conclusion(s): Our data suggest that the administration of rocuronium 0.6 mg/kg leads to significant prolongation of onset and recovery of neuromuscular blockade in children with DMD compared to children without muscle disease.

References:

- 1 Uslu M, Mellinshoff H, Diefenbach C. *Anesth Analg* 1999; 89:340-1.
- 2 Ririe DG, Shapiro F, Sethna NF. *Anesthesiology* 1998; 88:351-4.
- 3 Viby-Mogensen J, Engbaek J, Eriksson LI, et al. *Acta Anaesthesiol Scand* 1996; 40:59-74.

A-564**Reduced dosage of rocuronium (0.3 mg/kg) in children with Duchenne's muscular dystrophy does not lead to a short recovery**

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Background and Goal of Study: The administration of a standard dosage of rocuronium in patients with Duchenne's muscular dystrophy (DMD) lead to very long duration of neuromuscular block (abstract submitted). The aim of this study was to evaluate whether a reduced dosage of rocuronium (0.3 mg/kg) leads to shortened recovery from neuromuscular block.

Materials and Methods: After approval of the local Ethics Committee and signed consent, 12 children with DMD and 8 healthy children were investigated. Total intravenous anaesthesia was done using propofol and remifentanyl. Neuromuscular blockade was monitored at the adductor pollicis muscle using acceleromyography according to a standard protocol¹. After administration of rocuronium 0.3 mg/kg we measured the following: Onset time, peak effect, recovery of first twitch to 10, 25 and 90%, recovery index, recovery time and recovery of TOF ratio to 90%. Data are shown as mean ± SD.

Results and Discussions: Demographic data of both groups were comparable. Time course data of response to rocuronium 0.3 mg/kg are presented in the table. Recorded times of DMD children were significantly longer compared to times of healthy subjects (** = p < 0.01, Mann-Whitney-U test). The peak effect of only 84% in DMD children contradicts the expected higher sensitivity of these children against non-depolarising neuromuscular blocking agents. The markedly prolonged recovery needs further investigations and remains unexplained.

mean ± SD	DMD	Control
Onset time (min)	5.4 ± 1.53 **	3.1 ± 0.61
Peak effect (%)	84.2 ± 14.14	77.3 ± 23.89
Recovery index	50.0 ± 14.10 **	6.6 ± 1.67
T90 (min)	102.4 ± 42.77 **	17.1 ± 7.35

Conclusion(s): Our data suggest that in children with DMD a reduced dosage of rocuronium does not cause a short recovery from neuromuscular blockade.

Reference:

- 1 Viby-Mogensen J, Engbaek J, Eriksson LI, et al. *Acta Anaesthesiol Scand* 1996; 40:59-74.

A-565**Mivacurium for muscle relaxation in Multicore disease**

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Background and Goal of Study: Multicore disease (MCD) is a congenital nonprogressive myopathy with a close relationship to central core disease. Multicore myopathy is associated with malignant hyperthermia (MH)¹ and at least one case of a death related to general anaesthesia has been reported². In this report we studied characteristics of neuromuscular blockade after administration of 0.2 mg/kg mivacurium in one case of a young woman.

Materials and Methods: Anaesthesia was done as total intravenous using propofol, fentanyl, oxygen, and air. Tracheal intubation was performed without nondepolarizing neuromuscular blocking agent. Neuromuscular blockade was monitored at the adductor pollicis muscle and orbicularis oculi muscle using acceleromyography. After administration of mivacurium 0.2 mg/kg we measured the following: Onset time, peak effect, recovery of first twitch to 10, 25 and 90%, recovery index, recovery time. All procedures were done with reference to the Copenhagen Consensus Conference.³

Results and Discussions: The recorded time course is shown below. The response to mivacurium was within the range reported from healthy adults. Interestingly, to a supramaximal TOF stimulation the adductor pollicis muscle showed an excessive response with an increase in twitch response from 1st to 4th.

(min)	Onset time	T ₁₀	T ₂₅	T ₉₀	T ₂₅₋₇₅	T _{25-TOF₉₀}
M. adductor pollicis	2.1	14.1	15.4	24.1	7.3	23.1
M. orbicularis oculi	2.4	7.6	10.1	22.1	7.5	15.4

Conclusion(s): Onset and recovery of neuromuscular blockade after administration of mivacurium in a patient with MCD were comparable to data from healthy subjects.

References:

- 1 De Cauwer H, Heytens L, Lubke U, et al. *Clin Neuropathol* 1997; 16:237–42.
- 2 Gordon CP, Litz S *Can J Anaesth* 1992; 39:966–8.
- 3 Viby-Mogensen J, Engbaek J, Eriksson LI, et al. *Acta Anaesthesiol Scand* 1996; 40:59–74.

A-566

Absence of neuromuscular blockade after administration of intratracheal succinylcholine

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Background and Goal of Study: In emergency situations, rapid neuromuscular (NM) blockade can be occasionally needed without intravenous access. In these circumstances, intramuscular or intraosseous succinylcholine (SC) administration have been used, but their effectiveness to achieve a rapid control of the airway is not well documented^{1,2}. Since the intratracheal route is successfully used during cardiopulmonary resuscitation, this study analyses if intratracheal SC can be useful to provide NM blockade.

Materials and Methods: In 10 ASA I consecutive patients undergoing knee arthroscopy, evoked electromyography (EMG) was recorded. Ulnar nerve was stimulated using the train-of-four sequence (supramaximal stimulation; duration 0.2 ms; frequency 2 Hz). Induction of anaesthesia was achieved with remifentanyl 0.5 µg·kg⁻¹·min⁻¹ and propofol 1.5 mg/kg. Patients were intubated after the administration of 1 mg/kg intravenous SC, when the maximal twitch depression was observed. Remifentanyl and propofol infusions were maintained to achieve a BIS number below 50. Once the recovery from NM blockade was achieved, intratracheal SC (1 mg/kg) was administered in 10 mL saline. EMG was monitored throughout surgery.

Results: Intravenous SC produced complete twitch abolition in all the patients. Time to maximal block was 80 ± 20 s and T1 time to 90% recovery was 499 ± 282 s. Intratracheal SC did not produce twitch depression, and all the patients had a twitch height ≥90% of basal T1 up to the end of surgery (105 ± 19 min). No cough, bradycardia or bronchospasm were observed. Data are mean ± SD.

Table 1. Demographic characteristics of the patients.

Age (yr)	Weight (kg)	Height (m)	BMI (kg/m ²)	Gender (m/f)
36 ± 11	76 ± 13	1.7 ± 0.07	27 ± 3.5	7/3

Conclusions: Intratracheal succinylcholine (1 mg/kg) is not useful to provide neuromuscular blockade.

References:

- 1 Liu et al. *Anesthesiology* 1981; 55:599–602.
- 2 Seah et al. *Singapore Med J* 1998; 39:328–330.

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A-567

Large bolus dose versus continuous infusion of cisatracurium during hypothermic cardiopulmonary bypass surgery

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Background and Goals: Cisatracurium (CIS) can be used to maintain muscle paralysis during a cardiac procedure with hypothermic cardiopulmonary bypass (CPB) using a bolus followed by a continuous infusion¹. We investigated whether a single large CIS bolus (8 × ED₉₅)² given at induction could provide similar operative conditions, lower the incidence of postoperative residual curarisation (PORC), yet reduce waste and consequently costs.

Materials and Methods: After IRB approval, 20 ASA II–III patients presenting for cardiac surgery were randomly assigned to one of two groups (n = 10 each). After i.v. induction of anaesthesia, CIS was administered either as a single large bolus dose (0.4 mg kg⁻¹) (group 1) or a smaller bolus (0.1 mg kg⁻¹) followed by an infusion (at a rate of 1 µg kg⁻¹ min⁻¹ before CPB, 0.75 µg kg⁻¹ min⁻¹ during CPB, and 1 µg kg⁻¹ min⁻¹ following CPB)¹ started 30 min later (group 2). If gross movement occurred, an escape bolus (0.03 mg kg⁻¹) was given. Any involuntary movements during surgery and the consequent, additional CIS boluses were noted; a recovery record was kept, as well as the CIS consumption in both groups. Results are presented as mean ± SD.

Results: Duration of surgery was 273 ± 75 and 272 ± 77 min in group 1 and 2, respectively (P = 0.97).

Group	n	Escape bolus (n)	Final TOF > 0.9 (n)	CIS dose (mg)
I	10	6*	4	34.5 ± 7.8**
II	10	0	2	21.3 ± 5.7**

*In 4 of these patients, final TOF was 0 because an escape bolus was given near the end of surgery. **P = 0.0004. TOF = train-of-four.

Conclusions: Even though the total amount of CIS administered is higher, the duration of action of a single large bolus is shorter, leading not only to (1) an unacceptably high incidence of movement and (2) a greater need for escape boluses, but also to (3) a high incidence of PORC. If CIS is used to maintain muscle paralysis during a cardiac procedure with hypothermic CPB, a single large bolus does not confer any clinical advantage over a smaller bolus followed by a continuous CIS administration.

References:

- 1 Cammu G et al. *Br J Anaesth* 2000; 84: 587–90.
- 2 Belmont MR et al. *Anesthesiology* 1995; 82: 1139–45.

A-568

Residual neuromuscular block after an intubation dose of cisatracurium and rocuronium in lumbar disc surgery

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Introduction: Postoperative residual neuromuscular block (NMB) is a matter of concern. We investigated the recovery from NMB after an intubation dose of cisatracurium (CIS) and rocuronium (ROC) in lumbar disc surgery.

Patients and Methods: After IEC approval, 32 consenting patients were randomised into two groups to receive twice the ED₉₅ of either CIS (GC) or ROC (GR) before tracheal intubation. Anaesthesia was induced with propofol and sufentanil, and maintained with sevoflurane and 60% N₂O in O₂. Once patients were placed in prone position, neuromuscular transmission was monitored at the wrist by accelerometry using train-of-four (TOF) stimulation. NMB was antagonized when the TOF ratio (TOFR) was <0.75 at muscle closure (MC). The times from curare injection to MC (TMC), TOFR 0.25 (TTR 0.25), and TOFR 0.50 (TTR 0.50) were recorded. Data were analysed using Student's t-tests, χ² tests and twoway ANOVA. We calculated the prediction probability (PK) of TMC and TTR 0.25 for the necessity to antagonize NMB in both groups. P < 0.05 was considered significant.

Results: NMB was antagonized in 8 (GC) and 6 (GR) patients. TMC was shorter in patients whose NMB was antagonized (A). PK of TMC was significant in GC but not in GR. In GR contrarily to GC, TTR 0.25 and TTR 0.50 were longer in patients whose NMB was antagonized. PK of TTR 0.25 was significant in GR only.

Mean or n	Cisatracurium		Rocuronium	
	A	NA	A	NA
Nb of patients	8	8	6	10
TOFR at MC (SD)	0.44 (0.21)	0.88 (0.11) ⁺	0.52 (0.15)	0.91 (0.09) ⁺
TMC (min) (SD)	63.8 (14.5)	87.4 (17.8) ⁺	77.5 (13.1)	88.2 (17.5) ⁺
TTR 0.25 (min) (SD)	50.1 (12.4)	49.8 (5.3)	60.4 (6.5)	36.1 (15.1) ⁺⁺
TTR 0.50 (min) (SD)	61.8 (7.7)	61.2 (6.2)	74.4 (11.1) ⁺	48.9 (17.9) ⁺⁺
PK (SE)	TTR 0.25 0.53 (0.17)	TMC 0.84 (0.64) [#]	TTR 0.25 0.93 (0.07) [#]	TMC 0.69 (0.14)

⁺p < 0.05 compared to antagonized, *p < 0.05 compared to CIS,

[#]p < 0.05. A = NMB antagonized, NA = NMB not antagonized

Conclusions: An intubation dose of CIS or ROC may be associated to residual NMB at the end of surgery, depending on length of surgery and duration of action of the muscle relaxant (more variable for ROC than for CIS).

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A comparison of equilasting doses of Mivacurium and Rocuronium during short procedures

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Background and Goals of the Study: To compare intubating conditions and time-course of action of Rocuronium and Mivacurium for day-case anaesthesia.

Material and Methods: Fifty ASA 1 or 2 physical status patients were enrolled in this study. Anaesthesia was induced with propofol TCI ($6\text{--}8\ \mu\text{g ml}^{-1}$) and sufentanil ($0.25\ \mu\text{g kg}^{-1}$), maintained with Propofol (TCI = $3.5\text{--}4.5\ \mu\text{g ml}^{-1}$) and 50% nitrous oxide in oxygen. Muscle relaxation was achieved with Mivacurium ($0.15\ \text{mg kg}^{-1}$) or Rocuronium ($0.3\ \text{mg kg}^{-1}$).

Neuromuscular transmission was monitored and recorded continuously by acceleromyography using a TOF-WATCH SX (Biometer™) with supra-maximal train-of-four stimulation of the ulnar nerve.

Tracheal intubation was carried out by an experienced anaesthetist who was blinded to the identity of the muscular relaxant. Intubating conditions were evaluated according to a standard scheme (case of laryngoscopy, position of vocal cords, airways and limb movement).

Results: Results are summarized in the table. The two groups were equivalent.

	Mivacurium	Rocuronium	p
Onset time (sec ± SD)	241 ± 88	276 ± 76	ns
Max block	97.32%	91.39%	ns
25–90% T1 (sec ± SD)	512 ± 205	512 ± 183	ns
Time to intubation performed	285 ± 95	306 ± 77	ns
Vocal cords (%)			
Abducted	88	100	
Intermediate	12	0	ns
closed	0	0	
Airway reaction (%)			
None	48	74	
Diaphragm	44	36	ns
Sustained	8	0	
Intubation cond. (%)			
Excellent	92	100	
Good	8	0	ns
Poor	0	0	

Conclusions: There is no significant difference between Mivacurium and Rocuronium concerning the onset, the depth and the recovery of muscle relaxation. Rocuronium is an excellent alternative in short procedures, without the risk of prolonged relaxation due to a defect in plasma cholinesterases.

References:

- 1 Prien Th *Europ J Anesthesiology* 1995; 12: 85–90.
- 2 Dahoba *Can J Anesth* 2001; 48: 1084–1090.

A-570

Gender differences in pharmacodynamics of rocuronium: a randomised, prospective, placebo-controlled trial

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Background and Goal of Study: There is increasing evidence for sex differences in the pharmacodynamics (PD) of anaesthetic drugs and neuromuscular blocking agents, e.g. rocuronium (Roc) (1). Pain on injection (Pain) is one of the main disadvantages of Roc (2). However, whether gender influences this Pain and leads to erythema or venous sequelae is unclear.

Materials and Methods: After Ethics Committee approval and informed consent, 60 female and 60 male patients (Pat) were randomised each in 2 groups to receive Roc 0.03 mg/kg (Roc groups) or saline (Sal groups; Placebo). 3 min later, anaesthesia was induced with alfentanil, thiopentone and succinylcholine. After administration of the study drug (Roc or Sal) incidence and severity of the Pain (by using a 4-point rating scale; (3)) was evaluated. Local signs (erythema and venous sequelae) were assessed at the end of injection of Roc, 24 h and 48 h after surgery. Statistics: χ^2 test and ANOVA.

Results and Discussion: Men were significantly larger and heavier ($p < 0.001$) than women, but the body mass index was comparable (n.s.). The overall incidence (Male and Female) of Pain was 32.5%. The incidence and severity of the Roc-associated pain was gender-related, with females being significantly more often involved than males and, these reactions were not associated with erythema or venous sequelae.

	Roc groups		Saline groups	
	Female (n = 40)	Male (n = 40)	Female (n = 20)	Male (n = 20)
Pain				
Incidence	18 (45)*†	8 (20)‡	1 (5)	0 (0)
Severity	(0–3)*†	0 (0–2)‡	0 (0–1)	0 (0)
Local signs				
Incidence	0	0	0	0

Values are numbers, (%) or median and range (severity).

* $p < 0.05$ vs. Male Roc group. † $p < 0.05$ vs. Female Sal group, ‡ $p < 0.05$ vs. Male Sal group

Conclusions: Women experienced more pain on injection of Roc than men, moreover it is an additional evidence for gender-related differences in PD. However, no adverse consequences for the Pat could be revealed.

References:

- 1 *Acta Anaesthesiol Scand* 2003; 47:241–59.
- 2 *Br J Anaesth* 2003; 90:377–9.
- 3 *Br J Anaesth* 1997; 79:382–3.

A-571

Rapid reversal of rocuronium by the cyclodextrine ORG 25969: A two centre dose finding and safety study

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Background and Goal of Study: ORG 25969, a cyclodextrine derivate, is a very effective agent for reversing rocuronium induced neuromuscular block in animals and in human volunteers. The primary objective of this phase II study was to explore the dose response relationship of ORG 25969 given for reversal of rocuronium ($0.6\ \text{mg/kg}$) induced neuromuscular block and secondarily to evaluate the safety of ORG 25969.

Materials and Methods: After Ethics Committee approval, 27 ASA 1–2 male patients (20–64 year) consented to participate. Rocuronium $0.6\ \text{mg/kg}$ was given for tracheal intubation and the neuromuscular function monitored using train-of-four and acceleromyography (TOF Watch® SX). At reappearance of T_2 the patients received randomly placebo or a dose of 0.5, 1.0, 2.0, 3.0 or $4.0\ \text{mg/kg}$ ORG 25969. The primary efficacy parameter was time from injection of ORG 25969 to recovery of TOF ratio 0.9. Occurrence of re-curarization was noted. Subjective safety assessments were performed postoperatively at the day of operation, 1 and 7 days later.

Results and Discussions: The table shows the median (range) time to recovery of TOF ratio 0.9 in min:sec.

Placebo (n = 5)	19.04 (14.24–35.24)
0.5 mg/kg (n = 5)	4.17 (1.18–8.29)
1.0 mg/kg (n = 5)	2.11 (1.23–4.55)
2.0 mg/kg (n = 4)	1.18 (0.51–1.43)
3.0 mg/kg (n = 5)	1.12 (0.41–3.10)
4.0 mg/kg (n = 3)	1.07 (0.59–1.22)

Coughing and movement shortly after injection of ORG 25969 was seen in 4 patients. Whether this was due to the sudden recovery of normal neuromuscular function combined with a light plane of anaesthesia is not clear. In two of these patients also a clinically relevant drop in BP was observed after 2 and $3\ \text{mg/kg}$ ORG 25969, respectively and additional doses of propofol/fentanyl. No case of re-curarization was seen. All patients recovered without sequelae.

Conclusion(s): ORG 25969 caused a dose dependent rapid recovery of a rocuronium induced moderate block (T_2 in the TOF response present). It remains to be seen whether the recorded cases of coughing, movements and hypotension occurred by chance or were caused by the injection of ORG 25969.

A-573

Intubation conditions after rocuronium or succinylcholine for rapid sequence induction with alfentanil and propofol in the emergency patient

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Background and Goal of Study: Previous studies mainly conducted on elective patients recommend doses of $0.9\text{--}1.2\ \text{mg}$ rocuronium/kg to obtain intubation conditions comparable with succinylcholine $1.0\ \text{mg/kg}$ after 60 sec. during a rapid sequence induction (RSI). The quality of the intubating condition is not only determined by muscle relaxation, but also by the quality of anaesthesia and the suppression of the laryngeal reflexes by the induction agents. We therefore, decided to compare the overall intubating conditions of standard doses of rocuronium and succinylcholine during a strict RSI regimen including propofol and alfentanil in patients scheduled for emergency surgery with a genuine increased risk of pulmonary aspiration of gastric content.

Materials and Methods: Male and female patients (ASA I–III) older than 17 years scheduled for emergency abdominal or gynaecological surgery were randomised to a RSI with alfentanil, propofol and succinylcholine 1.0 mg/kg or rocuronium 0.6 mg/kg. Patients with a predicted difficult airway were excluded. A senior anaesthesiologist “blinded” for the randomisation did the intubation 60 sec. after injection of the neuromuscular blocker. Intubating conditions were evaluated according to an established guideline. Tracheal intubation not completed within 30 seconds was recorded as failed. We decided that less than 9% difference in the clinically acceptable intubating conditions was of no clinical interest, and calculated with a significance level (2α) = 5% and a β of 0,1 that 107 patients were required in each group.

Results and Discussions: 222 patients were randomised. Three patients had their operation cancelled and 10 didn't fulfil the inclusion criteria. Clinically acceptable intubation conditions were 93,5% in the succinylcholine group ($n = 107$) and 96,1% in the rocuronium group ($n = 102$) (Fisher exact test, $p = 0,5938$). First intubation attempt failed at 5 patients in the succinylcholine group and at 2 patients in the rocuronium group, but was successful either in the second, third or fourth attempt.

Conclusion(s): During a RSI induction with alfentanil and propofol, both rocuronium 0.6 mg/kg and succinylcholine 1.0 mg/kg provides clinically acceptable intubation conditions in 60 sec. in patients scheduled for emergency surgery. Under the conditions of this RSI-regimen rocuronium may be a substitute for succinylcholine.

A-574

Laryngeal morbidity and quality of tracheal intubation following rapid-sequence induction: comparison of succinylcholine and rocuronium

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Background and Goal of Study: Postoperative hoarseness (PH) and sore throat (ST) after general anaesthesia are a significant source of morbidity for patients and range between 3–44% (1). Several risk factors for laryngeal injury have been identified in the past (2). However, whether the quality of tracheal intubation (TI) following rapid-sequence induction (RSI) affects their incidence is unclear.

Materials and Methods: After Ethics Committee approval and informed consent, 170 patients (Pat) were randomised in 2 groups ($n = 85$ each) to receive thiopentone (5.0 mg/kg) and fentanyl (2–3 μ g/kg) with succinylcholine 1.0 mg/kg (Sux group) or rocuronium 0.6 mg/kg (Roc group) for induction of anaesthesia. Intubating conditions (IntCond) were evaluated (3), PH and ST were assessed in the PACU (PA) and at 24, 48 and 72 h after surgery. If PH persisted a stroboscopic examination was carried out. Statistics: χ^2 test and ANOVA.

Results and Discussion: Incidence of PH and ST was comparable between Sux and Roc groups (see table). However, excellent IntCond were significantly increased in the Sux group compared to the Roc group ($p < 0.001$). Clinically acceptable (excellent and good) IntCond were less frequent associated with PH compared to poor conditions: (47% vs. 89% of patients, respectively; $p < 0.05$).

Table 1. Values are numbers.

	Postoperative Hoarseness			Sore Throat		
	Sux $n = 79$	Roc $n = 81$	<i>P</i>	Sux $n = 79$	Roc $n = 81$	<i>P</i>
PA	29	32	0.84	17	12	0.37
24 h	19	17	0.78	14	15	0.94
48 h	10	13	0.70	9	7	0.96
72 h	7	5	0.73	6	3	0.47
>72 h	4	2	0.65	2	1	0.98
Pat	41	41	0.97	31	21	0.10

Conclusions: PH (51%) and ST (32%) were frequent and the quality of tracheal intubation affected the incidence of laryngeal morbidity. A RSI with thiopentone/fentanyl and Sux or Roc allowed TI in all Pat, but is associated with an increased incidence of laryngeal morbidity.

References:

- 1 Anaesthesia 1992; 47:213–16.
- 2 Anesthesiology 2003; 98:1049–56.
- 3 Acta Anaesthesiol Scand 1996; 40:59–74.

A-575

Comparison of dexmedetomidine with midazolam in premedication

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Introduction: Dexmedetomidine is a highly selective, specific and potent α_2 -adrenoceptor agonist, with potent sedative, analgesic and sympatholytic effects. We aimed to compare dexmedetomidine with most frequently used premedication drug midazolam.

Materials and Methods: Following ethic committee approval and written informed consent, 40 patients aged 18–45 (ASA I–II) scheduled for elective lower abdominal surgery were randomly divided into two groups. For premedication, 45 mins before anaesthesia induction 2.5 μ g kg^{-1} dexmedetomidine to Group I, 0.07 mg kg^{-1} midazolam was given intramuscularly to group II patients. Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), oxygen saturation (SpO_2), anxiety and sedation score were evaluated before and after study drug injection, 5, 10, 15, 30 and 45 mins after study drug injection. Anaesthesia induction was done by propofol, 1 μ g kg^{-1} fentanyl and 0.6 mg kg^{-1} atracurium. HR, SBP, DBP, MAP and SpO_2 values were recorded after induction, before and after intubation, 5, 10 and 15 mins after induction. Postoperative patients were followed for 24 hrs for postoperative analgesia and side effects.

Results: Demographic variables were similar between groups. When groups were compared for sedation scores there was significant difference in group I when compared with group II at 15, 30 and 45 mins after injection ($p < 0.05$). Propofol dose used for induction was found to be lower in group I ($p < 0.05$). Intraoperative HR in 10 min was lower in group I and bradycardia was determined in 5 patients. Groups were similar in incidence of side effects and analgesic requirements.

Conclusions: Dexmedetomidine can be used as a premedication drug with favourable sedation effect, however bradycardia may limit its use and precaution must be taken.

A-576

Reversal of rocuronium induced neuromuscular block by Org 25969: pharmacokinetics

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Background and Goal of Study: Org 25969, a modified gamma-cyclodextrin, forms a complex with rocuronium (roc) (1) and has been shown to reverse profound neuromuscular block within minutes in volunteers (2). The pharmacokinetics (PK) of Org 25969 and its effects on roc PK were studied.

Materials and Methods: Following Ethics Committee approval, 99 ASA 1 or 2 male patients (19–63 year) consented to participate in a phase II multicenter, randomized, parallel dose-finding trial. Standard anaesthesia procedures (propofol/fentanyl) were followed. Each patient received roc 0.6 mg/kg for intubation. 3, 5 or 15 minutes later, placebo ($n = 9$) or a single bolus dose of 1.0, 2.0, 4.0, 6.0 or 8.0 mg/kg Org 25969 was given ($n = 18$ for each dose group). Neuromuscular block was measured acceleromyographically (TOF-Watch SX). Total roc and Org 25969 in plasma (C_p) and urine were determined using validated assay methods which do not discriminate between roc-Org 25969 complex and the separate compounds.

Results and Discussions: C_p of Org 25969 increased proportional to the dose of Org 25969. The median amount excreted in urine up to 24 h varied between 48 and 86% of the Org 25969 dose. C_p of roc was elevated when 0.6 mg kg^{-1} roc was followed by administration of Org 25969 compared to placebo. For example, when 8.0 mg kg^{-1} Org 25969 was given three minutes after roc the C_p of roc at 20 minutes postdose (median 3465 ng ml^{-1}) was $2.2 \times$ higher compared to C_p after roc dosing only (median 1570 ng ml^{-1}). A median of 26% of the dose was recovered in urine up to 24 h after administration of roc only. When roc dosing was followed by Org 25969 3, 5 or 15 minutes later, the % of the roc dose excreted increased to 58–74% at Org 25969 dose levels ≥ 4.0 mg kg^{-1} .

Conclusion(s): Administration of Org 25969 leads to altered distribution and elimination of roc as a result of complex formation, as evidenced by elevated C_p and increased urinary excretion.

References:

- 1 Angew. Chem. 2002; 114: 276–9.
- 2 Anesthesiology 2002; 96: A1008.

Acknowledgements: This multicentre phase II study is organised by NV Organon, The Netherlands.

A-577**Effect of choice of intravenous induction drug on intubation conditions for rapid sequence induction with rocuronium**

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Background and Goal of Study: Endotracheal intubation may be affected not only by the neuromuscular blocking drug used but also by the intravenous induction agent. The goal of this study was to assess whether selecting the intravenous induction drug would affect the intubating conditions produced by rocuronium 0.7 mg/kg is used for rapid sequence induction.

Materials and Methods: After obtaining informed consent from all patients, we studied 60 adult ASA physical status I or II patients undergoing elective surgery. Patients were randomly allocated to thiopental group (5 mg/kg, n = 20), propofol group (2 mg/kg, n = 20) and etomidate group (0.2 mg/kg, n = 20). After preoxygenation patients in the different group received the estimated induction dose of the assigned induction agent. Rocuronium 0.7 mg/kg IV was then given. Induction drug syringes were hidden and an experienced anesthesiologists who was unaware of the induction drug performed laryngoscopy and intubation 60 seconds after the rocuronium injection. Intubation conditions were assessed by jaw relaxation, vocal cord movement, response to tracheal intubation and evaluated as excellent, good, fair and poor. Arterial blood pressure and heart rate were measured before induction, immediately after intubation, 1 min, 3 min, 5 min and 10 min after intubation.

Results and Discussions: The frequency of excellent intubation conditions was higher in propofol group (60%) as compared with thiopental group (55%) and etomidate group (45%), but there was no statistical significance among the three groups. Arterial blood pressure was increased and moderate tachycardia was seen after intubation in all three groups, but the blood pressure was relatively lower in the propofol induction.

Conclusion(s): The intubation conditions are similar after either thiopental, propofol, or etomidate when rocuronium 0.7 mg/kg is used to facilitate to endotracheal intubation for rapid sequence induction.

Reference:

- 1 Fuchs-Buder T, Sparr HJ, Ziegenfuss T. Thiopental or etomidate for rapid sequence induction with rocuronium. *Br J Anaesth.* 1998; 80: 504-6.

A-578**Safety and effectiveness of pharmacokinetic controlled amino-glycoside dosing as a routine procedure on the ICU**E. Wiesner¹, L. Saager¹, H. Sprenger², S. Nägle², A. Rothhammer¹*¹Dept. of Anaesthesiology and Critical Care Medicine, Leopoldina Hospital; ²Dept. of Laboratory Medicine, Leopoldina-Hospital, Schweinfurt, Germany*

Background and Goal of Study: The amino-glycoside therapy with a fixed dosing regimen frequently results in a subtherapeutic or toxic serum level (1). The clinical trial accounts the effectiveness of a daily measured, current kinetic based dosage.

Materials and Methods: In altogether 465 days, 93 intensive care patients received gentamycin according to the following pattern: After determining a base value (G1), patients received 160 mg of gentamycin over a time course of 20 minutes. 10 (G2) and 100 min. (G3) after cessation of infusion samples were taken. (Enzyme-Immunoassay EMIT, Dade-Behring, Analyzer aca-star, Dade-Behring.) We used a one compartment model in order to estimate the volume of distribution, half-life and clearance from which the subsequent two-point dosage schedule was calculated. At the calculated time the fourth sample (G4) was taken to control the target peak level (graph 1).

Results and Discussions: After the loading dose of 160 mg Gentamycin 79.4% of the measured values (G2, 7.61 ± 2.30) ranged between 6 mg/l and 12 mg/l. After individual calculated pharmacokinetic dosage 90,5% (G4, 8.85 ± 2.85 mg/l) achieved a plasma peak concentration within the desired range. Toxic levels of concentration did not increase. The daily total gentamycin dosage was between 3.6 and 7.4 mg/kg.

Conclusion(s): The low therapeutical broadness limits the use of amino glycosides for intensive care patients. When applying a stable dosage scheme there is a risk of ineffectiveness low or toxic high plasma levels due to strongly differing individual distribution-volume and half-life.

The presented dosage regimen has proven itself in daily routine. Therapeutic concentrations are achieved reliably under avoidance of toxic plasma levels.

Reference:

- 1 Crisp C.B. et al.: *Crit. Care Med.* 18:734,1990.

A-579**Org 25969, a new reversal agent for deep neuromuscular block induced by rocuronium in the anaesthetised Rhesus monkey**

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Background: Org 25969, a synthetic γ -cyclodextrin, is a novel reversal agent and has been especially designed to selectively bind the steroidal neuromuscular blocking drug rocuronium, instead of inhibiting acetylcholinesterase. The present study in Rhesus monkey shows that this mechanism allows the reversal of deep neuromuscular block.

Material and Methods: Female Rhesus monkeys were sedated with ketamine i.m., followed by intravenous bolus injection of pentobarbitone sodium and a subsequent infusion. The lungs were ventilated with a mixture of oxygen and nitrous oxide (2:3). Heart rate and blood pressure were monitored and body temperature was kept at 37–38°C. Contractions of the adductor pollicis muscle were induced by train-of-four stimulation of the ulnar nerve of the right thumb. After a bolus injection of five times the ED₉₀ of rocuronium ($500 \mu\text{-kg}^{-1}$) the preparation was allowed to recover spontaneously. After a steady state recovery of 30 minutes this procedure was repeated, but at one minute after the bolus injection of rocuronium, either saline 0.9% or 2.5 mg·kg⁻¹ Org 25969 was administered i.v.

Results and Discussion: Recovery variables of these experiments are presented in the table below. Org 25969 caused a rapid reversal of deep neuromuscular block induced by rocuronium. Haemodynamic changes were not seen. All animals recovered completely without any complication. Signs of residual blockade or re-curarisation were not observed.

TOF ratio (%)	Recovery after saline 0.9%	Recovery after Org 25969 2.5 mg·kg ⁻¹
50	21.4 (2.6)	3.9 (0.9)*
75	25.6 (3.0)	5.9 (1.5)*
90	28.2 (3.5)	7.9 (1.8)*

Neuromuscular recovery times (min) of the experiments. Values are mean and (SEM); n = 4 in each experiment; *p < 0.05 vs recovery after saline 0.9%.

Conclusions: Org 25969 is a new rapidly acting reversal agent for rocuronium, based on a new mechanism of chelation. This mechanism allows reversal of deep neuromuscular block without side effects.

A-582**Molecular volumes of n-alcohols and volatile anaesthetics determine their modulation of 5-HT_{3A} receptors**

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Background and Goal of Study: 5-hydroxytryptamine type 3 (5-HT₃) receptors are alcohol and anesthetic-sensitive, ligand-gated ion channels[1]. 5-HT₃ receptor antagonists are used to prevent and treat postoperative nausea and vomiting. The exact interactions of alcohols, volatile anaesthetics and 5-HT₃ receptors remain poorly understood. The aim of this study was to further characterize their interactions.

Materials and Methods: Currents from *Xenopus* oocytes expressing 5-HT_{3A} receptors were recorded using the two-electrode voltage-clamp technique. The effects of 12 n-alcohols and volatile anaesthetics of various molecular volumes at 2 × their *in-vivo* anaesthetizing concentrations on sub-maximal agonist-evoked 5-HT_{3A} currents were studied. Moreover, 5-HT concentration-response relationships were then constructed in the absence and presence of various n-alcohols and volatile anaesthetics at 1 × and 2 × their *in-vivo* anaesthetizing concentrations to define the effects on agonist EC₅₀ and peak current response.

Results and Discussions: 1) There was a strong correlation ($r_s = -0.963$) between molecular volume and modulation. n-alcohols and volatile anaesthetics with a molecular volume of <120 Å³ enhanced 5-HT 1 mikroM-evoked currents whereas compounds >120 Å³ inhibited these. 2) Full 5-HT concentration-response relationships revealed that only anaesthetics <120 Å³ caused a left-shift of the 5-HT EC₅₀. All drugs caused a block at high 5-HT concentrations, with the larger anaesthetics producing a greater block than the smaller ones.

Conclusion(s): The modulation of sub-maximal agonist evoked 5-HT_{3A} receptor currents by n-alcohols and volatile anaesthetics is dependent on their molecular volume. We suggest that n-alcohols and halogenated volatile anaesthetics increase the apparent agonist affinity by binding to a small site since the ability of these compounds to produce a leftward shift in the 5-HT concentration-current response curve exhibits a cutoff beyond 120 Å³.

Reference:

1 Jenkins A, Franks NP, Lieb WR. *Br J Pharm* 1996; 117: 1507–1515.

Note: Part of this work is presented at the 2004 Biophysical Society Meeting, Baltimore, USA.

A-583

The use of remifentanyl in preventing marked haemodynamic changes during laparoscopic adrenalectomy for pheochromocytoma

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Goal of Study: To prevent marked haemodynamic changes from catecholamine release during laparoscopic adrenalectomy for pheochromocytoma (1).

Material and Methods: After IRB approval nine patients scheduled for laparoscopic adrenalectomy for pheochromocytoma were studied. Preoperatively received α - and β -blockers for 2–3 weeks. Anesthesia was induced with fentanyl/propofol/cis-atracurium maintained with sevoflurane/N₂O/O₂. A continuous infusion 0.15–0.25 μ g/kg/min of remifentanyl started immediately after intubation. Central venous catheter and arterial line were inserted. All haemodynamic and ventilatory data were measured and calculated at the following time points: before induction of anesthesia (T₀), after induction of anesthesia (T₁), with the patient at lateral position (T₂), 5 min (T₃) and 20 min after insufflation (T₄), 5 min before adrenal vein ligation (T₅) and 5 min after adrenal vein ligation (T₆), after CO₂ deflation (T₇) and in the recovery room (T₈).

Results: Time course of changes in mean arterial pressure (MAP), heart rate (HR), central venous pressure (CVP) and infusion rate of remifentanyl during pneumoperitoneum and pheochromocytoma resection are shown in the table.

Time	MAP (mmHg)	HR (bp/m)	CVP (mmHg)	Remifentanyl (μ g/Kg/min)
T ₀	95 ± 17	74 ± 14		
T ₁	72 ± 13	66 ± 11	9.2 ± 0.8	0.15 ± 0.05
T ₂	74 ± 14	64 ± 13	9.3 ± 0.9	0.25 ± 0.05
T ₃	103 ± 12	65 ± 10	12 ± 0.8	0.5 ± 0.04
T ₄	97 ± 14	66 ± 11	13 ± 0.5	0.7 ± 0.06
T ₅	98 ± 10	79 ± 10	14.9 ± 0.8	1.7 ± 0.09
T ₆	99 ± 12	76 ± 0.8	14.3 ± 0.7	0.35 ± 0.06
T ₇	74 ± 11	64 ± 12	13 ± 0.6	0.15 ± 0.02
T ₈	75 ± 13	68 ± 10	10 ± 0.5	0.05 ± 0.03

The median consumption of remifentanyl per patient throughout the study was 2.3 mg (2.1–5.4 mg).

Conclusion: The use of remifentanyl seems to be effective in preventing marked haemodynamic changes from catecholamine release during laparoscopic adrenalectomy for pheochromocytoma.

Reference:

1 Joris J, Hamoir E et al. *Anesth Analg* 1999; 88:16–21.

A-584

The importance of receptor subunit composition and anaesthetic molecular volume in defining modulation of 5-HT_{3AB} receptors by anaesthetics

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Background and Goal of Study: 5-hydroxytryptamine type 3 (5-HT₃) receptors are thought to be involved in the pathogenesis of postoperative nausea and vomiting (PONV). It is known that homomeric 5-HT_{3A} receptors are modulated by anaesthetics. No data is available on the modulation of heteromeric 5-HT_{3AB} receptors by anaesthetics. Therefore, the aim of this study was to define the actions of n-alcohols and halogenated volatile anaesthetics on human 5-HT_{3AB} receptors.

Materials and Methods: Currents from *Xenopus* oocytes expressing 5-HT_{3AB} receptors were recorded using the two-electrode voltage-clamp

technique. The effects of 9 n-alcohols and volatile anaesthetics of various molecular volumes at 2 × their *in-vivo* anaesthetizing concentrations on sub-maximal (5 microM) agonist-evoked 5-HT_{3AB} currents were studied. 5-HT concentration-response relationships were then constructed in the absence and presence of butanol, octanol, chloroform, isoflurane and sevoflurane at 1 × and 2 × their *in-vivo* anaesthetizing concentrations to define their effects on agonist EC₅₀ and peak current response.

Results and Discussions: A strong correlation ($r_s = -0.962$) between molecular volume and modulation was detected. n-alcohols and volatile anaesthetics with a molecular volume of <100 Å³ enhanced 5 microM 5-HT-evoked currents whereas compounds >110 Å³ inhibited currents. Full 5-HT concentration-response relationships showed that none of the drugs caused a substantial shift of the 5-HT EC₅₀. However, the larger anaesthetics caused a concentration dependent inhibition at all 5-HT concentrations.

Conclusion(s): The results of this study show that similar to 5-HT_{3A} receptors, modulation of 5-HT_{3AB} receptors by halogenated volatile anaesthetics and n-alcohols is dependent on the molecular volume of the drug. The degree of current inhibition observed with larger anesthetic compounds is also similar in both receptor subtypes. However, the degree of current enhancement observed with small anesthetic compounds is substantially reduced in 5-HT_{3AB} receptors. This suggests that the 5-HT_{3B} receptor subunit differs from the 5-HT_{3A} receptor subunit in that it lacks a binding site for modulators that confers enhancement.

A-585

Quantitative measurement of skin blood flow after injection of local anaesthetic isomers

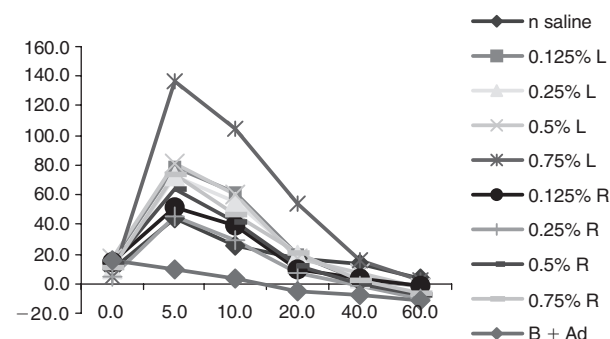
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Background and Goal of the Study: Vasoconstriction is an advantageous property of local anaesthetics. However, it is debatable whether either of the new single isomer LA's causes vasoconstriction likely to be of clinical relevance.¹

Materials and Methods: In a double blind study, 10 volunteers received intradermal injections of S(-) bupivacaine (L) and of ropivacaine (R) in various concentrations [0.125% to 0.75%]. An injection of 0.9% Saline and 0.5% bupivacaine with 1:200,000 epinephrine was also given. Skin blood flow was measured using laser Doppler perfusion imaging at regular intervals for 60 min. AUC was calculated and compared using ANOVA.

Results and Discussion: Both S(-) drugs at all concentrations produced an increase in skin perfusion which returned to baseline at around 40 min. Only in the group containing 0.5% bupivacaine with 1:200,000 epinephrine was significant vasoconstriction seen.



Conclusion: To achieve clinically significant vasoconstriction with the new single isomer LA's, epinephrine needs to be added.

A-586

Normalisation of Wolff–Parkinson–White syndrome conduction with propofol

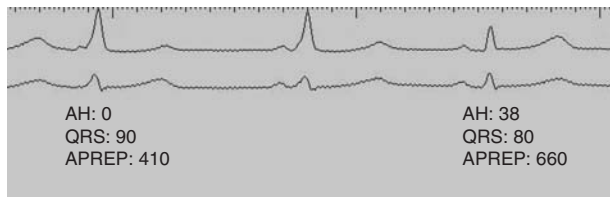
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Background and Goal of Study: Propofol has not been reported to have any direct effect on the accessory pathway conduction in patients with Wolff–Parkinson–White (WPW) syndrome¹. However, PR interval and QRS amplitude normalisation have been documented during propofol infusion in WPW patients². We observed that propofol normalised not only the ECG pattern but also the accessory pathway effective refractory period in a patient with WPW syndrome.

Materials and Methods: A 60 y.o. woman with WPW syndrome was scheduled for radiofrequency catheter ablation. Antiarrhythmic therapy was discontinued for a period greater than 5 half-lives before de study and no premedication was given. The ECG showed a delta wave and a short PR interval. Once the electrode catheters were in place, baseline measurements were obtained. These being the accessory pathway effective refractory period (APERP) of 410 milliseconds (ms). Just before the ablation was started, propofol (bolus of $1 \text{ mg}\cdot\text{kg}^{-1}$ followed by $3 \text{ mg}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) was administered. A few minutes after propofol initiation the delta wave disappeared, the QRS amplitude was shortened and the APERP was prolonged up to 660 ms (figure). Delta wave reappeared just after propofol discontinuation. Radiofrequency ablation was performed uneventfully under sedation with midazolam and alfentanil.

Results: ECG layout and EP values (ms) before and after propofol administration.



APERP: Accessory Effective Pathway Refractory Period.

Conclusions: Propofol induced reversible prolongation of the accessory pathway conduction with normalisation of the QRS complex in a patient with WPW syndrome.

References:

- 1 Sharpe MD et al. *Anesthesiology* 1995; 82:888–95.
- 2 Seki S et al. *Anesthesiology* 1999; 90:1779–81.

A-587

Effects of propofol, fentanyl and remifentanyl on the QTc interval

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Background and Goal of Study: Corrected QT (QTc) interval prolongation may cause potentially hazardous arrhythmias. Propofol, fentanyl and remifentanyl are drugs commonly used as sedatives for different procedures and their effects on the QTc interval are not completely understood. The aim of the study was to assess the effect of propofol alone or propofol and fentanyl and lastly remifentanyl as sedatives on the QTc interval during electrophysiological (EP) studies.

Materials and Methods: 32 ASA I–II patients undergoing EP studies were randomly allocated into three groups: a) propofol ($n = 12$, bolus of $1 \text{ mg}\cdot\text{kg}^{-1}$ followed by $3 \text{ mg}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ infusion), b) propofol (bolus of $1 \text{ mg}\cdot\text{kg}^{-1}$ followed by $3 \text{ mg}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ infusion) with fentanyl ($n = 10$, bolus $1 \text{ mcg}\cdot\text{kg}^{-1}$) and c) remifentanyl ($n = 10$, $0.1 \text{ }\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). After monitoring ECG, SatO_2 and NIBP, 35% oxygen by a face mask was administered. QTc interval was measured before and 15 min after study drug administration. QT interval (ms) corrected for heart rate (QTc) was calculated using Bazett's equation. Statistical analysis: paired *t*-test. *P*-value < 0.05 was considered as statistically significant.

Results and Discussions: Data (mean \pm SEM) are shown in the table. **P* < 0.01 .

	Propofol	Propofol/fentanyl	Remifentanyl
Basal	441,4 \pm 8,8	445,1 \pm 10,1	443,1 \pm 14,8
15 min	454,4 \pm 10,5*	421,9 \pm 12,2*	436,5 \pm 13,9

Propofol alone significantly prolonged QTc interval, but when fentanyl was added a significant shortening of the QTc was observed. Interestingly, remifentanyl did not appear to have a significant effect on the QTc.

Conclusions: When sedation is planned in patients with prolonged QTc: 1) propofol alone should probably not be used and 2) the combination of propofol and fentanyl, or remifentanyl appear to be more appropriate.

A-588

A comparison of subcutaneous injection of fixed low dose heparin in different areas such as thigh, arm and abdomen

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Background and Goals: Bruising and indurations associated with subcutaneous heparin injection (SHI) often results in sustained tenderness and

severe ecchymosis at the injection site (1). Previous study evaluated the effect of syringe size on bruising following SHI (2). This study was designed to compare the effects of different areas of SHI on mean and maximum areas of bruises (BA mean & BA max) and pain intensity (PI).

Material and Methods: After approval of the proposal by ethics committee and obtaining the informed consent this semi experimental complete crossover study designed and was done on 58 patients who received SHI in randomly ordered sites (abdomen, arm, thigh) with a 12 hours interval. The pain intensity was estimated immediately after injection. Bruise size was observed 24, 48 and 72 hours after injection. Statistical analysis was performed with ANOVA.

Results: Data (mean \pm SD) are shown in table.

	BA mean (mm ²)	BA max (mm ²)	PI (VAS: 1–10)
Abdomen	133.2 \pm 265.2	152.9 \pm 285.7	4.1 \pm 2.4* [?]
Arm	144.0 \pm 255.4	159.3 \pm 269.2	5.8 \pm 2.5
Thigh	158.2 \pm 238.8	172.1 \pm 255.1	5.6 \pm 2.6

[?]*P* = 0.000 vs Arm; **P* = 0.001 vs Thigh

Conclusions: According to the results of this study, abdomen area may be considered as the preferred site for subcutaneous heparin injection because of less pain intensity.

References:

- 1 Chamberlain SL. *AJN* 1980; 80: 1115–1117.
- 2 Hadley SA, Chang M, Rogers K. *Am J Crit Care* 1996; 5: 271–276.

A-589

Myotoxicity of ropivacaine after single intramuscular injection on rats

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Background and Goal of Study: Myotoxicity of various local anesthetics has been described in studies on rats and humans (1,2). Goals of this study were to evaluate the potential myotoxic effects of ropivacaine on rats, when administered in clinical concentrations.

Materials and Methods: Forty, 12-week-old male Wistar rats have been used. Under sedation with xylazine $10 \text{ mg}\cdot\text{kg}^{-1}$ and ketamine $90 \text{ mg}\cdot\text{kg}^{-1}$ given intraperitoneal, we injected the right tibialis anterior muscle of the rats with either 100 ml of ropivacaine 0.75% (group R, $N = 20$) or 100 ml of normal saline 0.9% (group S, $N = 20$). The contralateral tibialis anterior muscle of both groups has been used as a control. We sacrificed 10 rats from each group 2 days after the injection. The remainder 10 rats from each group were sacrificed 7 days after the injection. The injected and control muscles were examined under light and electron microscope.

Results and Discussions: Two days after injection, focal necrotic areas in the muscle fibers with neutrophilic granulocytes, macrophages and fibroblasts accumulation were observed in biopsies obtained from group R. Regenerated fibers with large nuclei and prominent nucleoli were also observed. Vacuolation in the cytoplasm of the fibers was a common finding under electron microscopy. In group S biopsies and in biopsies obtained from control muscles, only a few inflammatory cells and rarely damaged muscles were observed. Seven days after the injections, the degenerated areas of the muscle fibers have been cleaned by the inflammatory cells and regeneration of the fibers has been noted in all groups.

Conclusion(s): Ropivacaine, like other local anesthetics, can cause reversible histologic changes in skeletal muscles in rats. Further studies are required in order to evaluate the potential action of the drug to human skeletal muscles.

References:

- 1 Basson M.D. *Anesth Analg* 1980; 59: 275–282.
- 2 Komai K. *Anesthesiology* 1999; 90: 835–843.

A-590

Effects of lignocaine and BN52021 on platelet activating factor induced neutrophil priming

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Background and Goal of Study: Lignocaine has been shown to attenuate neutrophil (PMN) priming by platelet activating factor (PAF) both by

concentration and time dependent fashion (1). BN52021 is a PAF receptor antagonist (2), acting at a different level to attenuate PAF effects. We hypothesized that lignocaine and BN52021 might have additive or synergistic effect. We present our preliminary data.

Materials and Methods: PMN were isolated from the venous blood collected from 15 healthy volunteers. PMN were pre-treated with different concentrations of lignocaine, BN52021 and both for 1–3 hours. PMN were primed with PAF and challenged with fMLP. Neutrophil respiratory burst (NRB) is measured with flow cytometer. Data were analyzed with Student's *t*-test.

Results and Discussions: Lignocaine and BN 52021 both decreased the NRB induced by PAF and fMLP (Figure 1). Percentage decrease of NRB compared to control (Table)

Table

Lignocaine 2 µg	Lignocaine 4 µg	BN52021 1 × 10 ⁻⁹ M	BN52021 & Lignocaine 2 µg	BN52021 & Lignocaine 4 µg	BN52021 & Lignocaine 8 µg
8	15	40	55	62	80

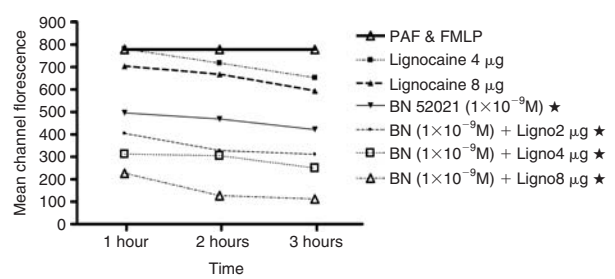


Figure 1. **p* value < 0.05

Conclusion: Lignocaine might have synergistic action with BN52021 in decreasing PAF effects.

References:

- Herroeder S et al. *Eur J Anaesthesiol* 2001; 18 (21):78, 2001.
- Vercellotti GM et al. *Blood* 1988; 71: 1100.

Paediatric Anaesthesia and Intensive Care

A-591

Applicability of risk scores for postoperative nausea and vomiting in paediatric patients

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Background and Goal of Study: Risk scores to predict the occurrence of postoperative vomiting (PV) or nausea and vomiting (PONV) are well established in adult patients. Their use in children is limited since some risk factors are difficult to assess or do usually not apply in paediatric patients. The aim of this survey was to evaluate the applicability of risk scores primarily developed and tested in adult patients in a heterogeneous population of paediatric patients.

Materials and Methods: During the first 24 hours, the incidence of PV was evaluated in 1063 children (0–14 years) undergoing various types of surgery in general anaesthesia without antiemetic prophylaxis. The validity of five predictive models was compared with respect to discriminating power and calibration.

Results: The incidence of PV was 34.3%. The discriminating power (AUC with its 95%-confidence interval) obtained by the models was: Apfel 1998: 0.58 (0.55–0.61); Apfel 1999: 0.59 (0.56–0.62); Koivuranta 1997: 0.62 (0.58–0.65); Palazzo 1992: 0.56 (0.53–0.59); Sinclair 1999: 0.65 (0.62–0.68). The calibration curves (expressed by the slope and the offset, where *y* is the actual and *x* is the predicted incidence) were: Apfel 1998: $y = 0.46x + 19$; Apfel 1999: $y = 0.70x + 14$; Koivuranta 1997 (PONV): $y = 0.94x - 3$; Koivuranta 1997 (PV): $y = 1.41 + 14$; Palazzo 1992: $y = 0.47 + 31$; Sinclair 1999: $y = 0.50x + 26$. Koivuranta's PONV-score has a good calibration characteristic with a slope near to 1.0 and only a minimal offset, indicating its applicability for group comparisons.

Conclusion: However, the low AUC-values of all scores demonstrate that none of the investigated models developed and tested in adults can sufficiently discriminate which individual child will vomit postoperatively and which will not. Thus, specialized scores for children are required.

References:

- Eberhart LHJ, Högel J, Seeling W, et al. *Acta Anaesth. Scand.* 2000; 44:480–488.
- Apfel CC, Kranke P, Eberhart LHJ, et al. *Br. J. Anaesth.* 2002; 88:234–240.

A-592

Capnography rapidly confirms correct endotracheal tube placement during resuscitation of premature babies less than 1000 grams

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Background and Goal of Study: In up to 40% of endotracheal intubation attempts in premature newborn babies, the tube is initially placed in the

oesophagus (1). Clinical verification of correct tube placement in these patients is often difficult and uncertain. We report the use of capnography to rapidly verify correct tube placement during resuscitation of newborn premature babies <1000 grams. Clinical experience with capnography in resuscitation of premature babies is limited (1).

Materials and Methods: In 4 cases, gestational age 25.5–27 weeks, birth-weight 505–875 grams, heart rate 60–100, we attempted to endotracheally intubate the newborns 2–3 minutes after a C-section. A midstream capnography device (Hewlett Packard Transport Monitor M1276) was immediately attached to the tube. An immediate and continuous capnography curve clearly different from the zero line was interpreted as carbon dioxide secretion from a correctly placed tube in the trachea. A continuous flat zero curve was interpreted as an oesophageal placement of the tube.

Results and Discussions: In two of the premature an obvious capnography curve was immediately present and was interpreted as continuous after 3–8 seconds. Clinical examination confirmed tracheal tube placement after 30–60 seconds. In the other two premature there was a flat continuous zero capnography curve after the first two attempts to intubate. Clinical examination gave uncertain results. After the third attempt in both cases, there was an immediate capnography curve clearly distinctive from the zero line, interpreted as continuous after 3–8 seconds. Further clinical examination confirmed tracheal tube placement after 30–60 seconds.

Conclusion(s): Midstream capnography verify tracheal placement of the endotracheal tube within 3–8 seconds after attempted tracheal intubation in premature newborn babies <1000 grams. Clinical verification alone of endotracheal tube placement is time consuming and uncertain at a crucial time for the premature newborn in need of a secured airway and ventilation.

Reference:

- Repetto JE, Donohue PK, Baker SF, et al. *J. Perinatol.* 2001; 21: 284–287.

A-593

Laryngeal mask airway and laryngeal tube: a prospective, randomized comparison in paediatric patients

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Background and Goal of Study: While the laryngeal mask airway (LMA, LMA Company) has been used in a large number of paediatric patients (1), reports on the use of the laryngeal tube (LT, VBM Medical) in this age group are limited. The two devices are compared for ease of insertion and quality of airway seal in a prospective clinical trial.

Materials and Methods: After obtaining approval of the local ethics committee and parental consent, 40 children, aged 2–8 years, scheduled for elective surgical interventions, were randomized to be ventilated with either LMA or LT. After induction of general anaesthesia with fentanyl and propofol, airway devices were placed according to manufacturer's instructions. Number of attempts (maximum 2), insertion time, time until first tidal volume

and intraoperative tidal volumes with an etCO_2 of 35 mmHg were recorded. Airway leak pressure was measured with cuff pressures set to 60 cmH_2O . After removal, devices were inspected for traces of blood and patients were questioned for hoarseness or soar throat.

Results and Discussions: 16 boys/4 girls were ventilated with LMA, 17 boys/3 girls with LT. Demographic data as well as baseline heart rate, blood pressure and peripheral oxygen saturation were comparable for both groups, mean age was 5.2 (± 2.0) years for LMA and 5.5 (± 1.8) years for LT. Insertion was successful for LMA in 95% of patients (1 attempt 15, 2 attempts 4) and for LT in 100% (1 attempt 17, 2 attempts 3). Insertion time and time until first tidal volume for LMA/LT were 12.7/11.2 and 24.5/21.9 seconds. Peak airway pressures were 15.6 and 17.6 cmH_2O with tidal volumes of 12.0 and 12.6 ml/kg for LMA and LT. Airway leak pressure with LT was higher than with LMA: 25.8 (± 6.2) vs. 19.8 (± 3.5) cmH_2O ($p < 0.001$). Anaesthesia time was 74.2 min for LMA and 89.1 min for LT. Traces of blood after removal were found in 5 LMAs and 3 LTs, mild complaints of hoarseness or soar throat were found in the recovery room in 3/6 patients and after 24 hours in 1/2 patients for LMA/LT.

Conclusion(s): Both laryngeal mask airway and laryngeal tube allow ventilation in the age group studied. The airway leak pressure, serving as an estimate to judge quality of airway seal, is higher with the laryngeal tube.

Reference:

- 1 Lopez-Gil M *Anaesthesia* 1996; 51:969–72.

A-596

Intraoperative awareness in children: an observational study

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Background and Goal of Study: Awareness during general anesthesia in children has been poorly investigated compared to adults. Two early studies, performed 20–30 years ago, suggested that the incidence was 0 and 5% respectively^{1,2}. We present the preliminary results of a prospective study which was designed to evaluate the incidence of awareness in children having general anesthesia with modern techniques.

Materials and Methods: 151 children (6–16 yrs) admitted for elective and emergency surgery under general anesthesia (any technique) were interviewed within 36 h and 1 month after surgery. We used a standard questionnaire based on the Brice interview for diagnosing awareness³, adapted to mnemonic and language capacities of children. Cases of awareness were rated as definite, probable, and unlikely. To estimate the incidence of awareness, we included only the definite and probable cases. The relationship between awareness and management of anesthesia was examined.

Results and Discussion: We identified 12 (8%) children with awareness. 7 of those (5%) had a definite and 5 (3%) had a probable awareness (inter-rater reliability was 81% using Cohen's Kappa). 33% of the children in the definite group had an indisputable awareness during their early interview, and 100% during their late interview. There was a significant relationship between multiple attempts for endotracheal intubation and awareness ($p < 0.05$). However, other factors such as premedication, myorelaxation and signs of wakefulness were not significantly associated with awareness.

Conclusion: Even with modern techniques of anesthesia, awareness remains an important problem in children. Awareness is more accurately detected during a late interview. Multiple attempts for endotracheal increase the risk of this complication.

References:

- 1 Hobbs AJ et al. *Anaesthesia* 1988; 43:560–62.
- 2 McKie BD et al. *Anaesth Intens Care* 1973; 1:407–14.
- 3 Brice DD et al. *Br J Anaesth* 1970; 42:535–41.

A-598

A modified landmark-guided technique for internal jugular vein cannulation in paediatric patients. A preliminary report

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Background and Goals: Central venous cannulation (CVC) is essential for children undergoing major surgery. Internal jugular vein (IJV) is the preferred site for this purpose (1). The study was designed to evaluate the effectiveness of a new technique on CVC using 3 external landmarks; (i) carotid artery (CA), (ii) cricoid cartilage (CC), (iii) sternocleidomastoid muscle (SCMM).

Materials and Methods: After Ethics Committee approval and parental informed consent, 15 paediatric patients scheduled to undergo major surgery

(14 cardiac, 1 abdominal) were enrolled. CVC was attempted by the first author in all cases after anaesthesia induction and tracheal intubation were performed prior to surgery. The steps of this modified high approach technique were as follows: (i) Trendelenburg position (10° – 15°), (ii) placement of rolled towel under the shoulders, (iii) head rotation to the left (30°), (iv) palpation of the CA, (v) identification of the puncture site: 2–3 mm lateral to the CA and medial to the SCMM, above the level of CC without retracting the CA.

Results and Discussions: Demographics of patients are shown in Table 1 [Number or Mean \pm SD (min–max)].

Table 1.

n	Sex (F/M)	Age (mo)	Infant (<6 mo)	Height (cm)	Weight (kg)
15	9/6	28.9 \pm 26.3 (1–96)	6	83.6 \pm 22.7 (45–130)	10.3 \pm 6.7 (2.8–29)

CVC-related results are given in Table 2

Table 2.

Number of attempts	Access Time (sec)	Cannulation Time (sec)	Success rate (%)	CA puncture (%)
1.06 \pm 0.06 (1–2)	15.80 \pm 7.65 (3–120)	143.66 \pm 13.70 (80–300)	100	0

Mean \pm SEM (min–max).

Conclusion(s): Various landmark-guided techniques have been described in children with different incidence of complications, mainly for puncture of CA (1,2). Successful cannulation was achieved in all subjects without CA puncture by this new modified technique. It can be a useful alternative to the previously reported external landmark-guided techniques under conditions where ultrasound technology is not available while keeping anatomic variations of IJV in mind.

References:

- 1 Verghese ST, et al. *Anesthesiology* 1999; 91:71–7.
- 2 Hayashi Y, et al. *Anesth Analg* 1992; 74:688–93.

A-599

Prediction of tracheal tube size in children using multiple variables

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Background and Goal of Study: More than 2000 paediatric patients are submitted to endotracheal intubation, in our hospital, each year. This study tests the accuracy of Levin's formula ($\text{Ø} = 18 + \text{age}/4$) in selecting the appropriate size of the endotracheal tube to be used and seeks for a new alternative formula, that could make a better prediction of the adequate endotracheal tube size.

Materials and Methods: A retrospective study was undertaken using our anaesthetic records of the recent 3 years (6325 children). Data pre-processing consisted on excluding: incomplete records, cases whose age was < 1 year or > 12 years, clinical situations where there is an inherent difficulty in the intubation process, endotracheal tubes reinforced with wire, cases where endotracheal intubation occurred without muscle relaxation, nasotracheal intubation, weight $< P_5$ or $> P_{95}$. The diameters of endotracheal tubes (Mallinckrodt®) were analysed in 2576 children. A screening of the variables sex, weight, $\ln(\text{weight})$ and paediatric age (P.A) was made, in order to select those that most explain the variability in endotracheal tube size data. With this purpose a multivariate regression analysis was first performed. Based on these results a "predictive model" was built, using ordinary least squares and a process named as "quantization" for the selected subset of variables. The results of this methodology were compared with Levin's formula using computer calculations.

Results and Discussions: The variables that most explain the variability found in the endotracheal tube size are: $\ln(\text{weight})$, followed by paediatric age (P.A). Predictive models were constructed with the variable subsets $\ln(\text{weight})$ and $\{\ln(\text{weight}), \text{paediatric age (P.A)}\}$; the results found for the R^2 -statistic in the model development phase were, $R^2 = 0,7213$ and $R^2 = 0,7751$ respectively. A formula with the last subset of variables was derived ($\text{Ø} = 3,4267 + 0,4960 \ln(\text{weight}) + 0,1545 \text{P.A.}$).

The performance of Levin's formula and the multivariate formula in predicting the adequate tube size was analysed, and showed that the results from this new formula were consistently better (it predicts correctly 5–6% more of the adequate tube sizes, than Levin's formula).

Conclusion(s): The selection of endotracheal tube size is best accomplished using more than one variable. Further prospective study is suggested for our new formula, with a larger number of children, and analysing separately cuffed and uncuffed endotracheal tubes.

A-600

Clinical experience with lightwand endotracheal intubation using the Trachlight in the newborn and infants

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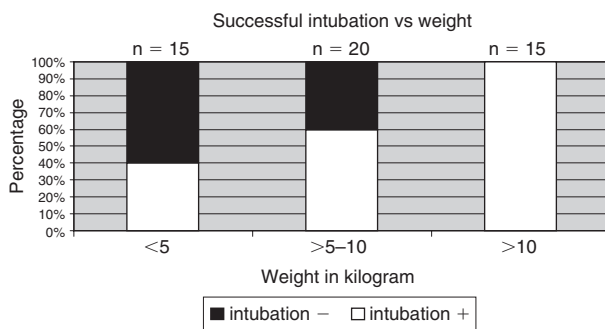
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Background and Goal of Study: Trachlight® (TL) intubation is one of many newer alternative techniques (1), which is only scarcely investigated in children (2). This prospective observational study investigated the clinical utility and limitations of the Trachlight in infants.

Materials and Methods: After informed consent 50 oral TL-intubations were performed in patients aged 0–24 months, ASA class 1–2. Following induction with 5% sevoflurane, endotracheal intubation was attempted using the appropriate-sized lightwand. We determined: success rate, time required for each intubation attempt and total time to intubation (TTI). Postoperatively we screened for mucosal damage, hoarseness and postextubation stridor. Data were analysed using the Fisher's exact test and Student's t-test.

Results and Discussions: Figure 1 shows the success rate of TL intubation in 3 weight groups. TTI was 37 ± 24 sec. in <10 kg vs. 20 ± 7 sec. in >10 kg ($P = 0.01$). No significant hypertension, tachycardia or $SpO_2 < 90\%$ were observed.

Two patients experienced mild hoarseness (<30 min).



The nonadjustable and overly bright light, resulting in a less distinct glow pattern, will not always allow differentiation of tracheal from esophageal intubation. It might be that the use of a muscle relaxant for intubation will increase the success rate.

Conclusion(s): Trachlight intubation may be an alternative intubation technique in children >10 kg. Lightwand intubation uses both tactile and visual cues regarding the location of the endotracheal tube tip. The visual cue in children <10 kg is less useful.

References:

- Hung OR, et al: Lightwand intubation: A new lightwand device. *Can J Anaesth* 1995; 42:820–5.
- Fisher QA, et al: Lightwand intubation of infants and children. *J Clin Anesth* 1997; 9:275–9.

A-601

Remifentanyl requirements during propofol-anaesthesia in children and adults

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Background and Goal of Study: During 1 MACawake sevoflurane administration remifentanyl requirements to block both somatic and autonomic responses to skin incision are two-fold higher in children than in adults [1]. Since it is unknown whether this occurs during TIVA, our aim was to define the remifentanyl infusion rate necessary to prevent movement to skin incision in 50% (IR50%) of children and adults during TIVA with propofol.

Materials and Methods: After IRB approval, unpremedicated, ASA I adults (20 to 60 yr) and children (3 to 11 yr) undergoing lower abdominal surgery under general anaesthesia were studied. Induction was with remifentanyl and TCI of

propofol set at a plasma level of $6 \mu\text{g ml}^{-1}$. After intubation this was reduced to $3 \mu\text{g ml}^{-1}$ in all patients. For the TCI of propofol, pharmacokinetic parameters derived by Marsh for adults [2] and Kataria for children [3] were used. The first patient of each group received remifentanyl $0.2 \mu\text{g kg}^{-1} \text{min}^{-1}$ and the subsequent IR were determined using the Dixons' up-and-down method with $0.02 \mu\text{g kg}^{-1} \text{min}^{-1}$ modifications. This IR was kept unchanged at least 20 minutes before surgery. At the beginning of surgery, only the skin incision was performed and the somatic response was observed by blinded investigators during 90 seconds. A positive response was any gross movement of extremity. The IR50% of both groups were compared with unpaired Student's t test. A $p < 0.05$ was considered significant. Values are mean \pm SD.

Results: 13 children and 19 adults were studied. Age (yr) was 6.2 ± 2.5 in children and 40 ± 12 in adults. The IR50% ($\mu\text{g kg}^{-1} \text{min}^{-1}$) was 0.15 (CI95%: 0.14–0.17) in children and 0.08 (CI95%: 0.07–0.10) in adults ($p < 0.001$).

Conclusion(s): Similarly to the association sevoflurane-remifentanyl, during TIVA with propofol at clinically useful concentrations, children require a remifentanyl IR 82% higher than adults to block somatic response to skin incision.

References:

- Muñoz HR, Cortinez LI, Altermatt FR, et al. *Anesthesiology* 2002;97:1142–5.
- Marsh BJ, White M, Morton N, et al. *Br J Anaesth* 1991;67:41–8.
- Kataria BK, Ved SA, Nicodemus HF, et al. *Anesthesiology* 1994;80:104–22.

A-602

Rocuronium attenuates oculocardiac reflex during squint surgery in children anesthetized with halothane and nitrous oxide

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Background and Goal of Study: The oculocardiac reflex (OCR) appears frequently during squint surgery. Different neuromuscular relaxants have been studied for the prevention of OCR, but not rocuronium. The goal of this controlled and prospective study was to test the possibility of preventing the OCR with 0.4 mg kg^{-1} of rocuronium.

Materials and Methods: ASA 1 children, 3 through 10 years old (5.7 ± 1.9 , mean \pm SD), undergoing surgery of the medial rectus muscle (MRM) were randomly assigned to two groups. In the R group (rocuronium, $n = 59$), 0.4 mg kg^{-1} of rocuronium was administered intravenously before intubation. In the C group (control, $n = 60$), no muscle relaxant was used. The anaesthesia was induced and maintained with halothane and N_2O/O_2 (50/50%). The OCR was defined as a $\geq 15\%$ reduction in heart rate and/or appearance of any other arrhythmias after the manipulation with MRM. ANOVA, Chi-square (with Yates correction), and t-test were used for statistical analysis; $p < 0.05$ was considered statistically significant.

Results and Discussions: There was no difference between groups regarding gender ($p = 0.77$), age ($p = 0.17$), body mass ($p = 0.77$), ET halothane ($p = 0.72$), or duration of surgery ($p = 0.75$), and anaesthesia ($p = 0.67$). In the R group, the incidence of sole arrhythmias and total OCR was decreased, but not of sole bradycardias and bradyarrhythmias.

Appearance	R (n = 59)	C (n = 60)	p
(a) Sole bradycardia	7	7	0.97
(b) Sole arr. (arr. w/o bradycardia)	3	11	0.05
(c) Bradycardia + other arrhythmias	6	10	0.30
Total OCR = (a) + (b) + (c)	16/59	28/60	0.03

Types of arrhythmias

Types of arrhythmias	R	C	p
VES (ventricular premature beats)	0	5	–
SVES (supravent. prenat beats)	0	5	–
Nodal rhythm	8	11	0.48
Nodal + VES	1	0	–

Conclusion: Rocuronium 0.4 mg kg^{-1} decreased the OCR occurrence in children undergoing surgery of MRM in halothane anaesthesia by reducing the incidence of supraventricular and ventricular premature beats.

A-604

Intravenous glycopyrrolate in sevoflurane-remifentanyl based anaesthesia for cardiac catheterisation in children with congenital heart disease

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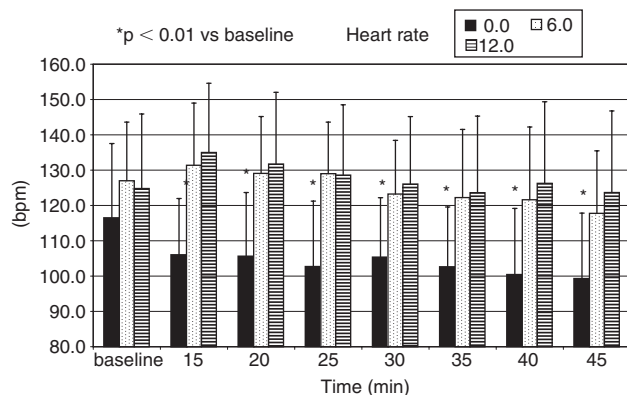
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Background and Goal of Study: We have previously shown that sevoflurane-remifentanyl anaesthesia for cardiac catheterisation is associated with

bradycardia. We have investigated whether intravenous (IV) glycopyrrolate can prevent bradycardia in this setting.

Materials and Methods: After ethics committee approval and written parental informed consent, 45 children (age 1–36 mo, ASA < 2 or more, n = 15 each group) were enrolled in a randomised double blind study. Mask induction with sevoflurane 8–6–4–2% in oxygen-air was followed by IV remifentanyl (0.15 µg/kg/min), cisatracurium (0.2 µg/kg) and either placebo, 6 or 12 µg/kg glycopyrrolate IV. After nasal intubation, sevoflurane was reduced to 0.6 MAC in oxygen/air. Monitoring included ECG, non invasive blood pressure, capnography, pulse oximetry and gas analysis.

Results and Discussion: Demographic data were comparable for all groups. In group 0 (0 µg/kg glycopyrrolate) heart rate (HR) decreased significantly from 12.5 min until 45 min ($p < 0.01$ vs baseline), whereas in group 6 and 12 no decrease in HR was noticed. In the 12 group significant tachycardia was seen between 5 and 9 minutes after induction. Heart rate is shown in fig 1.



Systolic blood pressure decreased from 20 min on in all 3 groups, diastolic blood pressure decreased in the 6 and 12 group only ($p < 0.05$, both vs baseline).

Conclusions: Intravenous glycopyrrolate effectively prevents bradycardia during remifentanyl-sevoflurane anaesthesia for cardiac catheterisation in children with congenital heart disease. The use of 12 µg/kg glycopyrrolate offers no additional benefit versus 6 µg/kg.

Reference:

L Foubert, K Reyntjens, D De Wolf et al. *Acta Anaesthesiol Scand* 2002; 46:355–36.

A-605

Compartment syndrome as a complication of lithotomy position in pediatric patients

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Background and Goal of Study: Compartment syndrome is a rare complication of operations in lithotomy position. We report three pediatric cases of compartment syndrome that took place in operations in lithotomy position.

Materials and Methods: The first case was a 11 year old male patient operated for congenital megacolon and adhesions. Operation lasted 8 h 30 min. The patient was discharged on the 6th postoperative day. The patient admitted to the emergency room with bilateral swelling and pain in the lower extremities on postoperative 11th day. Bilateral compartment syndrome was diagnosed and fasciotomy was performed the same day. The second case was a 16 year old male pseudo-hermaphrodite operated for sigmoid colon vaginoplasty for 5 h 15 min in lithotomy position. The patient complained from pain in the left leg right after recovery. The patient had fasciotomy in the postoperative 16th hour after consultation with the orthopedics department. The third case was a 13 year old male patient operated for rectum and anus reconstruction, who was initially operated in prone position for 2 h 45 min then the position was converted to lithotomy. The lithotomy position lasted for 4 h and 45 min. The patient has severe pain in the left leg in the recovery room. Swelling and pain on passive stretching was observed. Compartment syndrome was promptly recognized and the patient had fasciotomy in the postoperative 7th hour. All the patients were discharged without sequelae. None of the patients confronted hypotension during the operations. Hemodilution was not carried out and transfusions were made to maintain hemoglobin levels over 10 gr dL⁻¹.

Results and Discussions: Compartment syndrome may result from factors such as pressure on the calves, hypotension, hypovolemia, vasoconstriction, prolonged operation time and use of improper leg supports and bindings. Controversy exists in planning treatment. Early fasciotomy or conservative treatments are alternatives. Failure to diagnose and properly treat this syndrome without delay may result in injury from ischemia and reperfusion leading to poor neurological outcome.

Conclusions: Care must be taken to prevent the risk factors of compartment syndrome. An early diagnosis is precious in decreasing sequelae resulting from this complication.

Reference:

1 Pfeffer SD et al. *Anesthesiology* 2001; 95: 632–6.

A-606

Comparison of EMLA cream versus prilocaine infiltration for pediatric cardiac catheterization

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Background and Goal of Study: Studies have shown that use of the eutectic mixture of local anesthetics (EMLA) reduces the need for sedative-analgesics during venipuncture in pediatric patients; however, there are no reports on the use of EMLA during pediatric cardiac catheterization (PCC). The aim of this study was to evaluate whether application of EMLA cream reduces the need for sedative-analgesics and reduces respiratory and cardiovascular complications during PCC.

Materials and Methods: Hospital ethics committee approval was granted and informed consent was obtained from the families of 40 ASA 3–4 children scheduled for PCC via the femoral route. The children were randomly assigned to either the EMLA Group (n = 20) or the Infiltration Group (n = 20). All patients were premedicated with oral midazolam 0.5 mg/kg and hydroxyzine 1 mg/kg. Additional boluses of intravenous midazolam 0.1 mg/kg and/or ketamine 1 mg/kg were given to achieve and maintain a predetermined sedation score of 2–3 (0 = deeply sedated, 5 = agitated) throughout the procedure. The groups were compared with respect to demographic data, hemodynamic and respiratory parameters/complications, amounts of additional sedative-analgesics required, cannulation time and cannulation success rate.

Results and Discussions: The groups' demographic data, hemodynamic and respiratory parameters/complications, amounts of additional sedative-analgesics, cannulation times and cannulation success rates were similar. The mean sedation score during femoral puncture in the EMLA Group was significantly lower than that in the Infiltration Group (3 ± 1 vs 4 ± 1 , respectively; $p = 0.001$). There were no other significant differences with respect to sedation scores during the procedure.

Conclusion(s): The study showed that, compared to prilocaine infiltration, application of EMLA cream is associated with better sedation scores during femoral puncture in PCC. However, use of this cream has no effect on sedative-analgesic requirements or on the risks of hemodynamic and respiratory events during this procedure.

Reference:

1 Gall O. *Paediatr Anaesth.* 1999;9:305–10.

A-607

Pediatric regional anesthesia over 15 years in a single teaching hospital

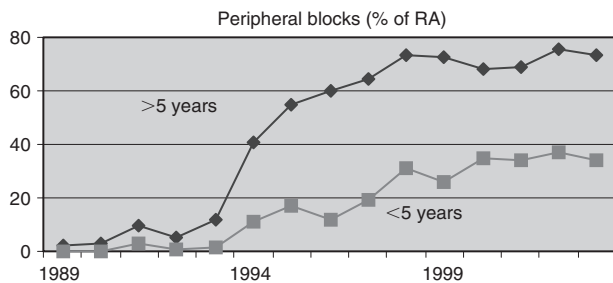
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Goal: Large series on pediatric regional anesthesia (RA) are few (1). Based on our medical information system records, we made a survey of the practice in pediatric RA in a single institution over 15 years and looked separately at patients <5 years and those older.

Results: Among 43678 anesthetics performed from 1989 to 2003 (48% in patients <5 years), 9794 RA (21.5%) were performed, increasing regularly from 9.3 to 24.4%. In the younger patients, RA increased from 9.5 to 29.3%. Medullar blocks fell from 100 down to 66% of RA. Spinal anesthesia began to increase in 1990, and now reach 20% of medullar blocks. The number of epidurals remained stable while caudals decreased by 50%, partly replaced by spinals in neonates and by peripheral blocks in toddlers. Peripheral blocks have increased since 1994 up to 30% of all RA. In the older patients, RA increased in a lesser extent, from 9.2 to 20.1%. The number of epidurals remained stable while caudals have decreased dramatically since 1997. Peripheral blocks started in 1994, outnumbered medullar blocks in 1995 and now reach 75% of RA. They are mainly plexic blocks.

Conclusion: In our institution RA rose continuously for 15 years; increase in peripheral blocks is the most remarkable change in recent years (fig).



Reference:

- Giaurfé E, et al. *Anesth Analg*. 1996; 83: 904–12.

A-609

Comparison of propofol versus ketamine induced upper airway anatomic changes in children using magnetic resonance imaging

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Background and Goal of Study: Anesthesia associated upper airway obstruction is generally attributed to reduced genioglossus activity and consequent posterior displacement of the tongue (1). The aim of this study was to compare propofol versus ketamine induced upper airway morphologic changes in children regarding the site of the airway narrowing and the smallest cross-sectional area of the airway, using magnetic resonance imaging (MRI).

Materials and Methods: Twenty-five ASA 1–2 children (aged 1–4 yrs) undergoing MRI of the head were studied. The children were randomly assigned to two groups. The propofol group (Group P, $n = 13$) received an IV propofol bolus of 1–3 mg/kg followed by a propofol infusion of 3–6 mg/kg/hr. The patients in the ketamine group (Group K, $n = 12$) were anesthetized with an IV ketamine bolus of 1–2 mg/kg followed by a ketamine infusion of 1.5–3.0 mg/kg/hr. All patients underwent additional MRI scans of the upper airway during deep sedation. The groups were compared with respect to demographic data, hemodynamic and respiratory parameters/complications, the site of airway narrowing and the smallest cross-sectional area of the airway.

Results and Discussions: Spontaneous breathing was maintained in all patients. The groups' demographic data, hemodynamic and respiratory parameters/complications were similar, except for the significantly higher heart rates in Group K ($p = 0.001$). In both Group K and Group P, the most common site of the airway narrowing was the soft palate (75% and 62%, respectively). The smallest cross-sectional area of the upper airway in Group K and Group P were $88.6 \pm 46.35 \text{ mm}^2$ and $79.3 \pm 30.51 \text{ mm}^2$, respectively ($p > 0.05$).

Conclusion(s): This study suggests that in contrast to the generally accepted view that posterior displacement of the tongue causes airway obstruction during anesthesia, airway narrowing occurs more commonly at the level of the soft palate. This study also showed that propofol and ketamine cause similar morphologic changes in the upper airway.

Reference:

- Mathru M. *Anesthesiology* 1996;84:273–9.

A-610

Alfentanil vs paraumbilical block for recovery in children undergoing pyloromyotomy

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Background and Goal: There are few data concerning pain management in infants undergoing pyloromyotomy by umbilical incision. In a prospective study we have examined the efficacy of two analgesia techniques.

Materials and Methods: We have prospectively studied 67 patients treated for pyloromyotomy. After induction with propofol or thiopental, children were intubated. Children were assigned to receive before umbilical

incision either received alfentanil 5 microg/kg (group A, $n = 38$) or paraumbilical block with bupivacaine 0.25% (group B, $n = 29$). Time points (in min) were measured as follows: time between analgesia technique and extubation (T1), end of surgery and extubation (T2), end of surgery and arriving in the PACU (T3), end of surgery and coming back in ward (T4) and end of surgery and first feeding (T5).

Results: Data (mean \pm SD) are showed in the following table:

	Group A ($n = 38$)	Group B ($n = 29$)
T1 (min)	74 \pm 33	55 \pm 16*
T2 (min)	37 \pm 33	17 \pm 13*
T3 (min)	26 \pm 14	15 \pm 7*
T4 (min)	113 \pm 38	92 \pm 20*
T5 (min)	403 \pm 94	364 \pm 91

* $p < 0.05$ (vs group A, t-test)

Conclusion: Regional anaesthesia significantly shortened delays for recovery, extubation, arriving in the PACU and discharge to ward. No change was noted regarding first feeding delay.

A-611

Use of fentanyl and lidocaine for preventing withdrawal associated with the injection of rocuronium in children

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Background and Goals: Spontaneous movements (withdrawal) are sometimes observed of the arm into which rocuronium is administered (1). To determine if fentanyl and lidocaine decreases the incidence of these movements, and to explore whether age related difference was occurred in the incidence of movements during rocuronium administration.

Material and Methods: Prospective, randomized, double-blinded, placebo-controlled study. 71 ASA I–II, aged 0–6 yr children were studied. Children randomly received 1 mg kg⁻¹ of 1% lidocaine, 3 µg kg⁻¹ of fentanyl or the equivalent volume of NaCl 0.9% 15 seconds prior to rocuronium administration. Inhalation anesthesia was performed. A tourniquet was applied to the arm from the time of injection of study drugs until rocuronium was injected. Spontaneous withdrawal was scored as follows: a) no withdrawal, b) limited to the wrist, c) involving the whole arm, including shoulder, and d) generalized body movement involving more than one extremity.

Results: The incidence of withdrawal movement limited to wrist was 4.5% in group F ($n = 22$), 4.2% in group L ($n = 24$) and 48% in group C ($n = 25$). None of the groups exhibited generalized withdrawal. Only one child (40%) showed arm/shoulder withdrawal. 12% of children in group C exhibited no withdrawal movement.

Conclusion: Spontaneous withdrawal due to rocuronium injection pain can be attenuated with preadministration of lidocaine or fentanyl which helps to deepen anesthesia. Clinical features of different withdrawal reaction between various age groups warrant further study.

Reference:

- Borgeat A, Kwiatkowski D. Spontaneous movements associated with rocuronium: is pain on injection the cause? *Br J Anaesth* 1997; 79(3):382–3.

A-612

Comparison of ketamine/propofol versus ketamine/midazolam as sedation for therapeutic and diagnostic procedures in children

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Background and Goals: The number of diagnostic and therapeutic procedures done outside of the operating room has increased dramatically in recent years. In children, most of these procedures require sedation, analgesia or both to achieve the degree of cooperation or immobilization necessary to complete these procedures successfully. The purpose of prospective study was to compare the effectiveness, recovery time from sedation, and complication rate of ketamine/propofol and ketamine/midazolam combination.

Materials and Methods: One hundred forty patients aged 8 months to 15 years undergoing diagnostic and therapeutic procedures were randomly allocated into two groups: Group 1 (ketamine/propofol $n = 70$) and Group 2 (ketamine/midazolam $n = 70$). Group 1 received 0.5 mg/kg ketamine + 1 mg/kg

propofol, Group 2 received 1 mg/kg ketamine + 0.05 mg/kg midazolam. Half of the initial drug dose was repeated to maintain a Ramsey Sedation level of 3–4. The patients were observed until the Steward Recovery Score became higher than 6. All adverse effects during the procedure and the following 24 hours were recorded.

Results: The time to a Steward Score of 6 or higher was 3.41 ± 1.93 minutes in Group 1 and 8.28 ± 3.96 minutes in Group 2, respectively ($p < 0.001$).

Table. Side effects in two groups

		Group 1 (n = 70)	Group 2 (n = 70)
During sedation	Oxygen desaturation	–	6*
	Apne	–	4
	Injection pain	4	–
	Increase oral secretions	3	3
	Inadequate sedation	–	2
After sedation first 24 hours	Nausea	3	11*
	Vomiting	4	12*
	Sleep disorder	–	2

* $p < 0.05$, Fisher's exact test

Conclusion: We conclude that ketamine/propofol combination can be preferable to ketamine/midazolam combination in children undergoing diagnostic and therapeutic procedures because of the significantly shorter recovery time and less side effects.

A-613

The effects of caudal magnesium administration on anaesthesia depth and analgesia requirement

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Background and Goal of Study: Recently most studies reported that magnesium was a N-methyl-D-aspartate (NMDA)-receptor antagonist and its analgesic and perioperative anesthetic effects were discussed with central desensitisation pathway. We aimed to study effects of caudal ropivacaine plus magnesium on anaesthesia depth and postoperative analgesia requirements.

Materials and Methods: After hospital ethic committee's consent, 32 patients (ASA I-II, 2–8 years) who had lower abdominal or penoscrotal surgery was enrolled to the study. After general anaesthesia induction, caudal blockage was applied. Patients were randomly assigned in 2 groups. Ropivacaine 0.25% was administered to Group I (n = 18), ropivacaine 0.25% plus 50 mg magnesium to Group II (n = 14) in 0.5 ml/kg volume. Perioperative anaesthesia depth was monitored at 1., 10., 15., 20. minute after caudal blockage with Bispectral index (BIS). Postoperative analgesia level was recorded at 15 minute and 1., 2., 3., 4., 6. hours with using Pediatric Objective Pain Scale (POPS) and The Children's Hospital of Ontario Pain Scale (CHEOPS). Postoperative motor blocks were evaluated with Modified Bromage Motor Block Scale.

Results: According to demographic characteristics, there was no significant differences between 2 groups ($p < 0.05$). POPS, CHEOPS, Bromage Motor Scales, analgesia duration and adverse effects were similar in Group I and Group II, but BIS of Group II (40.5 ± 9.0) was statistically lower than BIS of Group I (54.8 ± 12.7) ($p < 0.05$).

Discussion: Recent studies have shown that i.v. magnesium administration increases the anaesthesia depth. But only in one study, intratecal magnesium was used, and just now epidural magnesium has not been used in clinic researches. BIS is an objective scale to monitor the anaesthesia depth in general anaesthesia. Today BIS is begun to monitor the anaesthesia depth of central blocks.

Conclusion: In our study postoperative analgesia is effective in each group. Also addition of magnesium to ropivacaine increases anaesthesia depth, which is objectively determined by BIS. These results suggest that caudal magnesium administration may be a useful adjunct to reduce the anaesthesia requirements.

A-614

Dexmedetomidine in children requiring sedation for magnetic resonance imaging: preliminary results

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Background and Goal of Study: Dexmedetomidine is an α -2 adrenergic agonist agent with sedative properties. We aimed to evaluate the haemodynamic effect of dexmedetomidine in children requiring sedation for magnetic resonance imaging (MRI).

Materials and Methods: After approval of the parent and ethics committee, 30 children, 1–10 years of age were included in the study. All children received $1 \mu\text{g kg}^{-1}$ as the loading dose followed by continuous infusion ($0.5 \mu\text{g kg}^{-1}$) of dexmedetomidine. Systolic, diastolic and mean blood pressure, heart rate, respiratory rate and SpO_2 were recorded before procedure, during dexmedetomidine infusion and recovery room within 5 min intervals, as well as Ramsay sedation score was evaluated within 5 min intervals during dexmedetomidine infusion. During sedation, when Ramsay sedation score was ≤ 4 , midazolam 0.05 mg kg^{-1} was administered intravenously. Also, duration of sedation and MRI, total amount of dexmedetomidine, complications, midazolam requirements, eye opening and discharge times from recovery room were recorded.

Results and Discussions: Systolic, diastolic and mean blood pressure and heart rate did not decrease below 20% from baseline values in any children. Systolic, diastolic blood pressure 13%, mean blood pressure 12% and heart rate 11% decreased significantly according to baseline values. Respiratory rate did not change during dexmedetomidine infusion. Additional midazolam required in 11 children. Neither apnoea nor non-periodic breathing was observed during and after dexmedetomidine infusion. ETCO_2 was within normal limits and SpO_2 was not below 93% for all children.

Conclusion(s): We suggest that dexmedetomidine with $1 \mu\text{g kg}^{-1}$ loading and $0.5 \mu\text{g kg}^{-1}$ infusion dose can be used safely without respiratory depression and haemodynamic disturbance in children 1–10 years of age. However, dexmedetomidine alone may not provide adequate level of sedation for MRI in this dose. In this case, it should be combined with midazolam.

Reference:

Tobias JD, et al. *South Med J.* 2003;96:871–5.

A-615

Monitoring alveolar anesthetic concentration during the anaesthesia with the AnaConDa (anaesthesia conserving device)

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Background and Goals: The new Anesthetic Conserving Device "AnaConDa" (ACD) (Hudson RCI, Sweden) is a modified heat and moisture filter with activated carbon in which liquid anesthetic is administered via a syringe pump to an evaporator rod located in the device. With ACD, estimation of alveolar anesthetic concentration from End-tidal values could be misleading. We measured the true alveolar anesthetic concentration in order to correlate this value with the inspired and End-tidal concentrations measured with a standard clinical monitor.

Methods: Four Large white swine of 20 Kg were ventilated using an Evita 4 with 15 bpm and a VT of 8–12 ml/Kg (EtCO_2 35–45 mmHg). ACD device was then inserted between the Y piece of the ventilator and the endotracheal tube. Due to the 100 mL of dead space produced by the device, we readjusted VT to avoid rebreathing and hypercarbia. The sevoflurane syringe was adjusted at different rates for obtaining different anesthetic concentrations. Inspiratory (Fi) and End-tidal (Et) anesthetic concentrations were measured with an analyzer (Vamos, Dräger, GE) connected to the sampling port of the ACD. The sampling flow was returned to the anesthetic system. For measuring "alveolar" anesthetic concentration ET tube was clamped at end inspiration, disconnected from the ACD-ventilator port and connected to an exhalation bag. After an inspiratory hold of 5 seconds, passive expiration was allowed to the reservoir bag and the End-tidal value of this exhalation was considered representative of alveolar anesthetic concentration (FA). Ten measurements were determined at different expired concentrations in each animal.

Results: Measured inspired concentrations were always lower than End-tidal values on the monitor. Alveolar concentration values were slightly lower to End-tidal values. The following correlation were found:

$$\begin{aligned} \text{FET} &= 1.7 \text{ Fi} - 0.35 & r &= 0.94 \text{ } p < 0.001 \\ \text{FA} &= 0.75 \text{ FET} + 0.39 & r &= 0.90 \text{ } p < 0.001 \end{aligned}$$

Discussion: Alveolar sevoflurane concentration during anaesthesia with the AnaConDa device are close and well correlated to the End-tidal values measured with a clinical monitor. This way, for clinical purposes, End-tidal anesthetic values can be used as a guide to adjust the rate of infusion of liquid anesthetic.

A-616

Does recombinant factor VIIa significantly reduce the need for transfusion in infants undergoing major cardiac surgery?

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Background and Goal of Study: Recombinant factor VIIa (rFVIIa) may be effective in treating bleeding disorders after cardiopulmonary bypass (CPB)⁽¹⁾. In a retrospective casematch study we tried to assess whether infants undergoing heart surgery may benefit from a treatment with rFVIIa.

Materials and Methods: In the treatment group (NS) 16 infants (1.7 ± 3 months of age, 3.5 ± 1.3 kg BW) were treated with a single dose of rFVIIa (3–6 KIE per kg BW) after separation from CPB. Another 16 infants (1.9 ± 3.2 months of age, 3.8 ± 1.8 kg BW) served as control (C). We investigated the effects of recombinant factor VIIa on hemostasis, transfusion requirements and blood gases up to 48 hours after surgery.

Results and Discussions: Hemostasis (PT) and base excess were significantly better in the treatment group with a trend to reduced postoperative loss of drainage fluids and transfusion requirements.

	PT day 0 (%)	Transf. RBC day 0 (ml)	Base excess day 0	Drainage fluids day 0 (ml)	Drainage fluids day 1 (ml)
Group 1 (NS)					
Mean	99.93	20.25	0.09	35.06	81.50
Std	29.12	29.06	3.33	46.76	50.25
Group 2 (C)					
Mean	52.78	63.00	-4.65	89.36	129.64
Std	9.63	75.66	4.74	84.10	82.50
P (t-test)	0.00003	-	0.023	-	-
P (MWU)	-	0.067	-	0.062	0.073

Conclusion: Treatment with recombinant factor VIIa after major cardiac surgery in infants may be beneficial with regard to postoperative hemostasis and transfusion requirements. This should be further investigated in a prospective randomized study.

Reference:

1 Naik VN et al., *Can. J. Anaesth.* 2003; 50(6): 599–602.

A-617

Comparison of peritonsillar infiltration with bupivacaine and ropivacaine on postoperative pain after tonsillectomy in paediatric patients

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Background and Goals: Peritonsillar infiltration of local anaesthetic solutions before incision or postoperatively have been suggested to reduce pain after tonsillectomy (1,2). The aim of this study is to compare the effects of peritonsillar infiltration of bupivacaine and ropivacaine on pain after tonsillectomy in paediatric patients.

Material and Methods: Sixty patients who will have tonsillectomy operation under general anaesthesia, ranging 4 to 17 years were randomly allocated to 3 groups: Preoperative peritonsillar infiltration with bupivacaine 0.25% (Group B), ropivacaine 0.2% (Group R) and saline (Group C). All solutions were containing epinephrine (1:200000). Pain score were assessed with the use of visual analogue scale (VAS) at 1, 5, 10, 15, 30 and 60th minutes, 2, 6, 12 and 24th hours after extubation. Sedation scores were also recorded at the same measurement times. All patients were treated with 5 mg kg^{-1} acetaminophen (maximum 1.5 g kg^{-1}) when their VAS were higher than 4 and total acetaminophen dosage were recorded at 24th hour.

Results and Discussion: VAS values of all groups were demonstrated on figure 1. Total acetaminophen dosage were $6.25 \pm 2.20 \text{ mg kg}^{-1}$, $3.50 \pm 2.90 \text{ mg kg}^{-1}$ and $4.75 \pm 2.55 \text{ mg kg}^{-1}$ in groups C, B and R respectively. Total acetaminophen dosage was statistically lower in group B than in group C ($p < 0.05$).

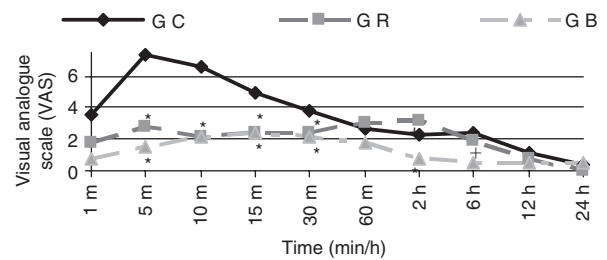


Figure 1. Visual analogue scale of groups. $p < 0.05$. * relative to group C; + relative to group R.

Conclusion: Although peritonsillar infiltration of bupivacaine is insufficient in controlling postoperative tonsillectomy pain it may be more effective than ropivacaine for reducing total analgesic consumption.

References:

- 1 Molliex S. *Acta Anaesthesiol Scand* 1996;40:1210–15.
- 2 Podoshin L. *Ann Otol Rhinol Laryngol* 1996;105:868–70.

A-618

Effects of propofol and ketamine on body temperature during induction of general anesthesia in children

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Background and Goals: The goals of study is to evaluate core temperature and skin-surface temperature gradients in use of ketamine for anesthetic induction compared with propofol in children (1).

Material and Methods: After institutional ethics committee approval and informed consent, 40 children undergoing elective surgery were randomly assigned to anesthetic induction with either 2.0 mg/kg ketamine ($n = 20$) or 2.0 mg/kg propofol ($n = 20$). Anesthesia in both groups was maintained with sevoflurane and 50% nitrous oxide in oxygen. Core temperature, forearm minus fingertip, skin-temperature gradients were recorded before induction of anesthesia, 3 min (just before endotracheal intubation), 5 min, and at 5 min intervals until 30 min after induction of anesthesia.

Results: Core temperature was decreased, but results did not differ significantly between two groups. Forearm skin temperature was increased, results did not differ significantly between two groups. Fingertip skin temperature was increased significantly after 3 min of anesthesia in the propofol group and 10 min in the ketamine group. Forearm minus finger skin surface temperature gradients was decreased significantly at 3 min of anesthesia in the propofol group and 10 min in the ketamine group. Gradients of 5 min of anesthesia was presented only significant between two groups.

Conclusions: Peripheral vasodilation is likely to facilitate core-to-peripheral redistribution of heat during induction of general anesthesia in children.

Reference:

1 Ikeda T. *Anesth Analg* 2001;93:934–8.

A-620

Patient controlled regional analgesia in children following lower limb surgery

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Background and Goal of Study: Recent findings support the evidence that regional analgesia (RA) in children leads to efficacious pain relief (1,2). In contrast, little has been reported about the ability of children to use patient-controlled peripheral RA (PCRA) or about the efficacy of this technique using ropivacaine 0.2% as the sole local anaesthetic. We report a preliminary analysis of prospectively recorded data in 21 children in whom PCRA was used for acute postoperative pain control.

Materials and Methods: Following lower limb surgery and before the end of general anaesthesia, perineural catheters were inserted and continuous popliteal nerve block or continuous fascia iliaca block was started with an initial 0.5 mL/kg administration of ropivacaine 0.2% followed by a low background infusion of $0.02 \text{ mL kg}^{-1} \text{ h}^{-1}$. Additional demand doses were left to the children discretion (0.1 mL kg^{-1} , lockout time of 30 min) with a secure dose of 1 mL kg^{-1} every 4 h. The following parameters were then noted throughout

the 48 h postoperative period: pain scores (VAS or Cheops when appropriate), additional analgesics (nalbuphine, 0.2 mg/kg) and motor blockade.

Results and Discussions: Twenty one children aged 11 ± 4 yr (range, 4–17 yr) and weighing 36 ± 17 kg (range, 10–62 kg) were included. Eleven popliteal nerve blocks and 10 fascia iliaca nerve blocks were performed. The average total dose of ropivacaine administered was 4 mg/kg ± 1.7 mg/kg (range, 2.3–8 mg/kg). Cheops and VAS scores have always been inferior to 6/13 and 2/10, respectively. Only one motor blockade has been noted. One child needed rescue analgesia.

Conclusion: Patient controlled peripheral regional anaesthesia performed with a low background infusion associated with self-administered demand doses seems to provide satisfactory postoperative pain relief following lower limb surgery in children. In addition, when compared to continuously infused ropivacaine (1), this technique would permit a 60% reduction in ropivacaine administration.

References:

- 1 Dadure C, Pirat P, Raux O et al. *Anesth Analg* 2003;97:697–90.
- 2 Paut P, Sallabery M, Schreiber-Deturmeny E et al. *Anesth Analg* 2001;92:1159–63.

A-621

Central venous catheterism in a pediatric university hospital: elements of choice of site and consequences

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Goal of Study: Advances in long term treatment of malignancy, malnutrition and infections have expanded the needs for central venous access. But there are few information about elements of choice for a sub-clavian or jugular site, how the operator's experience influences this choice and what are the consequences. Thus, we compared the ins and outs of a series of central venous catheters (cvc) in infants during 18 months.

Material and Methods: we prospectively recorded for each cvc: the age and weight, the hemostase, the operator (anesthesiologist senior or in continuing education), the site (sub-clavian or jugular) and the number of dermic punctures, and the immediate complications. Values less than 0.05 were considered as significant.

Results and Discussion: 250 children were included and gathered in 5 categories of age (less than 1 month, 1 to 6 months, 6 to 18 months, 18 to 72 months and more than 72 months) and 4 categories of weight (less than 10 lb, 10 to 20 lb, 20 to 40 lb and more than 40 lb). Hemostase was abnormal in 41 cases. 67% of cvc were put by senior anesthesiologists and more of 80% for children aged less than 6 months weighing less than 10 lb. For 176 children, the site of cvc was sub-clavian. The mean of age and weight of these children was upper than the ones with a jugular cvc ($p = 0.012$ and $p = 0.0107$). When hemostase was abnormal, there were more jugular puncture ($p = 0.0107$). We observed a higher frequency of multiple punctures for the children aged from 1 to 6 months, but the number of punctures depends neither on the operator's experience ($p = 0.23$) nor the site. This result must be relativised because the senior anesthesiologists take care of young children and are an help for anesthesiologists in continuing education in 71% of cases. The complications were: 43 troubles with catheterism, 13 arterial punctures and 6 pneumothorax. We observed a higher frequency of complications in children weighed 10 to 20 lb, and all pneumothorax were due to a sub-clavian puncture.

Conclusion: Choice of a site of cvc depends on age and weigh. Hemostase is the only factor that can influence it. The higher risk population for difficulties and complications is represented by children aged from 1 to 6 months and weighed from 10 to 20 lb. There is no difference according to the operator's experience when the anesthesiologists in continuing education are helped by senior anesthesiologists.

A-622

Admixture of tramadol to bupivacaine for ilioinguinal iliohypogastric nerve block in children

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Background and Goals: Tramadol used in caudal has been associated with a delayed analgesic action and increased incidence of nausea and vomiting episodes (1). However, the admixture of tramadol with mepivacaine for brachial plexus block has provided a pronounced prolongation of blockage without any side effects suggesting a specific peripheral action of tramadol (2). We designed a prospective controlled double-blinded study to assess the impact of tramadol added to bupivacaine on duration of ilioinguinal iliohypogastric nerve blockage in children.

Material and Methods: Sixty children were randomly assigned to one of 3 groups: 0.5 ml/kg bupivacaine 0.25% alone (group P, n = 20), 0.5 ml/kg bupivacaine with 0.5 mg/kg Tramadol (group 1, n = 20), 0.5 ml/kg bupivacaine with 1 mg/kg Tramadol (group 2, n = 20). During surgery, we recorded: heart rate, blood pressure and intra operative analgesic supplementation (heart rate >30% baseline). Pain was assessed postoperatively using mCHEOPS. We recorded: time to first analgesic postoperative pain rescue, incidence of sedation, nausea and vomiting. For statistical analysis and comparison between groups we used Fischer exact, Yates, and Kruskal-Wallis tests. A $p < 0.05$ was considered significant.

Results: Demographic data were comparable. Intra operative haemodynamic records remained unchanged for the 3 groups. No patients needed intra operative analgesic supplementation. Thirteen patients required analgesics after surgery. More patients in group P needed pain killers (8 patients), than in group 1 or group 2 (2 vs 3 patients) but the difference wasn't statistically significant. Time to first analgesic supplementation was longer in Tramadol groups (350 min group 1 and 288 min in group 2 vs. 277 min in group P), but the difference was no significant. Neither deep sedation nor nausea vomiting were reported in Tramadol groups.

Conclusions: In our study, admixture of either 0.5 mg/kg or 1 mg/kg Tramadol to bupivacaine 0.25% in ilioinguinal iliohypogastric nerve block was associated with a tendency of better post operative analgesia than in placebo group suggesting a nerve peripheral action of Tramadol.

References:

- 1 Prosser DP. *Br. J. Anaesth.* 1997; 79: 293–6.
- 2 Kapral S. *Anesth. Analg.* 1999; 88: 853–6.

A-623

Postoperative analgesia management using a continuous popliteal sciatic nerve block in children

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Background and Goal of Study: Analgesia using a continuous popliteal sciatic nerve block for foot surgery in children could lead to an optimal postoperative analgesia with fewer side effects than epidural analgesia (1). However, the postoperative management of the sciatic catheter is a source of failure of the technique and is poorly documented. We evaluated the clinical characteristics of the postoperative management of this technique in children.

Materials and Methods: In a retrospective study, we studied all the continuous popliteal sciatic nerve block (n = 51) performed in our hospital between 01/2002 and 09/2003. The protocol of analgesia was standardized: one hour after the initial bolus, a continuous drip from 0.2 to 0.4 mg kg⁻¹ h⁻¹ of Ropivacaine 2 mg ml⁻¹ was started. The children received systematically paracetamol during the postoperative period.

The studied parameters were: efficiency of postoperative analgesia (VAS, supplementary analgesic consumption), side effects and technical problems. **Results:** 51 children from 18 months to 17 years (mean = 10 yrs), ASA 1 to 3, were included in the study. Postoperative analgesia was effective with average VAS always lower than 30. A third of the children received none analgesic supplementary. Others received ketoprofene and/or nalbuphine with an average number of 2 drips by children over 48 hours.

The average duration of sciatic catheter's use was 43 hours (6–74 h). 39 catheters remained in place during at least 48 hours (76.5%), 12 catheters were removed prematurely for technical reasons: 7 cases of catheters dislocation, 4 cases of premature outward migration of the catheter, 4 cases of catheter occlusion and 3 cases of fluid leak in the point of draining.

No complication (infection, toxicity of LA) was observed.

Conclusions: Continuous popliteal sciatic nerve block for foot surgery in children seems to be an effective technique of analgesia. However, technical problems are rather frequent (25%) and thus require a quite particular attention to optimize the duration of this effective analgesia.

Reference:

- 1 Dadure C. *AFAR* 2003 (R405); 22: 318s.

A-624

Experience with gabapentin for neuropathic pain in children: report of 8 cases

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Background and Goal of Study: Gabapentin is an antiepileptic drug used for therapy of partial seizures in pediatric patients (1). It has analgesic potential

in the treatment of neuropathic pain in adults (trigeminal neuralgia, postherpetic and diabetic neuralgia, reflex sympathetic dystrophy and phantom limb pain) (1–3). The aim of this study was to investigate analgesic action of gabapentin in intractable neuropathic pain in children, mostly cancer patients.

Material and Methods: Eight patients treated in Children's Hospital Pain Clinic for intractable neuropathic pain, after informed parental consent, were included in this prospective study. Four were cancer patients, one had sympathetic reflex dystrophy, one neuropathic pain in neck (C3), two had phantom limb pain. Six of them had allodynia which is predictive factor for a positive treatment effect (2). Dosing was first day of treatment 10 mg/kg BW, second day 20 mg/kg, third day 30 mg/kg per os. We compared visual analogue scale (VAS) score of pain, ranging from 1 to 10, before and after the use of gabapentin. Follow up was 2–4 months. Statistical method used was t-test, p value of 0.005 was taken as a level of significance.

Results and Discussion: Demographic data: 75% patients were female, median age was 14,1 years, median BW 45,75 kg. Concomitant drugs used were NSAID, paracetamol, opioids (tramadol, Durogesic) and tricyclic antidepressants. Mean VAS before treatment with gabapentin was 9 (SD 0,9), after treatment 3,25 (SD 1,4). There was significant difference between pre-gabapentin versus postgabapentin pain scores ($p < 0,005$).

Conclusions: Gabapentin is effective in treating intractable neuropathic pain in children.

References:

- Backonja M, Glanzman RL. Gabapentin dosing for neuropathic pain: evidence from randomized, placebo controlled clinical trials Clin Ther 2003; 25(1):81–104.
- Gustoff B, Wahlin G, Spacek A. Gabapentin in the treatment of chronic intractable pain Schmerz 2002; 16(1):9–14.
- Rose Ma, Kam PCA. Gabapentin – pharmacology and its use in pain management Anaesthesia 2002; 57(5):451–62.

A-625

Does remifentanyl affect emergence agitation after sevoflurane anaesthesia in children?

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Background and Goal of Study: Sevoflurane has been associated sometimes with agitation on emergence from anaesthesia.¹ Addition of small dose of fentanyl to sevoflurane anaesthesia seems to decrease the incidence of this phenomenon.² The aim of this study was to investigate if remifentanyl, another opioid, also suppress agitation during emergence from sevoflurane anaesthesia either in intubated or extubated children.

Materials and Methods: Forty eight children were randomly divided in group A ($n = 24$) and B ($n = 24$). Induction and maintenance of anaesthesia was accomplished with inhalation of sevoflurane in a N_2O and O_2 mixture and iv infusion of remifentanyl $0.1 \mu\text{g kg}^{-1} \text{min}^{-1}$ for pain control. When operation was over, children were extubated in group A full awake (BIS > 85%) and in group B unconscious (BIS 50%). Infusion of remifentanyl was continued until BIS score 90% and after children response to verbal orders. Children were blindly evaluated for agitation using the modified Aldrete score³ and another anaesthetist's evaluation score (0 = no agitation, 1 = cough during extubation, 2 = agitation, cyanosis, cough). Statistical analysis was performed with ANOVA or chi-square test as appropriate.

Results: Demographic data were comparable between groups. Statistical difference between groups was found in Aldrete score as well as in anaesthetist's evaluation score as well (table, * $p < 0.05$).

Obstetric Anaesthesia

A-627

Chlorhexidine skin preparation prior to regional blockade for elective caesarean section – an effectiveness, time and cost study of chlorhexidine spray versus single use sachets

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Background and Goal of Study: The importance of skin preparation to control epidural catheter colonisation remains unchallenged. Chlorhexidine has been shown to be superior to povidone iodine for skin preparation prior to epidural insertion¹. Conventional use of chlorhexidine is by direct application. A spray chlorhexidine has potential benefits in terms of convenience but its

Group	Aldrete score	Anaesthetist's evaluation score		
		0	1	2
A	6.21 ± 2.67	7 (29.2%)	6 (25%)	11 (45.8%)
B	8.25 ± 0.99*	16 (66.7%)*	7 (29.2%)	1 (4.2%)*

Conclusions: In children of this study, remifentanyl failed to suppress completely the emergence agitation after sevoflurane anaesthesia. Early extubation with unconscious children seems to have benefit over extubation in full awake children and seems to play the main role in emergence agitation after sevoflurane anaesthesia.

References:

- Lapin SL, Auden SM, Goldsmith LJ et al. Pediatr. Anaesth. 1999;9:299–304.
- Cravero JP, Beach M, Thy B et al. Anesth. Analg. 2003;97:364–7.

A-626

Remifentanyl versus fentanyl analgesia in mechanically ventilated postoperative children

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Background and Goal of Study: We compared remifentanyl and fentanyl infusions for postoperative analgesia in pediatric intensive care unit (ICU) patients.

Materials and Methods: After receiving ethical committee approval, a prospective randomised, double-blind study was performed. 22 postoperative orthopedic surgery patients received either remifentanyl $0.1 \mu\text{g/kg/min}$ (group R) or fentanyl $0.025 \mu\text{g/kg/min}$ (group F) infusions diluted to the same volume. Analgesic infusion was titrated to predefined levels of analgesia (Behavioral pain scale (BPS) score of 3). Propofol was added if sedation was unsatisfactory (Riker Sedation agitation Scale > 4) after BPS score 3 had been achieved. The number of titrations and the time required to BPS score of 3, duration of mechanical ventilation, elapsed time from the end of infusion to extubation, physician and nursing assessments (between 1–5) of adequacy of analgesia and sedation as well as side-effects were recorded. Chi-square, Mann-Whitney U tests were used for statistical analysis.

Results and Discussion: Data is given as number of patients (n) or median (95% CI) in the table below.

	Group R (n = 11)	Group F (n = 11)	p
Age (yrs)	13 (3–16)	13 (3–16)	0.37
Female/Male (n)	3/8	2/9	0.50
Weight (kg)	30 (14–50)	36 (14–50)	0.69
Duration of operation (min)	225 (60–660)	270 (150–550)	0.88
ICU stay (days)	3 (2–4)	2 (2–13)	0.60
Mechanical ventilation (min)	1140 (685–1542)	1110 (795–2670)	0.79
Propofol needed for sedation (n)	3	1	0.29
Propofol dose (mg)	11.5 (10–12.5)	2 (2–2)	0.50
Number of titrations	3 (0–11)	3 (0–7)	0.97
Time to BPS score 3 (min)	5 (0–30)	10 (0–240)	0.34
Time to extubation (min)	5 (4–30)	10 (5–150)	0.07
Nurses' assessment of analgesia	4 (1–5)	4 (2–5)	0.80
Nurses' assessment of sedation	4 (1–5)	5 (2–5)	0.56
Physician's assessment of analgesia	5 (0–5)	4.5 (3–5)	0.97

The incidences of nausea, vomiting, apnea, desaturation, reintubation within 24 hrs, constipation were also similar between the two groups ($p > 0.05$).

Conclusion: Remifentanyl infusion provides clinically comparable analgesia to fentanyl infusion in mechanically ventilated postoperative pediatric patients.

efficacy has not been investigated. A prospective, randomised single-blinded study, to examine the effectiveness, time and cost of the two methods of chlorhexidine skin preparation – spray versus sachet, was conducted.

Materials and Methods: 120 healthy elective caesarean section patients were recruited during the period November 2002 to July 2003. The patients were randomised to receive chlorhexidine as a spray (chlorhexidine 0.5% Hydrex DS Derma spray, Adams Healthcare) or as a sachet (chlorhexidine 0.05% Unisept, Seton), prior to a standardised combined spinal-epidural technique (CSE). Skin swabs were taken from patient's backs prior to skin preparation and prior to removal of the epidural catheter postoperatively and cultured. Data relating to patient characteristics, time to achieve skin preparation and cost were also compared for the two groups. Unpaired T-test was used for continuous variables and χ^2 for categorical variables. A power calculation performed required 120 patients.

Results and Discussions: No significant difference was found in cultures of postoperative skin swabs between the 2 groups suggesting equal effectiveness in skin preparation. Time for preparation was significantly reduced in the spray group, $p = 0.02$, with a mean of 2.5 minutes (range 0.5–9), compared to 4.4 minutes (1.5–9) for the sachet group. Furthermore, spray chlorhexidine costs €0.01 per patient, compared with €0.33 per patient for sachet chlorhexidine. Patient characteristics and preoperative swabs were matched for the 2 groups.

Conclusion: The use of a chlorhexidine spray to prepare the skin prior to CSE insertion is as effective as individual sachets of chlorhexidine. It is also quicker to apply and less costly.

Reference:

- 1 Kinirons B. Chlorhexidine versus povidone iodine in preventing colonisation of continuous epidural catheters in children. *Anaesthesiology* 2001; **94**:239–44.

A-628

Patient controlled epidural analgesia alone or combined with a background infusion following combined spinal epidural labor analgesia

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Background and Goal: Maintenance of analgesia during labor is controversial. Patient controlled epidural analgesia (PCEA) reduces the dose of local anesthetic and increases patient satisfaction (1). However, controversy exists regarding the use of a background infusion. Especially following CSE a background infusion might be useful to gradually establish local anesthetic epidurally.

Material and Methods: Following ethical committee approval and patient informed consent, 80 healthy women with term, vertex presenting pregnancies in labor, requesting CSE analgesia, were randomized to 4 groups. All patients underwent CSE analgesia with an intrathecal dose of 3 mg ropivacaine (rop) and 1.5 µg sufentanil (suf). Maintenance of analgesia was performed using an epidural mixture containing rop 0.15% with 0.75 µg/ml suf. In group I, the epidural mixture was administered using PCEA without a background infusion. In groups II to IV, PCEA with 2, 4 and 6 ml background infusion respectively were used. Demographic data, obstetric data, local anesthetic consumption, visual analogue scale (VAS) score for pain, number of anesthetic interventions for pain, haemodynamic data and neonatal outcome were recorded. Data were analyzed using analysis of variance and appropriate parametric and non-parametric tests.

Results and Discussion: No differences in demographics, obstetric data, haemodynamics and neonatal outcome were observed. Hourly local anesthetic consumption was significantly reduced in groups I and II (6.6 ± 3.4 (I) and 7.7 ± 3.2 (II) vs 10.1 ± 2.9 (III) and 11.0 ± 4.6 (IV) mg/h). However in group I significantly more patients required anesthetic interventions for breakthrough pain (15 (I) vs 6 (II) and 7 (III) and 6 (IV) patients). Visual analogue scores for labor pain were comparable between the groups.

Conclusion: Based on these results we conclude that PCEA combined with 2 ml continuous epidural background infusion is optimal for maintenance of analgesia during labor during CSE analgesia. Higher infusion rates, result in more local anesthetic consumption without significant advantages with respect to pain relief. No background infusion results in more breakthrough pain.

Reference:

- 1 Van der Vyver et al. *Br J Anaesth* 2002; **89**, 459.

A-629

The significance of the subdural space (or spaces) to the obstetric anaesthetist; a radiographic study

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Background: Recent work on the ultrastructure of the subdural space has revealed that it is not a potential space, but a cavity or series of cavities at the dura-arachnoid interface produced by trauma. With this knowledge we are able to explain our findings in nine patients who accidentally received subdural injections of local anaesthetic during attempted epidural block.

Methods: This study forms part of an on-going radiological investigation into the cause of unsatisfactory obstetric epidural blocks¹. Following ethics committee approval, all mothers whose blocks had been inadequate or atypical, and whose catheters were still in place, were requested to undergo radiological examination following contrast injection (iopromide 10 ml).

Results: 123 mothers have been investigated over the past 20 years, with contrast injection revealing subdural catheter placement in 9. Our findings

suggest that there are two distinct types of subdural block. The first (4 cases) represents the classical type where the history is of a high neuraxial block of slow onset following a small dose of local anaesthetic², with the X-rays revealing extensive spread of contrast both circumferentially around the subdural space and also in a cephalad direction. The second type of subdural block (4 cases) is characterised by a failed or inadequate block. The radiographic findings here are of contrast confined to the posterior subdural space, with no extensive spread, but with anterior bulging of the arachnoid into the vertebral canal. One patient with a high block on catheter top-up showed both types of radiological appearance.

Conclusions: It appears that the subdural space is not a single entity, but may exist in two or more separate planes within the many layers of the dura-arachnoid. It seems likely that injection into a superficial (posterior) plane of the subdural space leads to poor and localised spread of local anaesthetic, whereas injection into a deeper plane can result in wider spread and an excessively high block.

References:

- 1 Collier CB. *An Atlas of Epidurograms: Epidural Blocks Investigated*. London UK; Taylor and Francis, 1998.
- 2 Collier CB, Gatt SP, Lockley SM. A continuous subdural block. *Brit J Anaesth* 1993; **70**:462–465.

A-630

Maternal satisfaction control chart: a way to monitor quality of labour analgesia

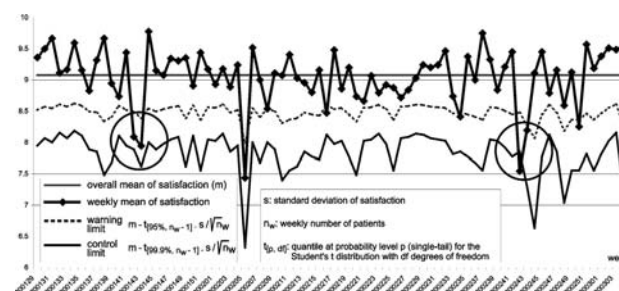
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Background and Goals: Labour analgesia is a routine procedure, amenable to quality control analysis.

Materials and Methods: Data was analysed from a systematic post-partum follow-up of parturients delivering with neuraxial analgesia from July 2001 to January 2003, including anaesthetic technique and complications, and maternal satisfaction (0–10 verbal scale; 0 = total dissatisfaction). A control chart of satisfaction was used to discriminate between common cause variations (small magnitude; intrinsic to care process) from special cause variations (large magnitude; linked to external events).¹ A special cause variation was identified when mean weekly satisfaction outlined either the warning limit during two consecutive weeks, or the control limit.

Results and Discussion: Two special cause variations were detected weeks 42/43 in 2001 and 2002. During these four weeks, more women experienced insufficient analgesia (1st stage 13% vs 4.8%; $p = 0.005$; 2nd stage 26% vs 14.2%; $p = 0.006$) and a painful epidural placement (7.8% vs 3.2%; $p = 0.04$), and required an epidural catheter replacement (6.2% vs 2.2%; $p = 0.04$).



These weeks coincide with the beginning of the academic year (October). Because of a local holiday and the ASA meeting, these are the only weeks when new trainees are not supervised by the regular obstetric anaesthesia staff.

Conclusion: Process control analysis can detect variations in the quality of health care delivery and even suggest possible causes and remedies.

Reference:

- 1 Berwick D. Controlling variation in health care: a consultation from Walter Shewart. *Med Care* 1991; **29**:1212–25.

A-632

Standard lidocaine epidural test dose: isn't it too much?

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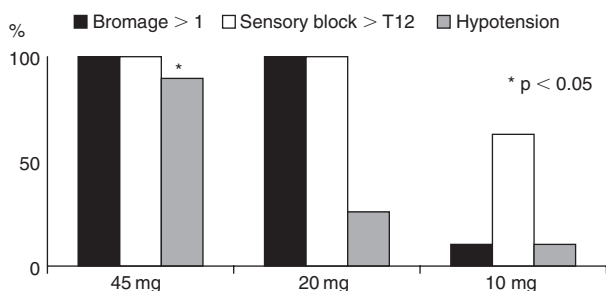
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Background and Goal of the Study: A commonly used test dose consists of 45 mg of lidocaine. However, high spinal block and hypotension have

been observed after such a dose (1). The aim of this prospective, randomized, double blind study was to determine whether a lower dose may act as a test dose without excessive spinal blocks or maternal hypotension.

Materials and Methods: After informed consent, we randomised 135 parturients scheduled for cesarean section into three equal groups to receive either 10, 20 or 46 mg of 2% intrathecal lidocaine under combined spinal epidural anesthesia. We evaluated sensory block (pinprick) and motor block (modified Bromage scale) at 2, 5 and 10 minutes. We considered effective the presence of any motor block (Bromage >1) and a sensory block >T12 (2). Hypotension was defined as a 20% decrease in mean arterial blood pressure and treated with iv ephedrine. All data were analyzed by chi square test or a two way ANOVA for repeated measures were appropriate.

Results: Results are reported in the Table. Both 46 mg and 20 mg were effective as test doses in 100% of parturients. The incidence of hypotension was lower in the 20 and 10 mg groups ($p < 0.05$).



Conclusions: 20 mg lidocaine represents a safe and reliable intrathecal test dose.

References:

- 1 Richardson MG et al. *Reg Anesth* 1996; 21:119–123.
- 2 Poblete B. *Can J Anaesth* 1999; 46:34–39.

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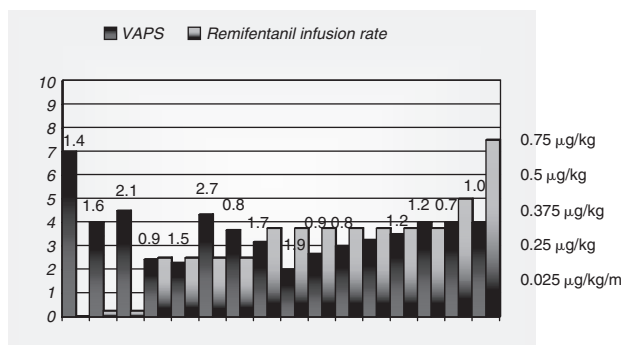
Remifentanil for labor analgesia: an alternative

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Background and Goal of Study: Epidural analgesia provides better labor pain relief compared to any other treatment options, however, it may be contraindicated. The pharmacokinetics of remifentanil suggests that it may be suitable for analgesia during labor. Here we investigate the efficacy and safety of remifentanil during labor using a patient controlled analgesia device.

Materials and Methods: 14 healthy term parturients with uncomplicated singleton pregnancies received patient controlled intravenous analgesia (PCA) pump with remifentanil 50 µg/ml, set to deliver remifentanil continuous background infusion of 0.025 µg/Kg/min and 0.25 µg/Kg boluses with a two minutes lockout period. The PCA bolus was increased of 0.125 µg/Kg if the visual analogic pain score (VAPS) was over 4. The PCA was started when the parturients experienced painful contraction (cervical dilatation range 3–5 cm) and stopped at childbirth. Maternal monitoring including non invasive blood pressure measurements, heart rate, percutaneous arterial oxyhemoglobin saturation and respiratory rate. The foetus was monitored by continuous cardiotocography and foetal ECG; Apgar scores and “ph veno omb” were noted at delivery.

Results and Discussion: In our study the continuous infusion of remifentanil combined with PCA has shown a satisfactory pain relief during labor and has been safe for both mother and baby.



References:

- 1 Thurlow JA et al. *Br J Anaesth* 2002;88(3):374–378.
- 2 Kan RE et al. *Anesthesiology* 1998 Jun;88(6):1467–1474.

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The factors influencing epidural uptake during labor

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Background and Goal of Study: The factors influencing the acceptance of epidural labor analgesia labor are largely unknown. We decided to study the socioeconomic and demographic variables of the women presenting for labor in a regional hospital in Ireland.

Materials and Methods: After hospital ethical committee approval, 143 women presenting for labor were given a questionnaire 24–48 hours after delivery over an eight month period. This included 74 women who requested epidural and 69 who got other methods of pain relief.

Results and Discussions: All mothers: There was no difference between the two groups as regard to marital status, knowledge of other forms of labor analgesia, associated medical problems, time of 1st exposure to epidural knowledge, occupation, qualification, religion and practice, partners involvement in the choice of analgesia and participation in child birth classes. 89.51% (#128) of all women learnt of epidurals through friends or media.

However mothers who had epidural were significantly more likely to have private health insurance, associated medical problems, primi, and were also more satisfied with the pain relief. It is likely that the obstetricians encouraged the mothers with associated medical conditions (notably pregnancy associated hypertension) to have epidurals. It is widely accepted that epidural provides the most effective pain relief yet.

Among the mothers who had epidurals, 81.1% were completely satisfied, 13.3% partially satisfied and 5.4% not at all satisfied. 90.6% of this group expressed strong desire to have an epidural in the event of another child birth and 91.9% said they would strongly encourage their friends to have one. Significantly more than half made a decision to have epidural before they entered hospital there by dispelling the myth that midwives strongly influence the decision of the mothers in labor in favor of an epidural. However a small group who themselves were not happy with their epidural said they would not recommend this mode of pain relief. The reasons for dissatisfaction were patchy block, delay in establishing a block, and post dural puncture head ache.

Conclusion(s): Various factors influence labor epidural uptake. Many of them are influenced by media who can be used by medical fraternity.

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Impact of early sulprostone infusion in magnitude of postpartum haemorrhage

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Background and Goal of Study: Postpartum haemorrhage (PPH) is the leading cause of maternal mortality in France. When oxytocine appears to be ineffective in uterine depression, sulprostone (Su) should be started precociously (1). The aim of this study was to evaluate the effect of shortening the time period between PPH diagnosis and onset of Su infusion (SuTP) on the magnitude of bleeding in PPH.

Materials and Methods: 75 parturients suffering of PPH after vaginal or caesarean delivery and treated with Su were retrospectively enrolled and divided in two groups: before (G1) and after (G2) institution of a policy of shortening SuTP. SuTP was free in G1, but recommended being less than 35 min in G2. The two groups were similar regarding to the main risk factors for PPH (2) and to prepartum Hb levels. Patients with prepartum coagulation abnormalities were excluded. Haemoglobin losses (Hb loss) i.e. difference between pre and postpartum Hb concentration was used to assess the magnitude of PPH.

Results and Discussions: 1 – a positive correlation was observed between the intensity of Hb loss and lengthening of SuTP ($R = 0.23, p = 0.03$) in G1; 2 – a **SuTP longer than 35 min was predictive of Hb loss larger than 20%** (ROC curves analysis in G1; $Se = 77.8\%, Sp = 60.0\%$).

Comparing G1 and G2, the shortening of SuTP lead to a smaller Hb loss in vaginal delivery.

	G1 (n = 23)	G2 (n = 27)	p
Vaginal delivery			
SuTP (min)	110.3 ± 77.4	54.6 ± 62.0	0.008
Hb loss (%)	31.0 ± 15.6	19.5 ± 15.2	0.012

However, in caesarean delivery (G1: n = 17, G2: n = 8) SuTP did not change significantly, nor did Hb loss.

The shortening of SuTP in vaginal delivery did not affect the prevalence of massive haemorrhage, i.e. leading to transfusion, artery embolisation or surgical management (21.5% in G1, 22.2% in G2), and did not lead to significant difference in Hb loss (44.4% in G1, 35.3% in G2).

Conclusion(s): Earlier infusion of sulprostone leads to significant reduction of Hb loss in moderate postpartum haemorrhage after vaginal delivery but does not avoid incidence and magnitude of massive haemorrhage.

References:

- Goffinet F. *J Gynecol Biol Reprod* 1995; 24(4):209–16.
- Reyal F. *J Gynecol Obstet Biol Reprod* 2002 Jun; 31(4):358–64.

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The use of Remifentanyl during Caesarean section under general anaesthesia: maternal and neonatal effects

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Introduction: Opioids during general anaesthesia (GA) for caesarean section are not recommended. Sometimes opioids are desirable to blunt the maternal stress response. Remifentanyl (R) has several advantages over older opioids. Kan et al (1) demonstrated that despite a high transplacental passage of R, R was rapidly metabolised in neonates. Neonates were vigorous following birth and did not require respiratory support. Several case reports (2,3,4,5) demonstrated the benefits of R in high risk patients.

Material and Methods: Following institutional approval and patient informed consent, 10 patients undergoing planned caesarean section received GA using R 0.5 µg/kg bolus followed by a continuous infusion of 0.2 µg/kg/min. R was combined with a target controlled infusion (TCI) of propofol of 4.0 µg/kg until loss of consciousness, followed by TCI propofol at 2.5 µg/kg. Muscle relaxation was done using iv succinylcholine 1.5 mg/kg. Following induction of anaesthesia and tracheal intubation, the lungs were mechanically ventilated to an end tidal CO₂ concentration of 28–30 mmHg. We recorded maternal haemodynamics, blood loss, dose of R used, neonatal outcome and the occurrence of complications.

Results: GA was performed for various reasons such as extensive spinal surgery, coagulation problems and patient refusal to receive regional anaesthesia. Three twin pregnancies were noted. Hypotension (>20% decrease in mean arterial pressure) occurred in 2 patients. Total dose of R used was 942 ± 290 µg. In 6/13 neonates, the 1 minute Apgar score was <7. However no newborn infant, showed a 10 minute Apgar score of less than 7. No umbilical artery pH value less than 7.20 was observed. Six neonates required brief (<5 minutes) mask ventilation, but no neonate required tracheal intubation or prolonged artificial ventilation.

Conclusion: Our experience suggests that R successfully blunts maternal stress response. R appears to be safe for the neonates. Respiratory depression occurred but could easily be managed by brief mask ventilation. Five minutes after delivery, further respiratory support was not required.

References:

- Kan et al. *Anesthesiology* 1998; 88, 1467.
- Lavand'homme P et al. *Anesth Analg* 2001; 92 (5), 1355.
- Manullang et al. *Can J Anaesth* 2000; 47 (5), 454–9.
- McCarroll CP et al. *Br J Anaesth* 2001; 86 (1), 135–8.
- Mertens et al. *Acta Anaesth Belg* 2001; 52, 207.

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Respiratory adverse effects after intrathecal versus epidural morphine for postoperative analgesia in caesarean section measuring endtidal carbon dioxide

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Background and Goal of Study: Neuraxial analgesia using morphine has proven to be an efficient means to achieve postoperative pain control for 24 hours after caesarean section (CS) under regional anaesthesia [1]. We usually inject 0.1 mg intrathecal or 2 mg epidural morphine [2,3], but no study is known to compare respiratory side effects following those 2 ways of neuraxial administration.

Materials and Methods: It was a prospective, experimental, and open study. We included 18 patients with previous caesarean section under combined spinal and epidural anaesthesia (CSE) or under spinal anaesthesia (S).

All of them received between 7.5 and 10 mg intrathecal hyperbaric bupivacaine 0.5% and 2.5 mcg intrathecal sufentanil; 9 received 2 mg epidural morphine and 9 received 0.1 mg intrathecal morphine. Endtidal carbon dioxide fraction (EtCO₂), oxygen arterial blood saturation (SpO₂), and respiratory rate were recorded for 24 hours after caesarean section with MICROCAP[®] (Oridion) monitor.

Results and Discussions: Statistical analysis was based on averages comparisons using Mann-Whitney U test. The 2 groups were quite close as regarding to quantitative and qualitative criteria. There was no significant difference (p = 0.26) in mean EtCO₂ with no patient up to 45 mmHg, and in mean SpO₂ (p = 0.52). There was a significant difference (p = 0.01) in the total time of desaturation with 7.3 seconds in S group and 150 seconds in CSE group. There was no correlation using Spearman Rho-test between higher EtCO₂ and total time of desaturation (p = 0.57). Mean respiratory rate, pain and quality score were quite similar in both groups.

Conclusion: Intrathecal and epidural morphine provide similar analgesia without any change in CO₂ ventilatory response. Desaturation times are different between both groups but still very short.

References:

- Cousins MJ; *Anesthesiol* 1984.
- Sarvela J; *Anesth Analg* 2002.
- Sun HS; *Anesth Analg* 1993.

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The effect of height and weight adjusted subarachnoid dose of bupivacaine on blood pressure

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Background and Goal of Study: Hypotension commonly complicates caesarean section under subarachnoid block. In this study we compare the effect of subarachnoid bupivacaine on blood pressure if given as a standardised dose or graded to height and weight of the patient.

Materials and Methods: Patients scheduled for elective caesarean section gave informed consent and were randomised into two groups for this prospective double-blinded study. Group 1 received a standardised dose of 0.4 ml diamorphine with 2.4 ml 0.5% heavy bupivacaine. Group 2 received 0.4 ml diamorphine with 0.5% heavy bupivacaine graded to the height and weight of the patient. Arterial hypotension, defined as a systolic blood pressure less than 30% of baseline, as well nausea or vomiting were treated with ephedrine. Data were analysed using unpaired student's T-test, Mann-Whitney and Chi-square tests as appropriate.

Results and Discussions: 84 patients completed the study. 45 patients in group 2 received a median dose of 1.9 ml (IQR 1.8–2.0, <0.001) of 0.5% bupivacaine. There were no differences in age, height, weight, indication for caesarean section and baseline blood pressures between the groups.

	Group 1	Group 2	p-value
Difference MAP; mmHg mean (SD)	35.0 (16.4)	28.8 (13.6)	0.06
Hypotension; n/total	28/39	22/45	0.03
Ephedrine; n/total	31/39	25/45	0.02
Ephedrine dose; mg median (IQR)	9 (3–18)	6 (0–13.5)	0.04
Nausea; n/total	24/39	24/45	0.45
Vomiting; n/total	7/39	2/45	0.05
Apgar 1 min; median (IQR)	9 (9–9)	9 (9–9)	0.2
Apgar 5 min; median (IQR)	10 (9–10)	10 (9–10)	0.69

MAP = mean arterial pressure

Conclusion(s): Adjusting the dose of 0.5% heavy bupivacaine according to height and weight of the patient appears to reduce the incidence of arterial hypotension, vomiting and the usage and dose of ephedrine.

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Changes in skin temperature in caesarian-section patients as an index of epidural anaesthesia: comparison with hysterectomy patients

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Background and Goal of Study: Evaluating the effect of Epidural Anaesthesia (EA) is important, but in some cases difficult. EA raises skin temperature (ST). We related the upper anaesthesia level (determined by the dermatomes affected) to the change in ST in obstetric patients.

Materials and Methods: We enrolled twenty female patients who were scheduled for Caesarian section (CS) at full term (group CG). For comparison, we enrolled ten patients scheduled for hysterectomy after a diagnosis of myoma uteri (group MG). The study was approved by the local ethics committee and we obtained informed consent from each patient. In each case, two EA taps were performed in the left lateral position: the upper tap was performed basically in the T11 to T12 intercostal space, while the lower tap was at L4 to L5. C-S patients were tilted to the left by 10–15 degrees after completion of EA, to avoid hypotension. ST was measured at four sites in different dermatomes on each side (right (R) of left (L)): thus, eight sites (T6, T12, L3 and S1 in dermatome) were used. We measured ST using an infra-red thermometer, as we reported at the last ESA meeting. We measured ST at about 20 min after the local anesthetics had been given. The effect of EA was evaluated by sensory changes and by dermatome temperature at the same time. Data are expressed as mean (standard deviation) or range. Statistical analysis was by a Mann-Whitney U test or Student's t-test.

Results and Discussions: The amount of local anesthetic given did not differ significantly between the groups. Patient ages (years) were 31.5 (5.2) in CG and 44.4 (8.4) in MG ($p < 0.001$). ST in the S area increased by more than 1.8 degree C (mean value) in both groups, but only CG patients had a higher value on L than on R ($P = 0.007$). The upper anesthesia level (as determined by the dermatomes affected) was as follows: in CG, T-8.4 (mean value) on R, T-7.9 on L; in MG, T-7.0 on R, T-6.8 on L. Thus, a rise in ST was observed after EA in both groups; however, there was a significant difference between the two groups in terms of laterality.

Conclusions: EA induced a rise in ST with laterality in CG, but not in MG. The age factor or the direction of tilt might have caused the difference, but the physiological changes induced by pregnancy should be considered as an influence over the EA-induced ST changes.

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Hyperbaric versus plain levobupivacaine during spinal anesthesia for cesarean section

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Background and Goal of the Study: The aim of this prospective, double blind study was to compare two different doses of plain (PL) and hyperbaric levobupivacaine (HL).

Materials and Methods: After informed consent, we randomised 160 parturients into 4 equal groups to receive 12.5 or 15 mg of either 0.5% spinal HL or PL under combined spinal epidural anesthesia. Hyperbaric levobupivacaine solutions were made with 6.7 mL of 0.75% levobupivacaine, 0.8 mL of 0.9% saline, and 2.5 mL of 33% glucose. Sensory block was evaluated with pinprick and light touch test and motor block was assessed by a modified Bromage scale. Parturients were asked to report their intraoperative level of pain on a 100 cm visual analogue pain scale (VAPS). Intraoperative pain was treated with boluses of epidural 2% lidocaine. Hypotension was defined as a 20% decrease in mean arterial pressure and treated with iv boluses of ephedrine. All data were analyzed by a chi square test or ANOVA for repeated measures were appropriate.

Results: Number (%) of parturients with intraoperative pain and high sensory blocks are reported in the table. Incidence of hypotension and degree of motor blockade did not differ between the groups.

Levobupivacaine	Pain	Sensory block > T1
12.5 Hyperbaric	2 (5%)	0 (0%)
15 Hyperbaric	0 (0%)	3 (7.5%)
12.5 Plain	18 (45%)	18 (45%)
15 Plain	9 (22.5%)	22 (55%)

* $P < 0.05$

Conclusions: Hyperbaric levobupivacaine was associated with a significant superior success rate to that observed in the plain group with the same incidence of hypotension and a lower incidence of high blocks.

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Effects of position on hemodynamic parameters and block levels during combined spinal epidural anesthesia using plain bupivacaine for cesarean delivery

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Background and Goal of Study: We aimed to evaluate the effects of left lateral and sitting positions on hemodynamic parameters and block levels

during induction of combined spinal epidural anesthesia (CSE) using plain bupivacaine for cesarean delivery.

Materials and Methods: Following approval of the ethics committee 32 ASA I-II patients undergoing elective cesarean section were randomly assigned to the sitting (Group 1) and left lateral (Group 2) positions. All received 1.7 cc 0.5% plain bupivacaine intrathecally. Maternal heart rate, systolic arterial pressure, oxygen saturation, need for ephedrine, sensory and motor levels of anesthesia and APGAR scores were evaluated. Statistical analysis was performed using Chi-squared and Mann-Whitney U tests. P value < 0.05 was significant.

Results and Discussions: SAP values on the 4th–10th minutes were significantly lower and maximum decrease in SAP was more and earlier in Group 1 (38.7% and 8.0 ± 2.3 min in Group 1, 25.5% and 11.4 ± 3.6 min in Group 2) ($p < 0.05$). Total hypotensive period was longer and need for ephedrine was more in Group 1 (9.3 ± 2.8 min and 23.4 ± 7.0 mg in Group 1, 3.6 ± 2.2 min and 7.3 ± 6.2 mg in Group 2) ($p = 0.000$). Blocks of all patients in Group 1 and 8 patients in Group 2 reached to T₄, time to reach T₄ was 7.2 ± 2.9 min in Group 1, 17.0 ± 7.8 min in Group 2 with spinal anesthesia ($p = 0.000$). Number of dermatomal segments blocked and patients with Bromage 3 motor block were more in Group 1 ($p < 0.05$). Nausea and vomiting and pain during uterin manipulations were more in Group 1 and Group 2, respectively ($p < 0.05$).

Conclusion(s): Spinal anesthesia using 8.5 mg plain bupivacaine with the parturients in the left lateral position does not offer adequate surgical anesthesia and should be used as a part of CSE technique. In spite of quick onset and higher levels of blocks in sitting position, CSE with plain bupivacaine should be performed in left lateral position because of maternal and fetal risks of severe and longer hypotension.

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The effect of height and weight adjusted subarachnoid dose of bupivacaine on sensory blockade

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Background and Goal of Study: To compare the effect of subarachnoid bupivacaine on sensory blockade if given as a standardised dose or graded to height and weight of the patient.

Materials and Methods: Patients scheduled for elective caesarean section gave informed consent and were randomised into two groups for this prospective double-blinded study. Group 1 received a standardised dose of 0.4 ml diamorphine with 2.4 ml 0.5% heavy bupivacaine. Group 2 received 0.4 ml diamorphine with 0.5% heavy bupivacaine graded to the height and weight of the patient. Sensory level blocked was measured using cold sensation and pinprick every two minutes at the midclavicular line until the block reached T₄ bilaterally. Data were analysed using Mann-Whitney and Chi-square tests as appropriate.

Results and Discussions: 84 patients completed the study. 45 patients in group 2 received a median dose of 1.9 ml (IQR 1.8–2.0, < 0.001) of 0.5% bupivacaine. There were no differences in age, height, weight, gestation and indication for caesarean section between the groups.

	Group 1	Group 2	p-value
Time to incision; min median (IQR)	6 (4–8)	8 (6–10)	0.02
T4 cold right; min median (IQR)	6 (4–8)	8 (6–10)	0.01
T4 cold left; min median (IQR)	6 (4–7)	8 (6–10)	0.004
T6 pinprick right; min median (IQR)	6 (4–6)	6 (6–10)	0.018
T6 pinprick left; min median (IQR)	6 (4–6)	6 (6–10)	0.001
>T1 cold; n/total	6/35	2/44	0.07
>T1 pinprick	6/35	1/44	0.02
Supplemental analgesia n/total	0/39	2/43	0.5
Conversion to GA n/total	0/39	0/43	

Conclusion(s): Adequate operating conditions were achieved with lower volumes of bupivacaine in the height and weight adjusted group. The maximal sensory blockade level was lower and the onset of anaesthesia was slower in this group.

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Heart rate variability changes during caesarean section under general or spinal anaesthesia

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Background and Goal of Study: It is generally acknowledged that surgical trauma induces a systemic stress response, which includes the autonomic nervous system. Heart rate variability is used for the clinical assessment of

the autonomic nervous system and has been studied in several surgical procedures but not in the caesarian sections.¹ The goal of the present study was to investigate the effect of caesarean section on the autonomic nervous function by evaluating changes in heart rate variability (HRV) in women receiving general versus spinal anaesthesia.

Materials and Methods: Women undergoing elective caesarean section were randomly divided into two groups to receive general or spinal anaesthesia (GA and SA groups). The perioperative changes of the low (LF) and high frequency (HF) components, and the LF/HF ratio of the HRV were calculated by power spectrum analysis using a continuous 12 leads ECG-Holter for 30 min before, during the caesarean section and 30 min afterwards. Statistical analysis was undertaken by the univariate analysis of variance.

Results and Discussion: In the GA group were included 13 and in the SA group 9 women. The LF power, which represents an index of both sympathetic and parasympathetic activity mediated by the baroreflexes and other control mechanisms, increased significantly in both groups during and immediately after the caesarean section ($F = 6,946$). This increase was significantly higher in the group receiving general anaesthesia ($F = 4,379$). The HF power, reflecting the vagal effect on the heart, also significantly increased during and immediately after the caesarean section ($F = 5,292$), but to almost the same degree in the two groups ($F = 0,381$). The LF/HF ratio, reflecting the sympathetic effect on the heart, was not affected either by time ($F = 1,159$) or the anaesthetic technique ($F = 0,449$).

Conclusions: This study showed that both sympathetic and parasympathetic activity as expressed by HRV increased during and immediately after the caesarean section. This increase was significantly higher in the group receiving general anaesthesia.

Reference:

1 Cole CR, et al. Clinical assessment of the autonomic nervous system. In: Textbook of

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Neonatal mortality rate and umbilical artery pH in extremely pre-term neonates delivered by cesarean section after spinal, general and epidural anaesthesia

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Background and Goal of Study: The results of EPIPAGE cohort study (1) showed a higher mortality rate in extremely pre-term neonates (27–32 weeks

of gestation) delivered by cesarean section after spinal anaesthesia (12,2%) when compared with general (10,1%) and epidural anaesthesia (7,7%). However spinal anaesthesia is nowadays the most popular anaesthesia given for cesarean section (2). Spinal anaesthesia for cesarean section is associated with lower umbilical artery pH but pH do not correlate with maternal hypo-tension (3). Large ephedrine infusion may impact on neonatal acid base balance (4). The aim of this study was to evaluate neonatal mortality of extremely pre-term neonates live-born by cesarean section and factors correlated with neonatal acidosis.

Materials and Methods: 96 extremely pre-term neonates urgently delivered by cesarean section during 2 years were retrospectively enrolled. Neonatal mortality and umbilical artery pH were compared in 3 groups: spinal (S), general (G) and epidural (E) anaesthesia given for cesarean section. We studied factors correlated to low umbilical artery pH.

Results and Discussions: Groups were similar for gestational age, prevalence of low birth weight, abnormal FHR tracings and prevalence of maternal hypo-tension. There was no significant difference in neonatal mortality between groups, by contrast umbilical artery pH was significantly higher in the S group.

	S (n = 65)	G (n = 23)	E (n = 7)
Neonatal mortality	4,6%	8,7%	14,3%
pH after birth	7,30 ± 0,6	7,24 ± 0,2*	7,20 ± 0,1*

Low umbilical artery pH correlated with abnormal FHR tracings ($p = 0,004$) but did not correlate with low birth weight, maternal hypo-tension (decrease in systolic pressure >25%), nor with ephedrine infused before delivery (total doses not higher than 33 mg).

Conclusion(s): Spinal anaesthesia for urgent delivery by cesarean section did not affect outcome of extremely pre-term neonates in our study. Neonatal acidosis correlated with abnormal FHR tracings.

References:

- 1 Rozé JC. 8èmes Journées Francophones de Recherche en Néonatalogie. Paris Dec 2002.
- 2 Lyons G. Int J Obstet Anesth 1995; 4: 34–39.
- 3 Robson SC. BJA 1992; 68: 54–59.
- 4 Morgan D. Anesthesiology 2000; suppl (April): A5.

Intensive Care Medicine

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Low tidal volume mechanical ventilation in prone positioning patients with acute respiratory distress

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Background and Goal of Study: We investigated the efficiency of low tidal volume mechanical ventilation in Acute Respiratory Distress Syndrome (ARDS) patients during prone positioning.

Materials and Methods: Thirty patients with Acute Respiratory Distress Syndrome were chosen for the study. The patients who received volume controlled mechanical ventilation in prone position allocated to two groups: low tidal volume (6 ml/kg) administered patients in Group I ($n = 15$), conventional tidal volume (12 ml/kg) used patients in Group II ($n = 15$) were evaluated. The goal of ventilation to a PaO₂ value between 55–80 mmHg or SpO₂ 88–95% is to provide an adequate arterial oxygenation with a PaCO₂ value between 38–40 mmHg.

Heart rates, systolic and diastolic arterial blood pressures, central venous pressures, respiratory rates (RR), arterial oxygen partial pressure/fractional inspired oxygen concentration ratios (PaO₂/FiO₂), positive end-expiratory pressure (PEEP) levels and plateau pressures (Pplat) were recorded just after prone positioning, at 1 hour and every 3 hours during a 12-hour study duration in prone position.

Student-t and chi-square tests, Mann-Whitney rank sum or Kruskal-Wallis tests and Tukey test were used for statistical analysis. $p < 0.05$ was considered to be statistically significant.

Results and Discussions: There was no significant difference on hemodynamic parameters ($p > 0.05$). PaO₂/FiO₂ ratio increased significantly at 1 hour in both groups ($p < 0.05$). There were insignificantly difference between

the FiO₂, PEEP and RR values ($p > 0.05$). The plateau pressures were significantly lower in low tidal ventilation patients ($p < 0.05$).

Conclusion(s): In conclusion, we decided that low tidal volume ventilation in prone position might be considered as a safe and an effective therapeutic strategy in ARDS patients to improve oxygenation with limited lung injury.

References:

- 1 Matthay MA, Uchida T, Fang X. Crit Care Med 2002; 4(2): 139–149.
- 2 The ARDS Network. N Engl J Med 2000; 342: 1301–1308.

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Impact of recruitment maneuver following PEEP optimization

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Background and Goal of Study: Sustained inflations have been recommended in patients with early ARDS to restore lung recruitment (1), but the use of recruitment maneuvers remains a matter of dispute in patients ventilated with a lung protective strategy in whom the lungs have been near-optimally recruited by PEEP. The objective of our study was to evaluate the impact of lung recruitment maneuvers on oxygenation and intrapulmonary shunt fraction following PEEP optimization in patients with early ARDS.

Materials and Methods: In a prospective, randomized, and controlled study 30 consecutive, unselected ARDS patients were randomized either to a group with PEEP-optimization and a recruitment maneuver (RM) and PEEP-optimization without a recruitment maneuver (Control). The recruitment maneuver was performed with a sustained inflation of 50 cm H₂O for 30 sec.

Blood gases were recorded before, 3, and 30 min after the recruitment maneuver.

Results and Discussions: Following an improvement of gas exchange and intrapulmonary shunt fraction at 3 min, no difference could be detected at 30 minutes neither to baseline values nor between the groups.

	Baseline	30 min	P
PaO ₂ , mmHg			
RM	90,5 ± 20,9	94,9 ± 21,3	1
Control	94,7 ± 22,5	101,2 ± 32,1	0.13
Qs/Qt, %			
RM	30,8 ± 5,8	29,2 ± 7,4	1
Control	30,2 ± 8,5	28,1 ± 5,4	0.22

Conclusion(s): Our data demonstrate that in patients with early ARDS in whom lungs have been near optimally recruited by PEEP recruitment maneuvers seem to be of no further benefit.

Reference:

- Grasso S, Mascia L, Del Turco M, et al. *Anesthesiology* 2002; 96: 795–802.

A-648

Histological effects of intrapulmonary application of activated protein C and PP4 during PLV and TLV in a rabbit model of acute lung injury

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Background and Goal of Study: The still high mortality of acute lung injury and ARDS cause continuous research for new treatment modalities. Activated Protein C (APC) has been used successfully to treat patients with severe sepsis. Aim of this study was to find out whether the combination of partial and total liquid ventilation (PLV/TLV) using PP4 (Perfluoro-1,3,5-trimethylcyclohexan) and APC has an impact on lung histology in a wash out model of acute respiratory failure.

Materials and Methods: 19 NZW rabbits (2,76 kg ± 0,33 bodyweight) were randomized into 3 groups (control group, CG), acute lung injury group (ALI) and activated protein group C (APC). After induction of anaesthesia and tracheotomy, acute lung injury was induced by repeated pulmonary saline lavage. When meeting ALI criteria (paO₂/FiO₂ < 100 mmHg), the liquid ventilated animals underwent PLV and TLV with PP4 for 60 minutes each. During LV 2,5 mg/kg bodyweight/h APC were instilled into the trachea. After euthanasia, the lungs were extracted. Perfusion fixation was used to process the lungs for further examination. For histological analysis and image data acquisition a Leica Quantimed optical microscope was used.

Results and Discussions: When compared to the ALI group, the average septal wall thickness in the APC group changed significantly (ALI: dorsal 4,88 ± 0,72 μm, ventral 4,91 ± 0,86 μm, APC: dorsal 3,54 ± 0,28 μm, ventral 3,54 ± 0,27 μm, Control: dorsal 3,08 ± 0,47 μm ventral 2,96 ± 0,30 μm).

There were no significant changes in the average alveolar plane in all groups, however there was a trend to smaller diameters in the APC group (ALI: dorsal 2294 ± 105 μm, ventral 2304 ± 219 μm, APC: dorsal 2194 ± 329 μm, ventral 2213 ± 290 μm, Control: dorsal 1918 ± 290 μm, ventral 1965 ± 225 μm).

Conclusion(s): The significant impact on the septal wall thickness might be a hint that there is a positive effect of the combination of APC with PLV and or TLV. This might be explained by a reduction of the inflammatory process by activated protein C. In consequence inflammatory mediators like TNF, MIF or thrombin might be reduced and lead to a reduction of alveolar oedema and fibrosis.

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Does the sternovertebral gradient of distribution of lung volume exist in patients with acute respiratory distress syndrome?

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Background and Goal of Study: The loss of aeration in dependent lung regions characterizing acute respiratory distress syndrome (ARDS) is classically explained by “sponge” theory (the increased tissue mass causes the lung to collapse under its own weight) obtained from CT studies performed on a single juxta-diaphragmatic CT section (1). However, such collapse in dependent lung units was not found in canine with acid-oleic-induced ARDS (2). The aim of the study was to re-evaluate the sternovertebral (SV) gradient of lung volume in patients with ARDS using CT scan of the whole lung.

Materials and Methods: The CT scans of whole lung of 20 patients with early ARDS and 7 health volunteers (HV) were analyzed. The CT scans were acquired at end-expiration in zero end-expiratory pressure in patients and at end-expiration in HV. Ten patients had focal (F) and 10 had diffuse (D) CT morphologic patterns. SV distributions of total lung volume, volumes of gas and tissue of 2 transversal CT sections were analyzed: first one on upper lobe (1 cm above the carina) and second on lower lobe (1 cm above the diaphragmatic cupola) (LungView®). Each CT section was divided in 10 arbitrary sections from sternum to vertebra. SV distributions of total lung volume, volumes of gas and tissue of patients and HV were compared using two-ways ANOVA analysis.

Results: Total tissue volume was increased by 54% in patients [914 ± 140 (HV) vs. 1675 ± 406 (patients) ml]. On the upper lobe, SV distribution of total volume was superimposed in patients F and HV. In patients D, total lung volume was decreased, but the shape of SV distribution was not different as compared to HV. In all patients, lung aeration decreased from sternum to vertebra whereas lung tissue increased. On the lower lobe, total lung volumes as well as volume of gas in patients F and D were decreased but the shape of SV distribution of lung aeration was not different when comparing to HV.

Conclusions: The absence of SV gradient of distribution of total lung volume in patients with ARDS does not support the “sponge” theory. On the upper lobe, the loss of aeration in the dependent regions is replaced by increase of lung tissue. On the lower lobes, the collapse of lung units is equally distributed from sternum to vertebra.

References:

- Gattinoni et al. *AJRCCM* 2001;164:1701–11.
- Martynowica et al. *J Appl Physiol* 2001;90:1744–53.

A-650

Changes in lung volume during recruitment manoeuvres (RM) assessed by electric impedance tomography (EIT)

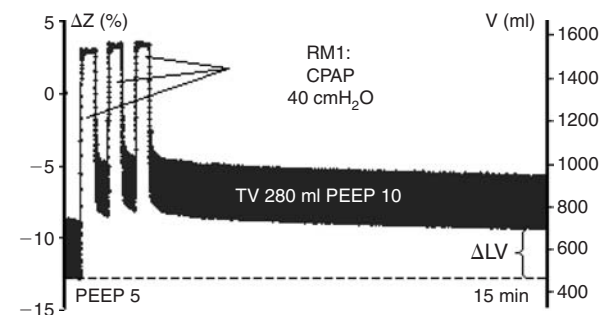
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Background and Goals: This study evaluates changes in lung volume (LV), hemodynamic and respiratory parameters during three different RMs using EIT.

Materials and Methods: In 14 anesthetised pigs, ALI was induced by repeated alveolar lavage. With 16 electrodes placed around the thorax impedance changes, ΔZ, (~ aeration) was monitored (Dräger/GOE MFII). Calibration was performed against known LV changes with a super syringe. FRC was measured at baseline (volume controlled ventilation 10 ml/kg, 20/min, I:E 1:2, PEEP 5) with N₂ wash in/out technique. Cardiac output (CO) was measured with thermodilution and PaO₂ continuously registered. In random order 3 repeated RM1; CPAP 40 cmH₂O or RM2; pressure controlled ventilation, peak airway pressure 40 cmH₂O, PEEP 20, 20/min, I:E 1:1 for 30 sec each and RM3; volume controlled ventilation, 10 ml/kg, PEEP elevation to 15 and end-inspiratory pauses of 7 sec every 30 sec for 15 min were performed. Following the RMs PEEP was set to 10.

Results: Impedance changes correlated well to known changes in LV (r² > 0.99) which could be closely followed, see fig. LV increased with 350 ± 37, 362 ± 40 and 328 ± 37 ml (mean ± SEM) 15 min after RM1, 2 and 3 respectively (ns between RMs). Similar and significant (p < 0,001) improvement in PaO₂ followed all RMs (ns between RMs). CO decreased during the RMs by 63 ± 4, 44 ± 2 and 21 ± 4% in RM1, 2 and 3 (p < 0,001 between all).



Conclusion: EIT can be used for on line monitoring of lung volume changes bedside. All recruitment manoeuvres were effective but CPAP (RM1) lead to severe circulatory depression which can be avoided if a slow RM (RM3) is performed.

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Risk factors of ventilator associated pneumonia in trauma patients treated with selective digestive decontamination

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Background and Goal of Study: Ventilator associated pneumonia (VAP) are the most frequent nosocomial infections in intensive care unit. The role of selective digestive decontamination (SDD) to decrease the rate of VAP in trauma patients has been highlighted. The objective of our study was to determine the risk factors of VAP in trauma patients receiving SDD.

Materials and Methods: Trauma patients admitted over a five-year period in a polyvalent ICU of a teaching hospital were included. The inclusion criteria were an injury severity score > 16, a duration of mechanical ventilation > 5 days, and the occurrence of VAP (clinical, radiological, and bacteriological criteria) after day 5 of mechanical ventilation. All patients received SDD consisting of polymixin E, gentamicin, and amphotericin B applied in nostrils, mouth, and gut have been included. A three-day course of cefazolin (1 g ×3/d IV) was administered from the admission day. Predictors of VAP occurrence were assessed by logistic regression analysis.

Results: Ninety (56%) out of 159 included patients exhibited 116 VAP episodes, which occurred on day 9 for a median ICU stay of 24 days. The overall mortality was 37% (59 patients). Multivariate analysis results are collected in table.

Criteria		OR	CI95%	p
Prior antimicrobial therapy	no	1		
	yes	0,3	0,12–0,74	0,009
Neuromuscular blockers for intubation on scene	No	1		
	Depolarizing	0,54	0,19–1,54	0,25
	Non depolarizing	3,41	1,08–10,73	0,036
Prior bronchial colonization		1,03	1,02–1,21	0,02
Duration of intubation		1,06	1,01–1,17	0,07
Length of ICU stay		1,05	1,02–1,09	0,002

Conclusion: The prior use of an antimicrobial therapy (except SSD), the use of non depolarizing agent for intubation on scene, a pre-existing bronchial colonization, the duration of intubation, and the length of ICU stay are associated with an increase risk of VAP in mechanically ventilated trauma patients treated with SSD. From these results, the use of non depolarizing neuromuscular blockers for intubation of trauma on scene should be discouraged.

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Echographic study of effects of inhaled nitric oxide on incidence of acute cor pulmonale during ARDS

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Background and Goal of Study: Despite protective ventilation, incidence of Acute Cor Pulmonale (ACP) during Acute Respiratory Distress Syndrome (ARDS) remain elevated¹. We conducted a prospective echographic study to determine if inhaled Nitric Oxide (NO) can decrease significantly right ventricular overload and particularly ACP.

Materials and Methods: Effects of inhaled NO were studied using transoesophageal echocardiography and right ventricular catheterization on 31 patients admitted with ARDS and ventilated with protective strategy (tidal volume = 5–7 ml/kg; PEEP = 11 ± 2 cmH₂O). Incidence of ACP, velocity time integral of pulmonary artery (VTI_{AP}), and right ventricle end diastolic area on left ventricle end diastolic area ratio (RVEDA/LVEDA) were studied before and during administration of inhaled NO (4 ppm). A patient was responder if inhaled NO induce a decrease in pulmonary vascular resistance >20%. Right ventricular enlargement (RVE) was defined by a RVEDA/LVEDA ratio >60%. ACP was defined by the presence of a RVE and a flat or inverted septum.

Results and Discussions: 17 patients were responders.

	Responders (n = 17)		Non Responders (n = 14)	
	Before	During NO	Before	During NO
Value of RVEDA/LVEDA ratio (%)	80 ± 18	66 ± 18*	72 ± 6	75 ± 19
% de Patients with				
RVE	71%	59%*	50%	43%
ACP	35%	17%†	0%	0%

*Wilcoxon test, p < 0.05. †Fisher's exact test, p < 0.05.

Conclusion(s): Despite protective ventilation right ventricle overloading and particularly ACP are still frequent. In responders patients, inhaled NO can reverse ACP and limit right ventricular overload.

Reference:

1 Crit Care Med 2001 (29): 1551–1555.

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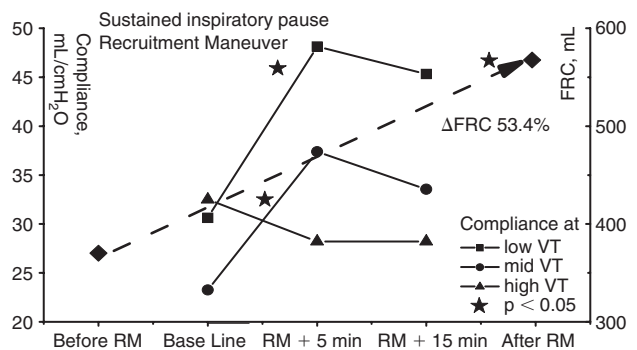
Changes in Volume Dependent Compliance during lung recruitment maneuvers

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Background and Goals: Increase in compliance has been regarded as a sign of successful lung recruitment. We used Volume Dependent Compliance (VDC) and FRC for assessing three different recruitment maneuvers (RM).

Materials and Methods: ALI was induced in 10 anaesthetised pigs by lung lavage. Three RMs were applied in random order: A) 30 s of CPAP at 40 cmH₂O, B) 30 s of pressure control ventilation with I:E-ratio 1:1, PEEP 20 and P_{peak} 40 cmH₂O, RR 20/minutes. The RMs were repeated 3 times with 30 seconds volume control ventilation (VCV) with I:E-ratio 1:2, PEEP 10 cmH₂O between RMs and for 20 minutes after completion of RMs, C) a 15-minute period of VCV at PEEP 15 cmH₂O in which endinspiratory pause was prolonged for five seconds twice a minute.



After RM, PEEP was reduced to 10 cmH₂O for 20 minutes. Breath-by-breath alveolar P/V curves were monitored for VDC at low, mid, and high part of the tidal volume using tracheal pressure measurements according to the Dynostatic Algorithm (1). FRC was measured by a modified N₂-washout/in method (2).

Results: FRC increased significantly with (mean ± SEM) 62 ± 22, 39 ± 18, and 53 ± 20% for RM A, B, and C respectively. VDC_{low} and VDC_{mid} increased significantly irrespective of RM and had a tendency to decrease during the post-RM period. VDC_{high} was higher than VDC_{low} and VDC_{mid} at baseline but remained unchanged after RM.

Conclusion: The effect of RMs can be continuously monitored by VDC. RMs lead to a significant basal and mid tidal volume increase in compliance without signs of overstretching at the highest part of the tidal volume.

References:

- 1 Karason S *ICM* 2001; 29: 955–62.
- 2 Olegård C *Eur J Anaesth* 2003; (Suppl) 30: A-637.

A-654

The effects of ventilation parameters, airway mechanics and hemodynamic variables on intraocular pressure in ALI/ARDS patients

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Background and Goal of Study: Positive pressure ventilation can effect organ perfusion by reducing cardiac output. The aim of this study was to investigate the effects of ventilation parameters, airway mechanics and hemodynamic variables on intraocular pressure in ALI/ARDS patients.

Material and Methods: Twenty-five patients undergoing mechanical ventilation therapy due to ALI/ARDS, aged 24 to 62, were included to the study following the hospital ethic committee approval. Controlled mechanical ventilation was applied to all patients with 8 ml/kg tidal volume to produce 40 mmHg

end tidal PCO_2 . Propofol ($2 \text{ mg kg}^{-1} \text{ hr}^{-1}$) and vecuronium bromide (6 mg hr^{-1}) was applied to produce sedation and neuromuscular blockade. During positive pressure ventilation, ventilation parameters (PEEP and inspirium/expirium ratio), airway mechanics (compliance and peak inspiratory pressure) and haemodynamic variables (central venous pressure) were recorded. In all patients, intraocular pressures were measured using Tono-Pen XL tonometer once a day for two days in both eyes. Intraocular pressure measurements were performed in supine position. In statistical analysis, average values of right and left intraocular pressures was considered for measurements.

Results and Discussion: Negative correlation was found between compliance and intraocular pressure ($r = -0.5$, $p = 0.002$), whereas, positive correlation was found between CVP and intraocular pressure ($r = 0.43$, $p = 0.02$). No statistically relevance was found between intraocular pressure and the other parameters (inspirium/expirium ratio, PEEP, and PIP) ($p > 0.05$). These results suggested that hemodynamic and ventilation parameters may likely affect intraocular pressure by decreasing drainage of aqueous humor from episcleral veins.

Conclusion: Our findings show that low compliance and high CVP increases IOP in ALI/ARDS patients during mechanical ventilation, suggesting that a decrease in compliance or an increase in CVP could be deleterious to the eye.

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Determination of time for optimal settings for high pressure lung recruitment maneuvers in an ARDS sheep model

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Background and Goal: Lung recruitment maneuvers (LRM) can markedly improve PaO_2 levels. Based on previous data (1,2) we considered LRM with PEEP of 25, PIP of 60 $\text{cm H}_2\text{O}$, I:E 1:1, respiratory rate (RR) of 6/min for 60 sec the most useful. In the present study we determined if a reduction in the time a LRM was applied would influence the efficiency of the LRM.

Materials and Methods: This study was designed as a Cross-Over Study. Saline lavage lung injury was induced in 8 sheep until PaO_2 decreased to $73 \pm 22 \text{ mm Hg}$ at an F_iO_2 of 1.0 and PEEP of 5 $\text{cm H}_2\text{O}$. Each LRM consisted of PIP of 60, PEEP of 25 $\text{cm H}_2\text{O}$, I:E 1:1 and RR of 6/min. 3 LRM were randomly compared in each animal; LRM-1: $t = 20 \text{ sec}$, LRM-2: $t = 40 \text{ sec}$, LRM-3: $t = 60 \text{ sec}$. Each specific LRM was repeated a maximum of 3 times if the PaO_2 did not reached our target of 400 mmHg .

Results and Discussions: LRM-1 was performed 17x; LRM-2 13x and LRM-3 10x ($p < 0.05$ LRM-1 vs. LRM-3). There was no significant difference in: blood pressure, heart rate and cardiac output among LRM's. Below are data 20 min after each LRM for PaO_2 , PaCO_2 , and V_t (mean \pm SD).

	LRM-1	LRM-2	LRM-3
paO_2 (mm Hg)	420 ± 201	445 ± 142	523 ± 73
paCO_2 (mm Hg)	46 ± 11	45 ± 10	38 ± 6
V_t (ml)	238 ± 79	217 ± 59	261 ± 71

Conclusions: Time has a significant effect on LRM. Based on our results we considered a PIP 60 $\text{cm H}_2\text{O}$, PEEP 25 $\text{cm H}_2\text{O}$, RR 6/min, and I:E 1:1 applied for 60 sec the optimal LRM in this model.

References:

- Suchodolski K. Am J Respir Crit Care Med 2002; 165:A683.
- Suchodolski K. Respir Care 2001; 46(10):1090.

A-656

The prone position with and without abdominal restriction

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Background and Goal of Study: The prone position (PP) is largely used to improve the gas exchange in ALI/ARDS patients.

During the PP, two thick pillows are usually placed under the bone pelvis and the shoulder to permit free abdominal excursions.

Aim of the study is to compare the effects of the PP with and without abdominal restriction compared to supine position.

Materials and Methods: 9 ALI/ARDS sedated and paralyzed patients (age 55 ± 17 y, ideal body weight 75 ± 11 Kg, $\text{PaO}_2/\text{F}_i\text{O}_2$ $188 \pm 48 \text{ mmHg}$, PEEP $11.6 \pm 2.8 \text{ cmH}_2\text{O}$) were enrolled. They were ventilated in volume controlled

(mean tidal volume/weight $7.1 \pm 0.8 \text{ ml/Kg}$, respiratory rate of $16.4 \pm 3.2 \text{ bpm}$) and starting from supine position (SP) they were randomly placed, in PP with and without the pillows. Gas exchange, dead space and end expiratory lung volume (EELV, by the Helium dilution technique) were measured after on hour. No changes in ventilator settings were allowed.

Results are expressed as mean \pm SD.

Results and Discussions:

	SP	PP without pillows	PP with pillows
PaO_2 (mmHg)	87.0 ± 12.2	$111.4 \pm 19.7^*$	$111.6 \pm 17.4^*$
PaCO_2 (mmHg)	44.0 ± 4.8	43.2 ± 5.5	45.1 ± 6.3
VD/VT (%)	0.63 ± 0.11	0.64 ± 0.12	0.65 ± 0.14
EELV (L)	1.25 ± 0.46	$1.07 \pm 0.23^*$	1.12 ± 0.30

* $P < 0.05$ One way RM Anova vs SP

Conclusion(s): Although oxygenation was increased in prone compared to supine position, and not different between the two conditions in prone, the PP without pillows reduced the EELV compared to SP. We suggest to not use the PP without pillows in the patients with a markedly reduction of EELV.

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Continuous vs. bolus administration of imipenem in critically ill patients with ICU-acquired pneumonia: A randomized, controlled trial

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Background and Goal of Study: Most recently, administration modus for β -lactam antibiotics has become a matter of debate and continuous infusion has been suggested [1]. We studied whether plasma concentrations of imipenem were sufficiently maintained using a loading dose and continuous infusion regimen, and that this regimen would be superior to a higher amount of drug given by the standard intermittent bolus regimen.

Patients and Methods: We randomized 20 critically ill patients with ICU-acquired pneumonia to receive imipenem either 2 g/24 h by continuous infusion (CON, $n = 10$) or bolus dosing (1 g every 8 h) (BOL, $n = 10$). In both groups, a loading dose of 1 g imipenem was administered which was followed by continuous infusion or further bolus treatment 4 h after loading. Plasma imipenem concentrations were measured at baseline, 4, 10, 16, 22, 46 and 70 h. Arterial blood samples were taken immediately prior to begin of the continuous regimen and before each respective bolus administration. Patients' age (62 ± 16 vs. 59 ± 16 yrs), SAPS II score (43 ± 12 vs. 44 ± 14) and renal function (creatinine clearance, 128 ± 35 vs. $122 \pm 33 \text{ mL/min}$) were comparable between both groups.

Results and Discussion: After 4 and 10 h, plasma imipenem concentrations were similar in both groups. However, mean imipenem plasma trough concentrations at the following time points (16, 22, 46, and 70 h) were significantly higher in CON than BOL. For comparison, at 16, 22, 46 and 70 h, all patients in CON had concentrations of $>2 \mu\text{g/mL}$ ($\text{MIC}_{50\%}$ for *Pseudomonas aeruginosa*) while this was only achieved in three of ten patients in BOL. These data suggest that continuous infusion is advantageous and its benefit should therefore be investigated in clinical outcome studies.

Conclusion: Continuous imipenem infusion administered as 2 g over 24 h guarantees more sufficient plasma concentrations when compared to a standard regimen (1g every 8 h) which is associated with insufficient trough concentrations.

Reference:

- Lipman J (1999) Continuous infusion ceftazidime in intensive care: a randomized controlled trial. J Antimicrob Chemother 43: 309-311.

A-658

Has the prone position any effect on mechanically ventilated patients with lung fibrosis?

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Background and Goals: Impact of body position changes on oxygenation are well known for over 20 yrs. We studied the effect of prone position on patients with lung fibrosis admitted to our ICU for acute respiratory failure.

Material and Method: We studied 8 patients with known lung fibrosis who were intubated and mechanically ventilated due to acute respiratory distress

syndrome (ARDS). Group A ($n = 4$) was the control group left on supine position. Group B ($n = 4$) was turned to prone position and included patients who did not show any improvement after being mechanically ventilated for >6 h, needed an $F_iO_2 > 0.6$ to achieve $SaO_2 = 90\%$ and did not respond to recruitment maneuvers.

Results: The following parameters were recorded in every patient of both groups: PaO_2/F_iO_2 ratio, SaO_2 , mixed oxygen venous saturation and arterial blood gases.

Conclusions: There was no statistically significant difference between the two groups neither regarding to the outcome (survival-death), nor to the improvement of their condition (lung pressures, oxygenation, weaning from the ventilator).

References:

- 1 G. Nakos, I. Tsangaris, E. Konstanti, C. Nathanail Effects of prone position on patients with hydrostatic pulmonary edema. *Am J Respir Care Med* 2000 Feb; 161: 360-8.
- 2 J. Marini Evolving concepts in the ventilatory management of acute respiratory distress syndrome. *Clin Chest Med* 1996.

A-659

Daily clinical practice of mechanical ventilation in a Dutch university hospital: ICU vs. OR

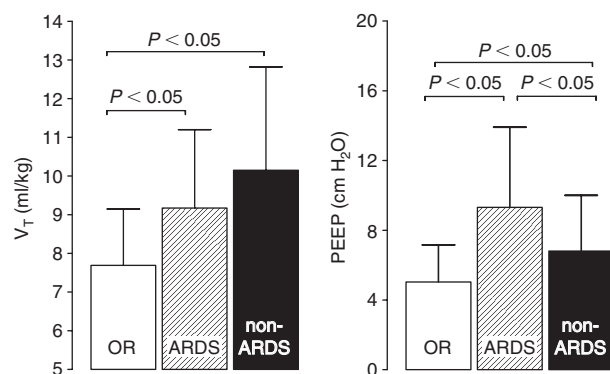
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Background and Goals: Use of "lung-protective" mechanical ventilation (MV), by applying small tidal volumes (V_T) is recommended in ARDS-patients. Animal studies suggest that such strategies may prevent lung injury in patients with healthy lungs as well. In our hospital, the MV-protocol for ICU-patients prescribes use of V_T of 6–8 ml/kg, regardless the existence of ARDS, while in the operating room (OR) no MV-protocol is presently on hand. We prospectively studied MV in daily clinical practice in ICU and OR-patients.

Material and Methods: MV-settings (MV-mode, actually applied V_T , and PEEP) were collected 3 times per day in 23 ICU-patients (ARDS/non-ARDS) and in 67 OR-patients. To determine *ideal* V_T , *ideal* body weight was calculated from patients' length. Data are means and standard deviation. Statistical analysis: Mann-Whitney U test. A P -value < 0.05 was considered significant.

Results and Discussion: In 90% of OR-patients volume-controlled MV was used, while 98% of ICU-patients were pressure controlled ventilated. The actually applied V_T was remarkably lower in OR than in ICU-patients ($P = 0.0001$) (figure). Furthermore, 89% of the observations in ICU-patients showed that applied V_T was >8 ml/kg. A possible explanation for the discrepancy between recommended and actually applied V_T was the use of *absolute* bodyweight instead of *ideal* bodyweight for V_T -calculation.



Conclusions: In our hospital, in OR-patients but not in ICU-patients small V_T is used for MV. Therefore, we think that implementation of small V_T -MV in ICU needs an educational program, which is presently applied.

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Are Dutch intensivists reluctant in applying small tidal volume-mechanical ventilation?

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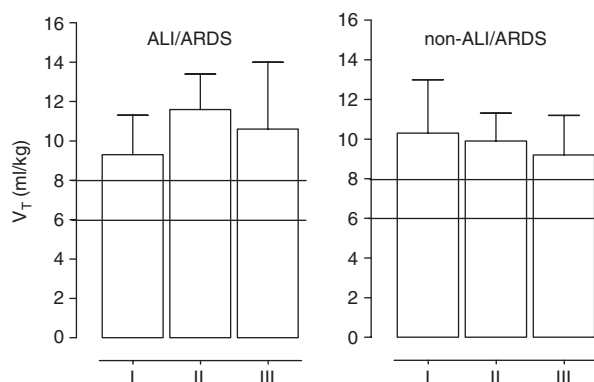
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Background and Goals: Studies in ALI/ARDS-patients have shown beneficial effect of "lung-protective" mechanical ventilation (MV) by applying small tidal

volumes (V_T). Animal studies suggest that such strategies may also prevent ventilator-associated lung injury in patients with healthy lungs.

Material and Methods: We prospectively evaluated MV in ICU-patients in The Netherlands. In an academic ICU and two non-academic ICUs, 43 consecutive patients (24 with ALI/ARDS) were studied. MV-settings (MV-mode, actually applied V_T and total PEEP) were collected 3 times per day. *Ideal* V_T was calculated from patient's length. Data are means (\pm SD). Statistical analysis: Mann-Whitney U and Kruskal-Wallis test. A P -value < 0.05 was considered statistically significant.

Results and Discussion: Pressure-controlled or pressure support MV-modes were most often used (97.7%). No differences were seen between the four MV-modes (ASV, VCV, ASB and PCV) with respect to applied V_T and PEEP. Surprisingly, higher levels of PEEP were used in ARDS-patients ($P = 0.002$). Importantly, in the majority of patients V_T was >8 ml/kg (figure, I–III, indicate hospital; dotted lines, 6–8 ml/kg). Moreover, V_T was significantly higher in ARDS-patients than in non-ARDS patients ($P = 0.002$). A possible explanation is that *absolute* bodyweight was used to calculate V_T , instead of *ideal* body-weight based on length.



Conclusions: There is a large discrepancy between *ideal* V_T and actually applied V_T . Implementation of small V_T -MV needs an educational program and evaluation, which is currently in progress in all three ICUs.

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Outcome of elderly patients mechanically ventilated in the immediate postoperative period

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Goal of Study: To analyze the need of Mechanical Ventilation in patients over 70 years old (elderly) in the immediate postoperative period after non Cardio-Thoracic surgery and describe the clinical features.

Materials and Methods: Setting: General District Hospital assisting to a 250,000 population. Capacity of 350 beds. 8 surgical specialties except Neuro and Cardio thoracic surgery.

Sample survey of 27,918 patients who underwent surgical procedures between January 2000 and June 2003. Data reported from the prospective data base collection of the Anaesthesia Unit and the computerised clinical history. Retrospective Cohort statistical survey including Fischer's and χ^2 tests for qualitative variables and U-Mann Whitney's and T-Student tests for quantitative variables.

Results: In the period of study 389 elderly (2.79% of the whole elderly surgical population) (Mean age 78.09 years old, 60.4% Males) went through the Surgical Intensive Care Unit. 187 needed MV in comparison with 166 younger (1.11%) (OR: 2.38; CI: 2.4–3.18; $P < 0.001$). 68.21% underwent General surgery procedures. 53.30% were submitted to emergency surgery.

The Median time of MV was 22 hours; Range: 67 days to 1 hour. 51.6% were MV during a period less than 24 hours and 13.9% over 10 days. Severity Score indexes APACHE and SAPS were significantly increased in the elderly (18.7 and 14.8 respectively) but paradoxically the average hospitalisation time and TISS Score (38.1 versus 36.6) were not statistically significant. Renal dysfunction and haemodynamic instability were increased as well, not finding any difference in the respiratory distress syndrome rate. MV elderly had a significant higher mortality being 55.5% in those who were MV less than 24 hours and 22.5% in MV > 24 hours compared with 11.1% mortality in younger.

Conclusions: 2.79% of elderly undergoing non Cardio-thoracic surgery needed MV. 53.30% after emergency surgical procedures. MV was associated

with high severity Score indexes and high morbidity. The global mortality in those elderly patients who needed postoperative MV was 28.87%.

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Optimum pressure support (Ps) during the weaning of COPD patients: changes in airway occlusion pressure (P0,1), breathing patterns, hemodynamics and blood gases

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Background and Goal of Study: The best PS level to be applied during the weaning of COPD patients should gradually reload the inspiratory muscles without causing diaphragm/inspiratory muscle fatigue. P0,1 is an estimate of neuromuscular drive; values of between 2–4 cmH₂O are generally accepted as good levels for sufficient but not excessive workload of respiratory muscles (1,2). Along with f, V_T, f/V_T values as breathing patterns, we aimed to assess the changes of P0,1 during the gradual reduction of PSV levels in patients weaning from mechanical ventilation. We also followed the hemodynamics and blood gases at the different levels of PSV.

Materials and Methods: 20 COPD patients (Aged 47–83, Apache II: 15–39) recovering from acute respiratory failure were included. They were considered to be ready for weaning and able to tolerate PSV with F_IO₂ levels of 0,4–0,5%. During the trial, four successive levels of PS were assessed: PS 20, 15, 10, 5 cmH₂O. After 30 min of each change of PS level; P0,1, f, V_T, f/V_T values were recorded from the ventilator (Dräger Evita 4). Hemodynamic parameters and blood gases were obtained at the same time.

Results: Results are on Table 1.

Table 1. Respiratory, hemodynamic parameters.

	PS (cmH ₂ O)				p
	20	15	10	5	
P0,1	1,33 ± 1,03	2,31 ± 0,63	3,31 ± 1,78	4,68 ± 2,23	0,001**
f	15,25 ± 4,12	17,80 ± 4,37	21,95 ± 6,74	26,25 ± 6,62	0,001**
V _T (ml)	680,45 ± 154,76	524,30 ± 113,35	468,65 ± 116,50	420,35 ± 130,50	0,001**
f/V _T	20 ± 10	30 ± 10	50 ± 30	70 ± 30	0,001**
pH	7,47 ± 0,05	7,46 ± 0,05	7,44 ± 0,06	7,42 ± 0,07	0,001**
PaO ₂ (mmHg)	86,69 ± 24,63	87,33 ± 17,98	88,60 ± 21,66	85,77 ± 23,02	0,767
PCO ₂ (mmHg)	54,73 ± 10,87	56,64 ± 10,68	60,00 ± 11,72	63,23 ± 13,17	0,001**
SAP (mmHg)	133,5 ± 15,85	133,45 ± 16,83	135,10 ± 37,87	138,90 ± 24,84	0,722
HR	101,95 ± 15,50	97,15 ± 16,32	101,95 ± 15,52	106,55 ± 16,09	0,019*

Discussion and Conclusion: It has been shown that P0,1 is closely correlated with the work of breathing in patients receiving PSV (1). It has been also found that V_T varies directly and f and f/V_T inversely with the level of PS (2).

Our findings are in accordance with these results. When PS is applied at 15 cmH₂O, P0,1 could be kept within ideal values in 80% percent of the patients; f, V_T, and f/V_T values were quite acceptable, so as the blood gases.

References:

- 1 Perrigault PF et al. Thorax 1999 Feb; 54(2):119–23.
- 2 Mancebo J et al. Anesthesiology 2000 July; 93(1):81–90.

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PEEP for PEEPi; which percentage?

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Background and Goal of Study: Dynamic hyperinflation and intrinsic positive end-expiratory pressure (PEEPi) are observed in patients with chronic obstructive pulmonary disease (COPD). PEEP levels approaching PEEPi may reduce inspiratory load due to PEEPi. The appropriate level of PEEP should not cause further hyperinflation, affect hemodynamics and gas exchange (1).

Materials and Methods: To determine the “best PEEP” level and its ratio to PEEPi, we studied 20 COPD patients. Who were sedated and mechanically ventilated (Dräger Evita 4). After the hemodynamic and pulmonary first-line treatment (within first 24 h); patients were curarised, kept on ZEEP, PEEPi was calculated using the standard method on the ventilator. Patients with PEEPi ≥4 cmH₂O were included. Vtrap (end-expiratory lung volume above passive FRC) and the other respiratory parameters, hemodynamic parameters, blood gases were recorded on ZEEP and on different PEEP levels calculated according to the PEEPi (25, 50, 75% of PEEPi). At least 30 min.

passed between each measurement. Ventilatory parameters were kept constant during the study period.

Results: Results were summarised on Table 1, 2.

Table 1. Respiratory parameters

PEEP	Vtrap (ml)	Ppeak (mbar)	Pmean (mbar)	V _{Tb}	C (ml/mbar)
0	238,0 ± 196,54	31,81 ± 4,53	8,72 ± 1,42	600,1 ± 110,8	39,70 ± 10,48
25	216,0 ± 200,78	31,00 ± 4,62	8,81 ± 1,40	602,4 ± 116,5	42,23 ± 12,01
50	138,0 ± 96,78	31,18 ± 4,44	10,0 ± 1,41	593,3 ± 116,5	46,60 ± 13,23
75	151,7 ± 178,66	31,45 ± 4,08	11,27 ± 1,62	598,9 ± 128,2	49,71 ± 15,62
p	0,001**	0,350	0,001**	0,596	0,001**
0–25	0,100		0,875		0,068
0–50	0,003**		0,017*		0,007**
0–75	0,091		0,003**		0,011*
25–50	0,029*		0,010*		0,003**
25–75	0,155		0,003**		0,008**
50–75	0,182		0,004**		0,033*

*p < 0,05 **p < 0,01 ***p < 0,001

Table 2. Blood gases and hemodynamic parameters

	pH	PaO ₂ (mmHg)	PCO ₂ (mmol/dl)	SAP (mmHg)	HR	SpO ₂
0	7,44 ± 0,06	94,82 ± 21,8	53,65 ± 8,91	116,7 ± 19,1	101,3 ± 26,8	97,27 ± 2,1
25	7,45 ± 0,07	91,72 ± 23,7	52,1 ± 10,01	126,0 ± 18,0	98,8 ± 26,6	97,45 ± 2,1
50	7,45 ± 0,06	104,8 ± 28,4	52,73 ± 9,15	135,8 ± 19,9	101,8 ± 23,3	97,45 ± 2,2
75	7,46 ± 0,07	105,6 ± 36,8	52,63 ± 9,98	124,4 ± 12,8	102,6 ± 22,8	97,09 ± 2,8
p	0,289	0,445	0,522	0,002**	0,437	0,730
0–25				0,136		
0–50				0,001***		
0–75				0,085		
25–50				0,043*		
25–75				0,651		
50–75				0,021*		

*p < 0,05 **p < 0,01 ***p < 0,001

Discussion and Conclusion: According to our results externally applied PEEP in the ratio of 50% of PEEPi significantly reduces air-trapping. Respiratory and hemodynamic parameters also were not affected by the same level of PEEP. 75–85% of PEEPi were recommended to be used as PEEP levels for COPD patients in the literature (2). This level gave similar results with applying 50% of PEEPi but among of trapped was higher.

References:

- 1 C. Guerin, et al. Intensive Care Med. 2000 Sep;26 (9):1207–14–13, 1993.
- 2 V. Marco Ranieri, et al. Am. Rev. Respir. Dis. 147: pp 5.

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Beta-adrenergic stimulation of alveolar liquid clearance: a novel strategy to resolve pulmonary edema after lung transplantation?

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Background and Goal of Study: Reperfusion injury remains an important clinical problem after lung transplantation. β-adrenergic stimulation of alveolar liquid clearance has been described to resolve pulmonary edema. In this study we investigated the effect of terbutaline in an isolated model of hydrostatic pulmonary edema.

Materials and Methods: Pig lungs were flushed with cold Perfadex[®], explanted and divided in 3 groups (n = 5/group). After a cold ischemic time of 70 min., they were reperfused and ventilated in an isolated circuit. Pulmonary artery perfusion pressure was fixed to 15 mmHg in group I [Control] and increased to 25 mmHg in groups II [Placebo] and III [Terbutaline]. At 40 min. of reperfusion, 50 ml of saline was instilled in all groups, with the addition of 10⁻⁵ M Terbutaline in group III only.

Haemodynamic, aerodynamic and oxygenation parameters were recorded up to two hours. Wet-to-Dry weight ratio (W/D) was calculated after reperfusion.

Results and Discussion: Data (Mean \pm SEM) are listed in Table:

	Control	Placebo	Terbutaline
Time	90'	90'	90'
PVR ¹	497* \pm 38	798 \pm 50	563* \pm 56
MeanAwP ²	8.2* \pm 0.2	9.1 \pm 0.3	7.8* \pm 0.3
PlatAwP ²	16.4* \pm 0.8	20.4 \pm 1.0	16.2* \pm 1.0
pO ₂ /F _i O ₂ ²	555 \pm 28	534 \pm 14	528 \pm 54
W/D	4.7* \pm 0.1	5.7 \pm 0.2	4.5* \pm 0.2

*p < 0.05 Control and Terbutaline versus Placebo;

¹Dynes \times sec \times cm⁻⁵⁰; ²mmHg.

There were no significant differences for all parameters between Control and Terbutaline.

Conclusions:

1. Elevation of pulmonary artery perfusion pressure induced reperfusion edema in Placebo versus Control.
2. Endotracheal administration of Terbutaline resulted in a decrease of pulmonary edema.

Instillation of a β -adrenergic drug, therefore, might be a new promising tool to resuscitate patients suffering from severe ischemia-reperfusion injury after lung transplantation.

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The influence of body position on the value of dynamic intrinsic PEEP during pressure support ventilation

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Background and Goal of Study: Dynamic intrinsic PEEP (PEEP_{idyn}) can be produced in the presence of dynamic hyperinflation and flow limitations in the lungs at the end of expiration. Observed in different lung pathologies, can considerably influence the work of breathing. The aim of the study was to determine the change of PEEP_{idyn} in supine and sitting position during pressure support ventilation at the ICU patients suffering from acute respiratory failure (ARF).

Materials and Methods: Prospective study on 14 patients suffering from acute respiratory failure (ARF) at 11-bed intensive care unit at a university medical center. Pressures: tracheal and central venous (P_cv) as well as gas flow using digital acquisition card with a sampling rate of 100 Hz were measured. PEEP_{idyn} was considered as a value of a negative deflection on the curve of P_cv from the onset of inspiratory effort to the point of zero flow during PS ventilation. The averages of several measurements of PEEP_{idyn} were compared in 3 positions: supine at the beginning of the study (supine 1), after 5 minutes of ventilation sitting position (sitting) and supine immediately after lying the patient back (supine 2).

Results and Discussions: No significant differences between the values of PEEP_{idyn} during the changes of body position were observed.

Position	Supine 1	Sitting	Supine 2
PEEP _{idyn} cm H ₂ O	6,29 \pm 5,77	5,89 \pm 5,88	5,83 \pm 6,5

Conclusion(s): The change of body position from supine to sitting, during PS ventilation did not influenced the PEEP_{idyn} values.

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The limited immunomodulatory effect of escharectomy on the kinetics of endotoxin, cytokines, and adhesion molecules in major burns

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Background and Goal of Study: Escharectomy has been shown to improve the survival rates and the outcomes in major burn patients. However, its exact mechanism, especially in human immune systems, has not been fully elucidated. This observational study was conducted to assess the changes of inflammatory mediators in major burn patients undergoing escharectomy.

Materials and Methods: Seventeen ASA physical status II or III adults major burn patients were initially recruited. When the escharectomy was scheduled, the series of blood samples were obtained four times at -3 and -1 days preop and +1 and +3 postop, respectively. The changing levels of endotoxin, pro- and anti-inflammatory cytokines (TNF- α , Interleukin-10), and adhesion molecules (sICAM-1, sVCAM-1, E-selectin) were measured with quantitative sandwich immunoassay and spectrometry.

Results and Discussions: Extensive escharectomy does not appear to have any significant impact on the levels of TNF- α , IL-10, sICAM-1 and sVCAM-1. On the contrary, endotoxin and E-selectin showed significant decrease when compared before and after the escharectomy.

Conclusions: Major burn injury certainly induces the systemic inflammatory responses. Inflammatory mediators behave in such a way that escharectomy has the limited immunomodulatory effect in major burns. This is probably related to the timing and extent of surgery, and the complex nature of burn related inflammation.

References:

- 1 Nakae H, Endo S, Yamada Y, Inada K. Bound and soluble adhesion molecule and cytokine levels in patients with severe burns. *Burns* 2000; **26**: 139-144.
- 2 Huang Y, Yang Z, Chen F, Crowther RS, Li A. Effects of early eschar excision en masse at one operation for prevention and treatment of organ dysfunction in severely burned patients. *World J Surg* 1999; **23**: 1272-1278.

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The human antimicrobial peptide LL-37 induces apoptosis in vascular smooth muscle cells

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Background and Goal of Study: Sepsis is one of the leading causes of death in Intensive Care Units (1). During Gram negative sepsis, lipopolysaccharide (LPS) from the bacterial cell wall triggers an immediate immune response in the host. An important part of the response is the release of antimicrobial peptides such as LL-37 from immune cells (2). LL-37 binds and neutralises the effects of LPS and may therefore be beneficial in the treatment of septic patients (3). Toxicological in vitro testing must precede clinical trials and therefore we investigated the direct effects of LL-37 of rat aortic smooth muscle cells in culture.

Materials and Methods: Vascular smooth muscle cells isolated from rat aorta were treated with LL-37 at different concentrations. Apoptotic changes were investigated with microscopy and measurement of DNA fragmentation, caspase-3 activity and cellular leak of lactate dehydrogenase. Apoptosis/necrosis was detected by flow cytometry in cells stained with Annexin V and propidium iodide, respectively.

Results and Discussions: LL-37 at 30 μ g ml⁻¹ caused cell shrinkage, membrane blebbing, nuclear condensation, DNA fragmentation and an increase in caspase-3 activity. Flow cytometry showed that LL-37 rapidly increased membrane permeability to propidium iodide slightly, followed by a slower development of FITC-annexin V binding. In parallel, the cells progressed into a state of severe loss of plasma membrane integrity.

Conclusion(s): The present results show that LL-37 induces apoptosis of vascular smooth muscle cells, probably triggered by a mild perturbation of plasma membrane integrity. The findings indicate that there may be limitations in the therapeutic use of LL-37 in septic patients due to its pro-apoptotic effects.

References:

- 1 Bone RC, Balk RA, Cerra FB et al. *Chest* 1992; 101: 1644-1655.
- 2 Cowland JB, Johnsen AH, Borregaard N. *FEBS Lett* 1995; 368: 173-176.
- 3 Scott MG, Davidson DJ, Gold MR et al. *J Immunol* 2002; 7: 3883-3991.

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Correlation of anemia and outcome of traumatic brain injury

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Background and Goal of Study: Maintaining cerebral oxygen delivery is one possible mechanism to prevent or decrease ischemia following head injury. Sixty percent of head-injured patients have evidence of ischemia at autopsy. In the injured brain CBF, cerebral blood flow, decreases from 50 ml to 30 ml/100 g/min within the first 8 hours and continues to decrease to less than 20 ml/100 g/min in the worst injured patients. More than half of brain-injured patients sustained hypoxemia, hypotension, hypercarbia, or anemia.

This is a retrospective study looking at the correlation between anemia during the acute and sub acute phase post injury, hematocrit of \leq 30, and secondary brain injury resulting as determined by FIM, Functional Independence Measure Score, scores.

Materials and Methods: A retrospective chart review was done on seventy-one patients from 1999-2001 with severe traumatic brain injury, Glasgow Coma Score \leq 8, ages ranged for 18-75. The outcome FIM Scores

from admission to discharge were compared with relation to GCS, age of the patient and patient's average hematocrit during the intensive care admission. **Results and Discussions:** 71 patients were enrolled, 50 M and 21 F. GCS ranged from 3–10. Using Pearson correlation coefficients and 2 tailed significance was calculated for each coefficient. Correlation was considered statistically significant when $p < 0.05$.

Strong positive correlation (0.869, $p = 0.002$) existed between lowest HCT and age. There was a strong positive correlation (0.819, $p = 0.004$) between total FIM score at admission and discharge.

Conclusion(s): Patients in the 45–65 age range with anemia resulting from severe traumatic brain injury had lower FIM scores from admit to discharge from rehabilitation than patients who were not anemic.

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The hormonal and inflammatory responses to pelvic reconstructive surgery following major trauma

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Background and Goal of Study: Circulating osteocalcin (OC) is a specific marker of bone formation [1] and decreases for several days after major surgery [2]. Secretion of OC is inhibited by cortisol, but cytokines and catecholamines may also be involved. We have examined the inter-relationships between serum osteocalcin, cortisol and inflammatory markers after pelvic reconstructive surgery in patients who had previously suffered major trauma.

Materials and Methods: Twenty (15 male and 5 female) patients undergoing pelvic reconstructive surgery received a standardised general anaesthetic. Perioperative blood samples were analysed for osteocalcin, bone-specific alkaline phosphatase (BSAP), cortisol, IL-6, 8 and 10 by ELISA; catecholamines were analysed by HPLC.

Results and Discussion: The mean (SD) interval between the time of trauma and surgery was 11 (5) d. The mean (SD) age, weight, and duration of surgery were 31 (9) yr, 86 (32) kg, 244 (97) min. Initial OC and BSAP concentrations were low and declined significantly even further. IL-6 and IL-10 concentrations increased during the first 48 h. Epinephrine concentrations were increased at 6 h, 48 h and 72 h. There were no significant changes in cortisol, norepinephrine or IL-8 concentrations throughout the study.

Conclusion: Pelvic reconstructive surgery following major trauma failed to evoke a cortisol response but was associated with a sustained increase in IL-6, IL-10 and epinephrine release. This suggests that although the glucocorticoid response to surgery may be impaired after major trauma, the inflammatory response is retained and may decrease OC secretion.

References:

- Cormier C. Markers of bone metabolism. *Curr Opin Rheumatol* 1995; 7: 243–8.
- Napal J et al. Stress decreases the serum level of osteocalcin. *Bone Miner* 1993; 21: 113–18.

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The impact of antithrombin administration on organ failure in patients following severe burn injury

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Background and Goal of Study: Thermal injury disrupts homeostasis by inducing subclinical disseminated intravascular coagulation and by promoting acute inflammation. The aim of this study is to investigate the effect of antithrombin (AT) administration on organ functions estimated by sequential organ failure assessment (SOFA) score in the acute phase of severe burn injury.

Materials and Methods: This prospective study was conducted on 24 patients aged 18–77 years with Total Burn Surface Area (TBSA) of $51.8 \pm 25\%$. Nine patients (group 1), who received AT concentrate infusions to raise the plasma level to 120% in the first 96 postburn hours, were compared to 15 control patients (group 2). AT activity levels were measured and SOFA score was evaluated on admission and for the following 15 postburn days.

The statistical analysis was performed using ANOVA test and Spearman correlation test.

Results and Discussions: On the first postburn day AT activity levels (group 1 – $38.9 \pm 18.2\%$, group 2 – $59.1 \pm 6.9\%$) were correlated to TBSA and SOFA score ($r = 0.75$, $p < 0.01$). Compare with control patients, patients treated with AT showed improvement of SOFA score from day one to day 15 after burn injury ($p < 0.001$).

	SOFA				
	Day 1	Day 3	Day 7	Day 9	Day 15
Group 1 (AT treated)	5.8 ± 1.95	5.75 ± 2.9	3.25 ± 1.7	3.8 ± 2	2 ± 1.6
Group 2 (control)	3.2 ± 1.2	4.1 ± 1.6	4 ± 2.7	3.5 ± 2.9	3.8 ± 2.9

*mean \pm SD

Conclusion: AT administration in early phase of burn trauma may modify the impact of thermal injury on acute inflammatory and coagulation status and seems to improve organ functions in this category of patients.

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Lack of effect of N-acetylcysteine treatment to ameliorate the progression of multiple organ failure

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Background and Goal of Study: The objective was to investigate whether prolonged infusion of the oxygen free radical scavenger N-acetylcysteine (NAC) that is commenced immediately after admission to intensive care unit could ameliorate the development or progression of multiple organ failure (MOF).

Materials and Methods: After receiving ethical committee approval, a prospective randomised, double-blind, placebo controlled study was performed. 24 patients were allocated to receive either NAC in 5% dextrose 40 mg/kg/day or the same volume of 5% dextrose both in four divided doses. Treatment effect on organ function was assessed by the Sequential Organ Failure Assessment (SOFA) scores according to physiological parameters of respiratory, hematologic, hepatic, cardiovascular, central nervous system (CNS) and renal system scores that were obtained on admission, then daily (1). Chi-square, Mann Whitney U tests were used for statistical analysis.

Results and Discussion: Data is given as number of patients (n) or median (95% CI) in the table below.

	NAC group	Control group	p
Age (yrs)	69 (16–85)	62.5 (16–80)	0.51
Female/Male (n)	5/7	7/5	0.34
Weight (kg)	70 (40–90)	65 (45–90)	0.51
SAPS II	38 (14–53)	43 (4–72)	0.54
Admission SOFA score	4.5 (1–9)	4.5 (0–12)	0.63
ICU stay (days)	6 (2–22)	4 (2–23)	0.10
Mechanical ventilation (hr)	50 (13–1008)	18 (4–720)	0.12
Maximum (max) SOFA	6 (1–24)	5 (0–13)	0.13
Delta SOFA	1.5 (0–17)	0 (0–4)	0.24
Max SOFA respiration	2.5 (0–4)	3 (0–4)	0.97
Max SOFA coagulation	1 (0–4)	0 (0–2)	0.04
Max SOFA liver	2 (0–4)	0.5 (0–2)	0.11
Max SOFA cardiovascular	1 (0–4)	1 (0–2)	0.38
Max SOFA CNS	2 (0–4)	0 (0–4)	0.22
Max SOFA renal	0.5 (0–4)	0 (0–4)	0.27
Mortality (n)	3	0	0.10

Conclusion: NAC (40 mg/kg/day) that was commenced immediately after admission to intensive care unit did not ameliorate the progression of MOF in this small cohort of patients.

Reference:

- Moreno R, et al. *Intensive Care Med.* 1999;25:686–96.

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Cardiogenic shock: a rare complication of thrombotic microangiopathy

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Background and Goal of Study: Thrombotic microangiopathies (TM) are microvascular occlusive disorders characterized by systemic aggregation of platelets and mechanical injury to erythrocytes. Thrombocytopenia and haemolytic anemia are the laboratory hallmarks of TM. The main clinical features are: hypertension, gastrointestinal or neurologic involvement and renal failure. Cardiac dysfunction is rare.

Materials and Methods: A 53 year-old woman was admitted to the hospital because of a 2 days history of bloody diarrhea and altered mental status. On admission, the temperature was 37.5°C , the pulse was 110/min and the

blood pressure was 175/95 mmHg. Laboratory results revealed anemia (11 g/dl), thrombocytopenia (68000/mm³), elevated lactate dehydrogenase (LDH) (4572 IU/L), hyperbilirubinemia (2,5 mg/dl) and elevated serum creatinine (1,89 mg/dl). TM was confirmed by the presence of schizocytes and a decrease in haptoglobine levels. Few hours after, she suddenly developed acute respiratory distress syndrome associated to elevated creatine kinase and troponine-I levels. An electrocardiogram showed elevated ST segments in leads I, aVL, V4, V5 and V6. Echocardiography indicated akinetic right ventricular wall. A coronarography did not shown any coronary disease. Despite the placement of intra-aortic balloon, fresh-frozen plasma, fluids and pressors, she died 12 hours after admission. At autopsy, the diagnosis of widespread myocardial TM was confirmed.

Results and Discussions: As illustrated in this case, TM is associated to high LDH levels, hyperbilirubinemia and low haptoglobine levels. In TM, ischemia of the brain and gastrointestinal tract is common. While cardiac involvement is commonly seen at autopsy, clinical cardiac dysfunction is rare. To our knowledge, only two cases of widespread ischemic cardiac disease have been described in the literature.

Conclusion(s): Anemia associated to thrombocytopenia and high levels of lactate dehydrogenase must evoke the diagnosis of TM. Although clinical cardiac dysfunction is rare, widespread acute myocardial infraction can occur.

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Evaluation of intensive respiratory rehabilitation after blunt chest trauma and prolonged mechanical ventilation in ICU patients: a prospective, comparative, randomised study

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Background and Goal of Study: Attempts of chest wall and respiratory muscles functions after blunt chest trauma and mechanical ventilation are important and underestimated. An early complete rehabilitation is now widely used in the post-operative period after major surgeries but not in ICU patients. The authors have evaluated the interest of an early intensive respiratory training in ICU blunt chest trauma patients after more than seven days of mechanical ventilation.

Materials and Methods: Twenty six blunt chest trauma patients, ventilated more than seven days, have been included after extubation in this prospective comparative randomised study, and divided in two groups: "Classical" respiratory training (NR): deep breath, cough and manual bronchial drainage; Intensive respiratory rehabilitation (R): inspiration/expiration against resistance at 25% of MIP or MEP levels, respiratory physiotherapy, bronchial drainage with an external percussive ventilator two times daily. An IV morphine PCA device was available in both groups. Patient characteristics and mechanical ventilation duration were noted. Functional respiratory explorations were made at T1: End of mechanical ventilation, patient extubated, T2: End of the ICU period, T3: three months later. VC, RR, Vt, VEMS, MIP, P0.1 (ventilatory control) and Ttmus (respiratory muscles fatigue) were noted.

Results and Discussions: The two groups were similar. Main results are reported in the following table:

Median values	VC (l)	P0.1 (cm H ₂ O)	MIP (cm H ₂ O)	Ttmus
T1R	1.5	3.4	38	0.35
T2R	2.1 ^{a,d}	1.5 ^{a,d}	48 ^a	0.11 ^{c,d}
T3R	3.7 ^{b,c,d}	1.5 ^b	129 ^{a,c,d}	0.06 ^{b,c,d}
T1NR	0.9	4	37	0.4
T2NR	1.1	3.2	41	0.27
T3NR	2.1 ^{b,c}	1.9 ^{a,b}	63 ^{b,c}	0.1 ^{b,c}

^ap < 0.05 T1 vs T2, ^bp < 0.05 T1 vs T3, ^cp < 0.05 T2 vs T3, ^dRehabilitation vs Classical training at each time.

Conclusion(s): An early intensive respiratory rehabilitation improves ventilatory mechanics, strength and fatigue of respiratory muscles in the ICU period (VC, RR, MIP, P0.1, Ttmus, VEMS, p < 0.05) and three months later (VC, MIP, Ttmus, p < 0.05) in blunt chest trauma patients after prolonged mechanical ventilation.

A-675

The frequency of ventilator associated pneumonia in polytraumatized patients

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Background and Goal of Study: Time on mechanical ventilation is essential for development of infection. Ventilator associated pneumonia (VAP) can develop early, in the first five to seven days combined with multiple organ dysfunction syndrome and sepsis. Severe polytrauma requires invasive procedures and monitoring which can lead to infection, multiple organ failure and lethal outcome. Aim of this study was to determine frequency of VAP in polytraumatized patients.

Materials and Methods: In a prospective study we analysed 108 polytraumatized patients, aged 16–58. They were divided into two groups. The first group included 47 patients who had chest injury combined with polytrauma and second group of 61 polytraumatized patients without chest injury.

Results and Discussions: Of all polytraumatized patients 52 had abdominal or orthopaedic surgery and were mechanically ventilated due to neurotrauma, haemorrhagic shock or respiratory insufficiency. All patients were assessed by APACHE II score. In the first group average duration of mechanical ventilation was 9–22 days and in the second 3–12 days.

In all patients broncho-alveolar aspirate and microbiological testing was performed. Pseudomonas spp. and Acinetobacter spp. were the most common Gram-negative bacterial pathogens, and Staphylococcus aureus was the common Gram-positive bacterial pathogen. In the first group pneumonia was detected in 19 patients (40,43%), in the second group only 5 (8,2%). **Conclusion(s):** The mortality of patients in the first group (23, 48, 94%) and incidence of pneumonia was significantly greater than the mortality of patients in the second group (3, 4, 92%) who did not have pneumonia. Patients who died during hospitalization had greater APACHE II score, developed acute renal failure, heart failure, multiple organ failure and sepsis. We conclude that VAP affects mortality significantly.

A-678

Endogenous carbon monoxide production correlates with severity of acute illness

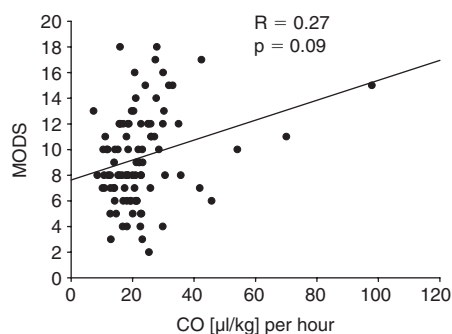
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Background and Goal: The enzyme haeme oxygenase-1 is highly inducible by oxidative agents. Its product carbon monoxide (CO) is thought to exert anti-inflammatory properties¹. We recently showed, that critically ill patients produce higher amounts of CO compared to healthy controls². In this study we compared endogenous CO production with the severity of illness.

Material and Methods: Exhaled CO concentration was measured in 95 mechanically ventilated, critically ill patients (mean age ± SD, 59.5 ± 15.7) on a CO monitor. Measurements were taken every hour for 24 hours in each patient. Data were analysed using Mann-Whitney Rank Sum test. Correlation analysis was performed with the Spearman Rank Order Correlation.

Results and Discussion: CO production correlates significantly with the Multiple Organ Dysfunction Score (MODS). Patients suffering from cardiac disease (median 22.5, 95% CI 10.8 to 45.1 vs median 18.2, 95% CI 10.6 to 35.2, p = 0.008) and critically ill patients undergoing dialysis (median 25.0, 95% CI 16.5 to 41.1 vs median 19.4, 95% CI 10.6 to 43.8, p = 0.004) produced significantly higher amounts of CO compared to critically ill controls. MODS was significantly higher in patients with cardiac disease (p < 0.001) and dialysis patients (p < 0.001) compared to ICU controls.



Conclusion: The findings suggest that endogenous CO production might reflect the severity of acute organ dysfunction. Outcome studies are warranted to investigate whether higher endogenous CO production is a predictor of survival in critical illness.

References:

- Otterbein LE et al.: *Nat. Med.* 2000; 6: 422–428.
- Scharte M et al.: *Biochem. Biophys. Res. Commun.* 2000; 267: 423–426.

A-679

Up-regulation of the glucocorticoid receptor and enhancement of the anti-inflammatory effects of steroids by inhaled nitric oxide in a porcine sepsis model

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Background and Goal of Study: We hypothesized that there may be an interaction between effects of inhalation of nitric oxide (INO) and systemic administration of glucocorticoid (GC), with an enhanced anti-inflammatory effect when administered together.

Materials and Methods: Three-month-old piglets, mean weight 28 kg, were studied during ketamine anesthesia and mechanical ventilation. A sepsis-like condition was created by continuous i.v. infusion of endotoxin (lipopolysaccharide, LPS) for 6 hours (25 µg/kg/hour for 2.5 hours, followed by 5 µg/kg/hour for the remaining 3.5 hours). At the end of the 6-hour period the pigs were killed and lung, liver and kidney tissues were taken for measurements of GR and inflammatory markers and for histological evaluation (LPS group; n = 7). After 2.5 hours of endotoxin infusion, other groups with 7 pigs in each received either an i.v. bolus of hydrocortisone 3.5 mg/kg (Solucortef®, Pharmacia) (steroid group), or inhaled NO 30 ppm (INO group), or both steroid (as above) and INO 30 ppm (INO + steroid group) for the remaining 3.5 hour study period.

Results and Discussions: Endotoxin caused a severe inflammatory response, both in the pulmonary and in the systemic circulation, and markedly reduced glucocorticoid receptor (GR) expression in lung, liver and kidney. This was accompanied by up-regulation of activator protein-1 (AP-1) and the inflammatory markers NF-κB and TNFα. When given separately, GC and INO had modest effect on the inflammatory response. However, INO up-regulated GR expression. Simultaneous administration of INO and GC attenuated the inflammatory response and almost preserved normal histology of both lung and systemic organs.

Conclusion(s): It is likely that the beneficial effect was a consequence of the up-regulation of GR by INO, blunting the release of early inflammatory markers and making steroid therapy more effective.

Acknowledgements: This study was supported by the Swedish Medical Research Council (5315) and the AGA Medical Fund.

A-680

Influence of inhaled nitric oxide and steroids on edema formation in lung and abdomen in an animal sepsis model

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Background and Goal of Study: Inhaled Nitric Oxide inhibits the expression of genes involved in inflammatory diseases. Steroids like Cortisone inhibit some of these factors also. This study was aimed to compare the effects of INO, steroids, and a combination of both in suppressing multiple organ failure by decreasing extravascular fluid leakage, inflammation and edema formation in the lung and abdomen/abdominal organs.

Materials and Methods: Anaesthetized mechanically ventilated piglets were exposed to endotoxin alone, endotoxin combined with INO, endotoxin with INO and steroids, or endotoxin with steroids alone (n = 6 piglets/group). Another six piglets served as a healthy control group. The extravascular leakage of fluids in the lung and abdomen was measured with a double-indicator-isotope technique; intravascular fluid being measured by ^{99m}Tcnetetium marked Red Blood Cells (RBC), extravascular fluid by ¹¹¹Indium labeled transferrin corrected for the RBC pool. Measurements were made of blood gases, hemodynamic parameters, intra-abdominal pressures and the radioactivity of intraabdominal fluid.

Results and Discussions: Infusion of endotoxin caused edema formation in lung and abdomen. Administration of INO decreased the edema in the lung but not in the abdomen. The combination of INO with steroids resulted in a reduction of free fluid accumulation in the abdomen compared with steroids or INO alone. The decrease in edema formation in the lung was similar to INO alone whereas steroids alone did not show any significant effect.

Conclusion(s): We conclude that the combination of INO and steroids decreases the inflammatory response in septic conditions and reduce vascular leakage and edema/ascites formation in the lung as well as in the abdomen. The enhanced effect by INO and steroids together may be attributed to an upregulation of the glucocorticoid receptor by INO, that promotes the steroid effect.

A-681

Is Acinetobacter baumannii “alert organism” for ICU acquired infections?

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Background and Goals: Aim of this study was to measure the incidence of Acinetobacter baumannii colonization and its role as an ‘alert organism’ for ICU acquired infections.

Materials and Methods: A retrospective observational study was conducted from January 2003 to August 2003. 147 patients admitted for more than 48 hours over the study period were deemed eligible. Tracheal aspirate and urine culture were performed at patients’ admission and were checked weekly.

Endotracheal aspirates were already positive for Acinetobacter baumannii at the admission in 11 patients who were excluded from the study. We divided the patients into 2 groups: Nosocomial infections (43 patients) and Non nosocomial infections (93 patients).

Results: 32 of the 43 patients (74.4%) with nosocomial infections had Acinetobacter baumannii at tracheal or other sites. 16 of the 43 patients (37.2%) were infected without previously colonization by Acinetobacter.

In those patients who developed nosocomial infections of any etiology, AB colonizations were diagnosed within 10.93 days (range 2–34 median 8 days) from admission to ICU and Nosocomial infections were developed within 10.37 days (range 1–27 median 8 days) from colonization.

Using SAPS II as a marker of severity of illness there was no difference between patients with nosocomial infection (SAPS II 40.25; range: 13–71) and those without (SAPS II 33.5; range: 10–78) (p < 0.05). Acinetobacter baumannii was the only causal agent of nosocomial infections in 7 of the 43 patient (16%) with a mortality of 43% (3/7 patients).

Conclusion: Acinetobacter baumannii colonization occurred in 25 out of 136 patients (18.38%).

Colonization of Acinetobacter baumannii, a quite early event, can be considered a risk factor to nosocomial infections development (Odds ratio = 13).

References:

- C. Theaker, B. Azadian, N. Soni. The impact of Acinetobacter baumannii in the intensive care unit. *Anaesthesia*, 2003, 58: 271–74.
J. Rello, E. Diaz. Acinetobacter baumannii: a threat for the ICU? *Intensive Care Med*, 2003, 29: 350–51.

A-682

Drotrecogin alfa (activated) in severe sepsis after cardiac surgery

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Background and Goal of Study: We administered drotrecogin alfa (activated) (Dα) to four cardio-surgical patients who had postoperative low cardiac output syndrome and developed severe sepsis.

Materials and Methods: We assess the patients status with the SOFA score 24 h before giving Dα and 72 h after it was finished. Dα was given in a dose of 24 mcg × Kg BW⁻¹ × hour⁻¹ as a continuous i.v. infusion for a total duration of 96 hours. We assumed that it could be deleterious to interrupt the hypocoagulants and we gave during the Dα infusion half of the usual dose of enoxaparine. On patients requiring continuous renal replacement therapy was administered unfractionated heparin during the procedure, but we tried to delay those procedures, as possible, after Dα infusion was finished.

Results and Discussions:

Case No.	SOFA score							Δ total
	Cardiovasc.	Resp.	Coag.	Liver	Renal	Neurol.	Total	
1. CABG	* 3	3	2	0	3	1	12	-2
+AVR	** 3	2	1	0	4	0	10	
2. CABG	* 3	3	0	0	0	2	8	-6
** 0	1	0	0	0	1	2		
3. CABG	* 3	2	1	0	0	0	6	+3
** 4	2	0	0	3	0	9		
4. AVR	* 4	2	0	0	1	0	7	+2
** 4	2	0	2	1	0	9		

*before Dα; **after Dα.

All the patients were surviving at 30 days. Only one patient had a long-term survival (case 2) and was discharged. There were no bleeding problems.

Conclusion(s): Even the small number of cases doesn't permit a statistical study we made some observations. In our cases the main trigger for the severe sepsis syndrome was the cardiac dysfunction. The only one patient with long-term survival was the patient whose cardiac function had clearly improved after D α , had no renal dysfunction and had the most significant improvement of the general status as it was revealed by the SOFA score variation. Another observation is that during administration of D α the anticoagulant therapy could not be strictly prohibited.

A-683

Plasma D-dimer level in pulmonary embolism and in sepsis in postoperative urologic patients

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Background and Goal of Study: D-dimer method is adopted in means of rapid exclusion of venous thromboembolism (VTE). If elevated or increasing values of D-dimer are observed in postoperative period diagnostic dilemma occurs, as coagulation and fibrinolysis are activated in cancer, inflammation and necrosis as well.

Materials and Methods: Cut-off value of $<125 \mu\text{g/l}$ was considered normal range of D-dimer, and $<500 \mu\text{g/l}$ excluded VTE. Pulmonary embolism (PE) was confirmed through routine diagnostic work-up in symptomatic patients. Bacteriuria, haemoculture and white blood cells count where confirmation of infection and sepsis. D-dimer values in group of patients with postoperative PE (Group A) and in group of postoperatively septic patients where VTE was excluded (Group B) were compared and correlated to D-dimer values of patients with preoperative urinary infection (Group C) and control group of ASA 1 patients scheduled for urogenital surgery (group D), without risk for VTE, infection or malignancy.

Results and Discussions: In group A average D-dimer value at the diagnosis was $1335,4 \mu\text{g/l}$ ($685\text{--}2715 \mu\text{g/l}$), with no correlation with severity of symptoms, age, ASA status or operating time and blood loss. Highest level of measured D-dimer was $2700 \mu\text{g/l}$. In group B average D-dimer level at the diagnosis was $1620,5 \mu\text{g/l}$ ($590\text{--}3046 \mu\text{g/l}$), maximum $4271 \mu\text{g/l}$. Range of D-dimer in Group C was average $420,3 \mu\text{g/l}$, and in control group D it was $132 \mu\text{g/l}$.

Conclusion(s): D-dimer can safely exclude VTE at cut-off value of $500 \mu\text{g/l}$. Normal levels could probably exclude infection as well. Although levels of D-dimer above $500 \mu\text{g/l}$ have poor positive value for PE, it can reliably rule in observing the course of illness as its increase can indicate thromboembolic event de novo or infection to sepsis. Elevation over $1500 \mu\text{g/l}$ was in this study correlated with high mortality in postoperative thromboembolic event (20%) and in postoperative septic patient as well (50%).

A-684

Effects of PARP inhibition on membrane proteins of red blood cell and fas-related splenocyte injury in sepsis

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Background and Goal of Study: Oxido-inflammatory effects of PARP has been reported exactly, but effects of PARP on red blood cell and fas-related apoptosis have not yet well-known. In our study we intended to evaluate the effect of 3-aminobenzamide (3-AB) on membrane proteins of red blood cell and Fas-related splenocyte injury in sepsis which was performed by cecal ligation and puncture (CLP).

Material and Method: After the hospital ethic committee's consent, 200–250 mg weigh, male Wistar rats were divided into 3 groups: Control ($n = 6$), CLP ($n = 6$), and CLP + 3-AB (In this group we administered 10 mg/kg 3-AB 20 minutes before CLP procedure.) 48 hours after the CLP procedure rats were sacrificed, blood and tissue samples were taken. Membrane proteins (spectrin, ankyrin, β -band 1–5) of red blood cell were examined with SDS-polyacrylamide gel electrophoresis (SDS-PAGE), and histopathology of spleen was evaluated with hematoxylin-eosin (H&E) dye. Also splenic tissue was studied immunohistochemically with Fas dye.

Results: In ankyrin band of gel electrophoresis, comparison with control group in CLP group there was significant reduction (2.5 ± 0.5 , 6.5 ± 2.5), in CLP + 3-AB group this reduction was limited (4.4 ± 2.0). In CLP group with H&E dye we determined a dense leukocyte infiltration, and with Fas dye an increase in Fas(+) lenfocyte was reported. Between CLP and CLP + 3-AB groups there was no significant difference in increase Fas(+) lenfocyte, but with H&E dye leukocyte infiltration was limited and histiositic activity was higher in CLP + 3-AB.

Discussion: Ankyrin disorder which is limited with PARP inhibition addresses the importance of PARP activation related with reactive nitrogen products on red blood cell. The same mechanism may be role in splenocyte injury and reduction of this with PARP inhibition.

Conclusion: As a result reactive nitrogen products have important role on inflammatory response to membrane proteins of red blood cell and splenocytes in sepsis. We think that administration of PARP inhibitors will be used clinically in the near future.

A-685

Impact of nutritional status on mortality of 34 patients supported by ventricle assist devices (VAD)

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Background and Goal of Study: The implantation of a VAD for end-stage heart failure is a therapeutic approach in adult cardiac surgery. The nutritional status of patients with end-stage heart disease supported by VAD while awaiting cardiac transplantation is not yet well known. The aim of this study was to evaluate nutritional assessment: prior to implantation (D–1), one month after (D30), during transplantation (DTx) and/or death (DD).

Materials and Methods: A retrospective clinical study including 34 ASA IV patients was performed between June 1997 and December 2002. Data: age, sex, weight, height, Body-MassIndex (BMI = $\text{weight [kg]} / \text{height}^2 [\text{m}^2]$), serum albumin level (Alb g/L). Statistical analysis was done with a p value < 0.05 taken as significant*. Data were expressed as median and extremes [], Odds Ratio (OR), 95% confidence interval [95%CI].

Results and Discussion: Age: 40,5 ans [10–63]; 30 men, 4 females. VAD: centrifugal pumps (3), pulsatile pneumatic (18), electrically powered (5), total artificial heart (8). BiVad (23), left (9), right (2). Indications: ischémia (19), dilatated cardiomyopathy (12), myocarditis (2), post-partum (1). Average duration: 67 days [1–261]. Transplantations: 18 (3 patients died). Global mortality: 19 patients.

	D-1	D30	DTx	DD	Total
n	34	24	15	19	34
BMI	21.4 [12.4–33.8]	19 [14.7–30.4]	20 [13.7–28.1]	17,6 [9.3–26.5]	19,4 [9.3–28.1]
ALB	25.3 [14.2–39.9]	26.6 [19.4–36.3]	30.1* [26–37.5]	20.3* [15–30.7]	24.6 [15–37.5]

No significant correlations were observed between BMI of the differents groups of patients objectively "thin" (BMI < 20). Multivariable logistic regression demonstrated that low albumin level ($< 21 \text{ g/L}$) and albumin level $> 33 \text{ g/L}$ were respectively independently associated with increased mortality ($p = 0,004$; OR = 0,541; [95% CI 0,36–0,82]) and with transplantation ($p = 0,003$; OR = 1,38; [95% CI 1,12 – 1,71]).

Conclusion: Malnutrition appeared to be a risk factor. Nutrition intervention is important before and after implantation of VAD.

A-686

Propofol and propofol-fentanyl sedation shortened duodenal feeding patterns

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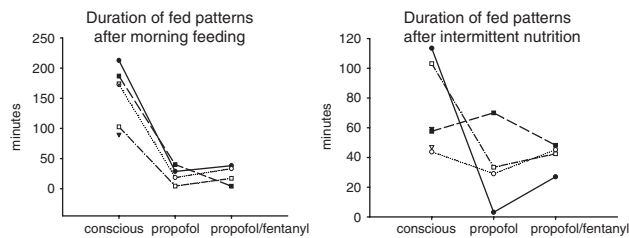
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Background and Aim of the Study: A previous investigation has shown evidence of shortened gastric feeding patterns during propofol and propofol-fentanyl sedation in pigs [1]. The present study was performed to investigate the effects of propofol and fentanyl on the postprandial duodenal motility.

Materials and Methods: Six pigs (32–40 kg) were instrumented with a central venous catheter (CVC), a percutaneous entero-gastrostomy (PEG), and a catheter for intraluminal impedanceometry (IMP) which was introduced via a PEG into the antrum and duodenum by endoscopy. Over three days, gastro-duodenal motility was measured for 8 hours after morning feeding and during gastric nutrition via the PEG in the conscious, propofol and propofol-fentanyl sedated states.

Results: After both morning feeding and gastric nutrition via PEG, duodenal feeding patterns were shortened during propofol and propofol-fentanyl sedation ($p < 0.05$). The shortened feeding patterns were associated by a partially decreased frequency of gastric motility activities. After sedation necropsies

demonstrated total gastric retention of food being fed in the morning. The figures show the individual duration of feeding patterns during conscious and sedated states.



Conclusion: Both propofol and propofol-fentanyl sedation shortened duodenal feeding patterns associated with a partially decrease of gastric motility activity. Our results suggest that shortened feeding patterns were associated with a delay of gastric emptying during sedation.

Reference:

- 1 Schnoor J, Unger JK, Kuepper T, et al. Eur J Anaesth 2003; 20: 155.

A-687

HLA-DR monocyte – expression in surgical cancer patients after vaccination

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Background: The immune functions of cancer patients are thought to be impaired. In particular, an altered function of monocytes in patients with head and neck carcinoma was found, which was associated with an increased postoperative infection rate indicating immediate postoperative immune suppression before the onset of infections. Vaccination can shift immunity versus HLA-DR mediated response.

The aim of the study was to determine the HLA-DR monocyte expression after vaccination in patients with a tumor of the upper gastrointestinal tract before surgery.

Material and Methods: In this ethically approved study, 21 patients with aerodigestive tract cancer were included. Patients were randomized to one of the following groups: The vaccine-group (n = 11) and the placebo-group (n = 10). Patients of the vaccine-group were vaccinated with hemagglutinine antigens of influenza virus (MUTAGRIP®, MSD) two times (day 1 and day 3). Blood samples to assess the immune response to vaccination were taken at baseline (day 1) until day 5. Expression of HLA-DR on monocytes was analyzed by flow cytometry. Statistical analysis: ANOVA.

Results: Basic patient characteristics did not differ between groups. In the vaccine-group a significant increase of HLA-DR monocyte expression ($p < 0.02$) occurred compared to the placebo-group. No serious adverse events were observed.

Conclusions: Patients undergoing surgery for upper gastrointestinal tract cancer might profit from an adjacent preoperative vaccination with respect to an increase in HLA-DR monocytes expression. This might be considered as a recovery of the patient's immunological defense and might be favorable to reduce postoperative infection rate.

A-688

Are the idric and sodium balance accurate in critically ill patients?

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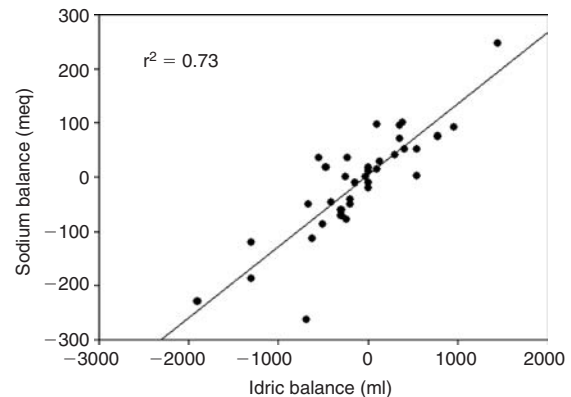
Background and Goal of Study: The critically ill patients are characterized by rapid fluid movements between intravascular, extravascular compartments. The idric and sodium balance can add useful informations for the daily clinical management. The idric and sodium balance are usually calculated by taking into account all the input (crystalloids, colloids, diet, drugs ...), output (urine, perspiration, drainage, ...) with the relative sodium concentration for each of these elements.

Materials and Methods: In this study we study the accuracy of idric and sodium balance calculation compared to the body weight variations

measured at the same time point. The body weight was measured using a dedicated bed balance (Hill-Rom), while in idric balance the perspiration was assumed to be 10 ml/Kg/every day.

5 critically ill patients (57 ± 21 years, BMI 26.4 ± 3.0 Kg/m², 3 pneumonia, 1 sepsis, 1 heat stroke) were studied until ICU discharged or death for a total of 35 measurements.

Results and Discussions: In figure is shown the linear regression between idric and sodium balance.



We did not find any correlation between idric balance and body weight ($r^2 = 0.23$, $P < 0.05$) and sodium balance and body weight ($r^2 = 0.19$, $P < 0.05$).

Conclusion(s): The idric and sodium balance are highly correlated and may give useful clinical information however they are inaccuracy regarding the body weight variations, probably due to the difficult to estimate the "real" output (perspiration, gastrointestinal losses).

A-690

A retrospective observational study of the prevalence of low serum zinc levels in critically ill patients

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Background and Goal of Study: Zinc (Zn) is essential for the body to function normally. Deficiency can result in impairment of cell mediated immunity and wound healing¹. In critical illness, Zn losses and utilization are increased. Low serum Zn levels are a common finding in critically ill patients. This study aims to determine the prevalence of low serum Zn levels in patients who have a prolonged stay in the Intensive Care Unit (ICU), to review their method of feeding and to establish whether additional Zn supplementation may be appropriate.

Materials and Methods: Retrospective data analysis of serum Zn levels in all patients admitted to the ICU over a 34 month period with admission lasting 7 or more days. Data was compiled from case note review and computerised biochemistry results. Exclusions: readmission to the ICU, transfer from cardiac or another ICU, unavailability of case notes.

Results and Discussions: 95 patients in study; age range 17–82 (median 61); 61 males, 34 females (ratio 1.8:1); ICU stay range 7.1–33.4 days (median 11.8)

	Lowest Zn	Highest Zn	Mean Zn
All patients	5.5(1.0–13.2)	9.7(4.4–30.2)	7.6(3.5–20.6)
NG Zn suppl.	5.8(1.9–9.8)	9.9(6.2–20.4)	8.0(4.7–11.8)
TPN alone	4.8(1.0–13.2)	9.9(4.4–30.2)	7.3(3.5–20.6)
NG feed alone	5.7(1.9–9.8)	9.6(4.5–30.0)	7.8(4.5–13.5)

Zn levels in (micromol/L); normal Zn ref. range 12–18 micromol/L; data – median(range); NG = nasogastric; TPN = total parenteral nutrition.

Conclusion(s): This study demonstrates that almost all patients who have a prolonged stay in our ICU have low serum Zn levels despite standard feeding regimes. Patients who receive NG Zn supplements in addition to Zn contained in their feed (NG or TPN) have higher serum Zn levels. This study also identifies patient subgroups most at risk of low serum Zn levels, perhaps requiring additional monitoring and intervention.

Reference:

- 1 Shankar A, Prasad A. Zinc and immune function: the biological basis of altered resistance to infection *Am J Clin Nutr* 1998; 68: 447S–463S.

A-691

Continuous method of enteral feeding was better tolerated in SICU patients than bolus method

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Background and Goals: Numerous studies indicate that enteral nutrition is superior to that of parenteral (1). The frequency of enteral nutrition-related gastrointestinal complications in critically ill patients is high (2). Enteral nutrition (Gavage) has complications such as diarrhea, nausea, vomiting and gavage intolerance (the residual volume of that which is aspirated from stomach is greater than 50% of the volume that is infused), which may cause fluid and electrolyte imbalance. The goal of this study was comparison of the above complications between bolus, intermittent and continuous methods of gavage in surgical intensive care unit (SICU) patients.

Materials and Methods: After approval of the proposal by the Ethics committee and obtaining the informed consent, this clinical trial study was done on 63 SICU patients. Patients divided in three groups randomly. The methods of gavage that used in three groups were bolus, intermittent and continuous respectively. Data collection was done with a checklist about gavage method and the complication data. Statistical analysis was performed with ANOVA and determination of Pearson correlation coefficient.

Results: The study showed that the incidence of diarrhea, nausea, and vomiting didn't have any significant difference in three groups. Data about gavage tolerance are shown in table:

Method of gavage	Times of gavage tolerance		
	Minimum	Maximum	Mean \pm SD
Bolus	8	15	13.71 \pm 2.19
Intermittent	11	15	13.95 \pm 1.35
Continuous	13	15	14.85 \pm 0.47*

* P < 0.05 vs bolus method.

Conclusions: This study showed that continuous method of gavage in SICU patients is better tolerated than bolus method.

References:

- Zaloga GP, MacGregor DA. *J Crit Illness* 1990; 5: 1180–1200.
- Juan C, Montejó MD. *Crit Care Med* 1999; 27: 1447–1453.

A-692

Acute heart failure in ICU patients. Levosimendan compared to dobutamine as drugs of choice

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Background and Goals: Our goal was to study the haemodynamic efficacy of levosimendan compared to dobutamine in patients with acute heart failure.

Material and Methods: In a randomized, double-blind trial, we studied 108 patients with acute heart failure. Group A (n = 54) received levosimendan in a single 24 hour infusion and group B (n = 54) dobutamine in continuous, open-label infusion of 7 mcg/kg/min. Cardiac output, systemic and pulmonary vascular resistance, as well as PAWP and SjO₂, were measured with a Swan-Ganz catheter.

Results: Levosimendan produced significantly greater haemodynamic stability and reduced 31 days' mortality compared to dobutamine (p < 0.001). It increased the number of days alive and had a lower incidence of myocardial ischaemia and arrhythmias compared to dobutamine. Its only disadvantage is the high cost of treatment.

Conclusions: We conclude that levosimendan is a useful new agent for the treatment of acute heart failure.

Reference:

- Mebazaa A, Erhart L: levosimendan a new dual-action drug in the treatment of acute heart failure: *Int J Clin Pract*. 2003 Jun; 57(5): 410–6.

A-693

Evolution of NO_x concentrations in tissues and plasma after cardiopulmonary bypass and lipopolysaccharide administration in pigs

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Background and Goal of Study: Cardiopulmonary bypass (CPB) induces a systemic inflammatory response while nitric oxide (NO) generation has been

demonstrated during cardiac surgery (1). Measurement of nitrite (NO₂⁻) and nitrate (NO₃⁻) are important in clinical chemistry as markers of NO synthase activity and NO radical production (2).

We have compared both stable NO metabolites concentrations in lung tissue, diaphragm, intercostal muscle and plasma of pigs subjected to CPB and endotoxin (LPS) administration.

Material and Methods: Fifteen pigs weighing 30 to 40 kg were randomized in 3 groups. First group (n = 5) were subjected to a sternotomy, the second group (n = 5) was subjected to a 90 minutes hypothermic non pulsatile CPB with a 75 min aortic clamping, the third group (n = 5) was subjected to CPB and post-CPB LPS infusion (1 µg/kg). After 24 h of ventilation, all animals were sacrificed. Diaphragm, intercostal muscle and lung samples were harvested. Nitrates and nitrites in samples were reduced to NO with vanadium (III) chloride. NO concentration was detected in samples by chemiluminescence. Dataq data acquisition system was used to collect and report the data.

Results:

NO _x	Lung (pmol/mg)	Diaphragm (pmol/mg)	Plasma (µmol/L)
Sham	5,6 \pm 0,8	9,8 \pm 0,9	12,4 \pm 5,8
CPB	5,2 \pm 2,9	10,4 \pm 1,1	
CPB + LPS	5,9 \pm 1,0	10,3 \pm 1,1	19,6 \pm 1,5*

Mean \pm SD. Kruskal-Wallis test and Mann-Whitney test were used when appropriated.

*P < 0,05 versus Sham.

Discussion and Conclusion: Our results suggest that NO production evaluated by stable NO metabolites concentrations is only increased in plasma and not affected in lung tissue, diaphragm and intercostal muscle 24 hours after CPB and CPB plus LPS. Our results must be interpreted with cautious as other factors can alter nitrate concentration in tissue or plasma.

References:

- Hall R et al. *Anesth Analg* 1997; 85: 766–82.
- Moshage H et al. *Clinical Chemistry* 1995; 41: 892–6.

A-694

Effect of perioperative administration inhaled nitric oxide on NO_x tissues concentrations after cardiopulmonary bypass and lipopolysaccharide administration in pigs

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Background and Goal of the Study: Nitric Oxide (NO) is a free radical that reacts rapidly with several molecules and is rapidly transformed to nitrite (NO₂⁻) and nitrate (NO₃⁻), which may be used to monitor NO production (1). NO_x has been implicated in several pathophysiological processes and nitrate concentration change in tissues and organs is increased by the inflammatory response (2). We have evaluated the impact of perioperative (24 h) administration of inhaled NO (INO) on tissue and plasma NO_x concentration in a cardiopulmonary bypass (CPB) pig model.

Materials and Methods: Thirty pigs were randomized into 6 groups. The first group was subjected to a sternotomy; the second group was subjected to a 90 minutes hypothermic non pulsatile CPB with a 75 min aortic clamping; the third group was subjected to a CPB and post-CPB LPS infusion (1 µg/kg). The three other groups were submitted respectively to the same procedure with INO (20 ppm). After 24 h of ventilation, all animals were sacrificed. Diaphragm, intercostal muscle and lung samples were harvested. Nitrates and nitrites in samples were reduced to NO with vanadium (III) chloride. NO concentration was detected in samples by chemiluminescence.

Results and Discussion:

Sample	Lung		Plasma	
	0	20 ppm	0	20 ppm
INO dose				
NO _x	(pmol/mg)		(µmol/L)	
Sham	5,6 \pm 0,8	7,4 \pm 1,4	12,4 \pm 5,8	102,5 \pm 48,0*
CPB	5,2 \pm 2,9	9,0 \pm 0,8		
CPB + LPS	5,9 \pm 1,0	8,6 \pm 0,6*	19,6 \pm 1,4	75,3,8 \pm 18,5*

Mean \pm SD. Kruskal-Wallis test and Mann-Whitney test were used when appropriated.

*P < 0,05 versus 0 ppm.

After 24 hours, NO_x were higher in tissues and plasma of pigs submitted to Sham, CPB and CPB + LPS with INO.

Conclusion: It is difficult to evaluate the significance of increased NO_x in tissue and plasma following the use of INO. These data have to be correlated with the clinical status of the animal as NO can have either beneficial or detrimental effect.

References:

- Moshage H et al. *Clinical Chemistry* 1995; 41: 892–896.
- Yang F et al. *Crit Care Med* 2002; 30: 650–657.

A-695**Acute renal failure requiring renal replacement therapy in cardiac surgery**

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Background and Goal of Study: Acute renal failure (ARF) after cardiac surgery is a cause of major morbidity and mortality (1). Only some patients with ARF require renal replacement therapy (RRT). Our objectives are: 1) to assess the incidence and outcome of ARF after surgery with cardiopulmonary bypass (CPB) and 2) to identify the predictors factors for ARF requiring RRT (ARF-RRT).

Methods: Demographic and perioperative data in 544 consecutive patients undergoing cardiac surgery with CPB from January 1, 2002 to December 28, 2002 were recorded and entered into a computerized database. ARF was defined as a rise in serum creatinine above 120 $\mu\text{mol/l}$ or a twofold rise of baseline value. RRT was indicated on clinical and biological grounds. Data were analyzed using Student's *t*-test, Chi-squared test and linear regression analysis, where appropriate.

Results: 65 patients (11.9%) had ARF; 21 of these (3.7% overall) developed ARF-RRT. In-hospital mortality in patients with ARF was 20% vs. 3.8% in those who did not develop ARF ($p < 0.001$); in patients with ARF-RRT was 52.4% vs. 4.5% in those who did not required RRT ($p < 0.001$). In patients with ARF-RRT who became anuric, in-hospital mortality was 77% vs. 12.5% in those with conserved diuresis ($p < 0.001$). In ARF patients the predictors of ARF-RRT included the following: post CPB inflammatory syndrome ($p < 0.01$), association between post CPB inflammatory syndrome and low cardiac output (CO) ($p < 0.01$), association between post CPB inflammatory syndrome and high doses of vasoconstrictors ($p < 0.01$). The association between low CO and high doses of vasoconstrictors is not a predictor of ARF-RRT. Anuria in patients with ARF-RRT correlated with age ($p < 0.05$), preoperative NYHA class status above III ($p < 0.05$), low CO after CPB ($p < 0.05$), and association between low CO and high doses of vasoconstrictors ($p < 0.05$).

Conclusions: ARF is a frequent complication after cardiac surgery with a high in-hospital mortality. In patients with ARF, post CPB inflammatory syndrome alone or in association with low CO after CPB or high doses of vasoconstrictors are correlated with ARF-RRT. There is a significant association between anuria and age, preoperative NYHA class status and low CO after CPB.

Reference:

1 Mangano CM.: *Ann Intern Med* 128: 194–203, 1998.

A-696**Diagnosis and subsequent management of an anterior papillary muscle rupture**

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Background: We present the clinical findings of an anterior mitral valve leaflet rupture, post myocardial infarction and subsequent perioperative management.

Clinical Presentation: A fifty-two year old lady presented to a peripheral hospital with history of severe intrascapular pain radiating anteriorly and sudden onset shortness of breath. Clinical examination revealed acute pulmonary oedema consistent with the patient being in severe cardiogenic shock post myocardial infarction. A computerised tomography scan of thorax excluded aortic dissection. Transthoracic echocardiography detected no regional wall abnormalities. Upon admission to intensive care the patient developed a ventricular tachycardia, which responded to amiodarone. Repeat transthoracic echocardiography revealed a rupture of the anterior mitral valve leaflet. A decision was made to transfer to St. James's Hospital for definitive surgical management (1).

Perioperative Management: On arrival to St. James's hospital, the patient was in multiorgan failure and required high dose inotropic support and renal replacement therapy. She was transferred to theatre for immediate mitral valve replacement. Intraoperative findings included a ruptured papillary muscle connecting to the anterior leaflet of the mitral valve. Post-operatively the patient remained in multiorgan failure requiring nitric oxide for severe refractory hypoxaemia in addition to intra aortic balloon pump counter pulsation, high inotropic support, and continuous renal replacement therapy. Over the next twenty four hours she made a significant improvement. Patient was then warfarinised and subsequently developed an iatrogenic haemothorax,

which required a thoracotomy and pleural decortication. Thereafter the patient had a prolonged but full recovery and was discharged home six weeks after initial presentation.

Conclusion: Central issues in this case is the early diagnosis of anterior mitral valve leaflet rupture with echocardiography and definitive surgical management even in apparently moribund patients (2).

References:

- 1 McQuillan B. *Rev in Cardiovasc Med* 2001; (1): 57–60.
- 2 Tavakoli R. *J Heart Valve Disease* 2002; (1): 20–5.

A-697**Prediction of mortality and prolonged intensive care unit stay after off-pump coronary artery bypass grafting**

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Background and Goal of Study: Prolonged intensive care unit (ICU) stay contributes to increased cost and resource utilization in cardiac surgery^{1,2}. The aim of this study was to evaluate prediction of outcome, i.e. 30-day mortality, and postoperative duration of ICU stay in patients undergoing off-pump coronary artery bypass grafting (OPCABG) using the European System of Cardiac Operative Risk Evaluation (EuroSCORE)³.

Material and Methods: From Jan 1st, 2001 to Dec 31st, 2002 398 patients underwent OPCABG in our institution (78% of all isolated CABG procedures performed during this period). Patients were scored using the simple additive EuroSCORE. 30-day mortality and duration of ICU stay were recorded. The discriminative power of the score was assessed by calculating the area under the receiver operating characteristic (ROC) curve. Additionally, Pearson correlation for EuroSCORE and ICU stay was calculated. $P < 0.05$ was considered to be statistically significant.

Results: EuroSCORE was 4.6 ± 3.6 for these patients (age = 64.3 ± 9.7 years, female/male ratio = 89/309, ejection fraction = $58.1 \pm 15.3\%$). The preoperative risk profile was equally distributed (low risk [EuroSCORE 0–2] = 30.4%, medium risk [EuroSCORE 3–5] = 33.4% and high risk group [EuroSCORE >5] = 36.2%). Predicted 30-day mortality was 5.3%, observed 30-day mortality was 1.5% (6 death during follow-up period). ROC area for EuroSCORE to predict mortality was 66% ($p = 0.17$; i.e. no significant difference from 0-hypothesis: true ROC area = 50%). Duration of ICU stay was 1.7 ± 1.4 d. ICU stay and EuroSCORE correlated positively (Pearson correlation coefficient [r] = 0.44, $p < 0.001$). ROC area to predict ICU stay >1 d was 66.3% ($p < 0.001$). For ICU stay >2 d ROC area was 74.8% ($p < 0.001$), for >3 d, >4 d and >5 d 80.2%, 90.4%, and 91.7% ($p < 0.001$).

Conclusion: The power of EuroSCORE to predict mortality in this sample of patients undergoing OPCABG was weak. By contrast, discriminative power to predict postoperative ICU stay was good. Use of the score might allow for more efficient resource allocation and thus for cost reduction.

References:

- 1 *Eur J Cardiothorac Surg* 2003; 23: 595–8.
- 2 *Can J Cardiol* 1994; 10: 721–7.
- 3 *Eur J Cardiothorac Surg* 1999; 9–13.

A-698**Effects of lignocaine on priming of neutrophils by plasma factors produced during coronary artery bypass graft surgery**

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Background and Goal of Study: Platelet activating factor (PAF) has a central role in neutrophil (PMN) activation (1), contributing to the reperfusion injury after coronary artery bypass graft (CABG) surgery. Lignocaine has been shown to attenuate neutrophil priming by PAF (2). In this study, we investigated effects of lignocaine on plasma priming.

Materials and Methods: Radial arterial blood was collected from 6 patients undergoing CABG surgery at 6 time points. Plasma was separated (called 'CABG plasma') and stored. Plasma PAF concentrations were measured. PMN were isolated from healthy volunteers. PMN respiratory burst, CD 11b and CD18 expression were studied after priming with the CABG plasma with and without pre-treating with different concentrations of lignocaine and BN52021. Data were analyzed with two way RM ANOVA and post hoc Bonferroni tests.

Results and Discussions: Priming of PMN with the CABG plasma increased neutrophil respiratory burst, CD11b and CD18 expression.

Lignocaine decreased the neutrophil respiratory burst (NRB), CD11b and CD18 expression (Table 1).

Table 1.

N = 6	NRB	CD11b	CD18
CABG plasma	659 ± 176	630 ± 266	782 ± 320
Lignocaine 5 µg ml ⁻¹	660 ± 180	589 ± 256	739 ± 309
Lignocaine 10 µg ml ⁻¹	527 ± 148*	492 ± 227*	586 ± 238*
Lignocaine 100 µg ml ⁻¹	211 ± 49†	316 ± 135†	337 ± 132†
BN 52021 1 × 10 ⁻⁹ M	60 ± 17†	61 ± 27†	74 ± 30†

* = p < 0.05; † = p < 0.01. Values are expressed as mean ± SD.

Conclusion(s): Lignocaine may be useful clinically by modifying ischemia-reperfusion induced inflammation during CABG surgery.

References:

- 1 Ingraham L et al. *Blood* 1982; 59: 1259–1266.
- 2 Hollmann MW et al. *Anesthesiology* 2001; 95: 113–22.

A-699

The role of S100β protein measurement in early determination of neurological neurocognitive functions in cardiac surgery

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Background and Goal: The aim of this study to determine the significance of S100β protein in explanation the neurological damages at early stage in the cardiac surgery.

Materials and Method: The study was performed on 22 cases undergoing cardiopulmonary bypass (CPB). Neurological examination and Mini Mental State Examination (MMSE) were applied to all patients preoperatively, on the first and the third days of the postoperative period. The patients premedicated 5 mg diazepam IM and induction of anaesthesia was performed with 2 mg/kg propofol, 0.1 mg/kg vecuronium, 2 µg/kg fentanyl. O₂/air (60/40%) and 0.5–1% isoflurane were used in maintenance of anaesthesia. 1–2 µg/kg fentanyl, 0.02–0.03 mg/kg vecuronium and 0.02–0.03 mg/kg midazolam were given at intervals. The patients were operated in moderate hypothermia (28–32°C). During the operation mean arterial pressure, pulse and esophageal temperature were recorded. S100β levels were measured by taking blood samples at the beginning of operation, after CPB, postoperative 5th hours and 24th hours.

Results and Discussion: Serum S100β levels of the patients increased significantly after CPB. Although S100β levels decreased of 5th hours after operation, the levels of S100β were found higher than preCPB levels. S100β proteins level increased in all patients whom minimal cognitive dysfunction were observed with MMSE at first postoperative day. Also in cases with minimal cognitive deficit in MMSE at the third days, S100β levels were found high.

Conclusion: S100β protein increases with many factors; duration of CPB, cross clamp time and advanced age affecting neurological outcome and S100β is a valuable marker that may be used in early diagnosis of cerebral damaging.

References:

- 1 Jonsson H, Johnsson P, Alling C et al. *Ann Thorac Surg* 65(6): 1639–44, 1998.
- 2 Westaby S, Johnsson P, Parry A et al. *Ann Thorac Surg* 61: 88–92, 1996.

A-700

Inflammatory response reduction following the use of dextran 70 in cardiac operations

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Background and Goal of Study: Cardiac surgery on CPB results in a complex immune reaction that plays a crucial role in the development of complications after cardiac surgery. In this prospective randomised study our objective was the investigation of the effect of dextran 70 on the serum levels of certain inflammatory mediators.

Materials and Methods: 42 patients (28 males, 14 females) undergoing either coronary artery bypass grafting on CPB (n = 32) or aortic valve replacement (n = 10) have been enrolled in the study. Two groups were set up after randomisation. In *Group A* dextran-70 infusion was given (0,45 g/kg before the initiation of CPB, 0,75 g/kg for 14 hours following the cessation of CPB. In *Group B* (control gr.) the same dose of gelatin was given. Aortic

cross clamp time was 56 ± 22.4 min. and 58 ± 17.8 min. in gr. A and B respectively. Arterial blood samples were taken at the following times: before the induction of anaesthesia; and 10 minutes, 2 hours, 4 hours, 24 hours, 44 hours after the cessation of CPB. In compliance with the kinetics of the particular inflammatory mediators 3 samples of each mediator were tested by ELISA method.

Results and Discussions: Concerning the inflammatory mediators, the kinetics of IL-8, IL-10, sELAM-1 and sICAM1 has shown a significant difference in the two groups. The level of these four mediators has consequently proved lower in the dextran group than in the control group, however concerning IL-6 and sVCAM levels there has been no significant difference between the two groups.

Conclusion: Our results have justified the anti-inflammatory effect of dextran-70 during cardiac surgery on CPB.

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A-701

Levosimendan in management of critical patients with heart failure

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Background and Goal of Study: Levosimendan (LEV), a novel calcium sensitizer, improves myocardial contractility without increasing myocardial oxygen demand, is an option for critical patients with heart failure.

Materials and Methods: We present 2 case reports of patients admitted to the ICU with severe heart failure successfully treated by LEVO with a fast discharge.

Results and Discussion: A 57-year-old female patient (history of 3 vessel disease, extent acute myocardial infraction, refused coronary artery bypass grafting surgery and cardiac transplantation) was admitted with: chest pain, cardiogenic shock, respiratory failure, acute renal failure, elevated cardiac enzymes, left ventricular ejection fraction <30%. Was submitted to invasive ventilation, and treated with furosemide, nitrates, fentanyl, nandroparine, aspirin, dobutamine (DB) and norepinephrine (NE) with very difficulty to maintain hemodynamic stability. After 24 h she received a loading dose of LEV 12 µg/kg over 10 min followed by 0,1 µg/kg/min over 24 h. 48 h later DB and NE were suspended, the weaning of ventilation was easy, and the renal function recovered. 72 h after she was discharged from UCI with hemodynamic stability and 7 days later from the hospital with a class II NYHA.

A 78-year-old male patient submitted to resection of a right hepatic tumor. In the 5th day after the surgery he presented a ventricular tachycardia with hemodynamic instability, elevated cardiac enzymes, and an impaired ventricular function (left ventricular ejection fraction: 17%). Was treated with aspirin, clopidogrel and DB during 4 days. In the 10th day he had presented respiratory failure caused by pulmonary infection that demanded intubation and invasive ventilation. The hemodynamic instability was difficult to manage (cardiac index 1,4 L/min/m²). Treatment with LEV was started: loading dose of 24 µg/kg over 15 min, followed by a continuous infusion of 0,1 µg/kg/min during 24 h. NA was started to maintain blood pressure. 24 h later the cardiac index was 2,6 L/min/m²; NE infusion was gradually reduced and he was extubated 36 h after administration of LEV. He was discharged from ICU 2 days later.

Conclusion(s): Management of critical patients with heart failure represent a challenge. In our patients levosimendan had improved cardiac function and helped a fast weaning from invasive ventilation.

A-702

Influence of different anesthetic regimens on the neuro-endocrine immune axis in alcoholic patients with upper gastrointestinal surgery

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Background: Different anesthetic regimens, i.e. total-intravenous anaesthesia and inhalational anaesthesia, have different impact on perioperative immune modulating parameters. Chronic alcoholic patients may profit from strategies to improve perioperative immune suppression to reduce postoperative infections. An increase of interleukine 10 during surgery is known to increase the postoperative infection rate. The aim of this study was to investigate IL10 in the perioperative context in chronic alcoholics with respect to the anesthetic regimen used for upper gastrointestinal cancer surgery.

Materials and Methods: 30 chronic alcoholic patients, undergoing surgery for tumor of the upper gastrointestinal tract were randomly allocated to two groups: *total-intravenous group* (n = 14) [6–12 mg/kg/h propofol, fentanyl] and *inhalational group* (n = 16) [1 Vol% endtidal isoflurane, fentanyl]. Ventilation was controlled (F_IO₂: 0.3, PaCO₂: 35–45 mmHg). Interleukine 6, and 10 as well as cortisol plasma levels were obtained before induction, 20 min after surgical incision, after tumor biopsy, after the end of surgery and on the first postoperative day.

Results: Basic patient characteristics did not differ between groups. Significant lower IL-10 plasma levels were found in patients with total-intravenous anesthesia after induction of anesthesia until the first postoperative day [5 pg/ml (2–25) versus 74 pg/ml (4–139) in the inhalational group, p < 0.01]. No differences were found between groups with respect to the postoperative infection rate.

Conclusions: Both anesthetic regimen might be used safely for surgery of the upper gastrointestinal tract, especially in chronic alcoholic patients. In addition, total-intravenous anesthesia might be favorable for chronic alcoholic patients due to decreased IL-10 plasma levels during and after surgery in chronic alcoholics with respect to an altered immune response in these patients. However, infection rate was not significant.

A-703

Dexmedetomidine for sedation in mechanically ventilated morbidly obese: a comparison with midazolam, remifentanyl and propofol – preliminary report

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Background and Goal of Study: After major abdominal surgery morbidly obese patients are often in danger or occurrence Critical Respiratory Event. Major abdominal surgery, morbid obesity, and postoperative pain management with opioids increase significantly the probability of CRE. From our experience CRE is especially met in male patients with BMI over 50 kg/m². Therefore they require mechanical ventilation and sedation in PACU for about 24 h.

Materials and Methods: After obtaining the local ethics committee approval 17 morbidly obese patients after Roux-en-Y-Gastric Bypass were randomised into 4 subgroups: continuous infusion of morphine 2–3 mg/h with 0.03–0.2 mg/kg/h midazolam (M) or 0.3–4 mg/kg/h propofol (P) or 0.2–0.7 mcg/kg/h dexmedetomidine (D). Remifentanyl (R) 0.02–0.25 mcg/kg/min was administrated alone. Doses were counted on corrected body weight = Ideal Body Weight + 0.4 × (actual weight – IBW). Infusion rate was changed basing on BIS monitoring, limits for sedation: 60–80. If patient was irritated additional dose of 10 mg midazolam in bolus was administrated. All patients were extubated within 24 hours after operation. Mean BMI was 55.26 kg/m², 57.45 kg/m², 55 kg/m², 55.1 kg/m² (range 50–74 kg/m²), in midazolam (5 pts), propofol (4 pts), dexmedetomidine (4 pts) and remifentanyl (4 pts) group respectively.

Results and Discussions: Mean rates of infusions were: 10 mg/h of midazolam, 30 ml/h of 1% propofol, dexmedetomidine, 20 ml/h of remifentanyl 50 mcg/ml. Additional required doses of midazolam: 50 mg, 30 mg, 10 mg and 0 in groups M, P, D and R respectively. Safe extubation was possible within 30 minutes in R group, 1–2 hours in P and D groups and 2 up to 3 hours in midazolam group after discontinuation of sedatives infusion. No complications were observed. The cost of sedation with propofol, dexmedetomidine and remifentanyl were comparable, and with midazolam was less expensive.

Conclusion(s): The less effective was sedation with infusion of morphine with midazolam. Sedation with morphine with propofol or dexmedetomidine were satisfactory. The most effective was sedation with remifentanyl. Further investigation is continued.

A-704

Reducing of the mechanical ventilation period in liver transplantation by a change in anaesthetic practice and the use of remifentanyl

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Background and Goal of Study: This study examined the use of Remifentanyl in liver transplantation in order to determine its influence in post-operative mechanical ventilation, ICU stay and cost of transplantation.

Materials and Methods: 56 consecutive patients undergoing Liver Transplantations were included initially, and randomized into two groups. Group I (26 patients) received anesthesia with Propofol, Remifentanyl and Sevoflurane.

Group II (30 patients) with Thiopental, Sevoflurane, Midazolam and Fentanyl. The neuromuscular blocking agent was Cisatracurium. Surgical technique was always Piggy-Back. According with pre-establish criteria, 5 Group I patients and 9 Group II were excluded. Sedation in postoperative period was obtained with Remifentanyl in both groups. Hours of mechanical ventilation, days of stay in ICU and costs were evaluated. U of Mann-Whitney was used for analysis of the data, considering p < 0.05 statistically significant.

Results and Discussions: Demographic details were similar in both groups. Age 53,6 (I) and 57,2 (II); sex (15 male and 6 female), Child-Pugh (mainly C), and diagnoses. Hours of mechanical ventilation (6,03 vs. 10,16) days in ICU (3,62 vs. 5,48) and costs (4301,9 vs. 6506,3 euros) are reduced in Group I. The difference is statistically significant for mechanical ventilation.

Conclusion(s): Remifentanyl seems to be appropriate to Liver Transplantation¹, the anesthesia is very predictable and does not alter hemodynamics significantly. Doses requirements are less than for general population². Mechanical ventilation, ICU stays and costs are reduced.

References:

- 1 Navapurkar VU, Archer S, Gupta SK et al. *Br J Anaesth* 1998; 81: 881–886.
- 2 Park GR, Evamns TN, Hutchins J et al. *Eur J Anaesthesiol* 2000; 17: 111–119.

A-705

Remifentanyl/propofol versus fentanyl/midazolam for ICU sedation

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Background: Surgery of supratentorial brain tumors is a routine neurosurgical procedure but may be followed by typical complications, e.g. bleeding or neurological deterioration. Accordingly, rapid post-operative awakening and neurological examination is desirable. In this retrospective study we compared 2 different techniques for ICU analgesia and sedation that were used during two consecutive time periods, i.e. fentanyl–midazolam vs. remifentanyl–propofol.

Methods: Intraoperatively, patients received continuous infusions of either fentanyl (0.2–1.0 mg/h) and midazolam (2–10 mg/h) with isoflurane (below 1 MAC) being added according to clinical needs, or in the subsequent group, remifentanyl (0.2–0.5 µg/kg/min) and propofol (3–6 mg/kg/h). After arrival on the ICU fentanyl (0.03–0.2 mg/h) and midazolam (2–12 mg/h) or remifentanyl (0.1–0.2 µg/kg/min) and propofol (0.5–3 mg/kg/h) were infused to reach a Ramsay Score of 3–4.

Results: Sixty patients (n = 30 each) undergoing supratentorial brain tumor surgery were enrolled. The groups were similar for age, weight, ASA status and duration of drug administration. Extubation times and the duration of ICU treatment were significantly shorter after remifentanyl–propofol. As a result of prolonged unconsciousness and the impossibility of neurological examination, a CT scan was necessary in 3 patients with fentanyl–midazolam to rule out neurosurgical complications.

	Remi-prop	Fenta-mida
Duration of infusion (min)	525 ± 382	548 ± 360
Extubation (min)	47 ± 34	481 ± 47*
ICU duration (days)	1.8 ± 1.3	3.6 ± 4.3*
CT scan necessary (n)	0	3

Statistics: Student t-test with *P < 0.05, data are mean ± SD.

Conclusion: In terms of weaning time and duration of ICU treatment, this retrospective study indicates the superiority of remifentanyl–propofol vs. fentanyl–midazolam for analgesia and sedation of neurosurgical patients after supratentorial surgery. In addition, a reduced necessity of expensive diagnostic investigations may perhaps make this technique cost-effective.

A-706

Inhalational sedation in the ICU: augmented spontaneous breathing with Desflurane

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Background and Goal of Study: Recently we reported a quicker emergence and improved mental competence after postoperative sedation with

Desflurane (DES) compared to Propofol in the ICU¹. The new anaesthesia work station Zeus[®] (Dräger Medical, Lübeck, Germany) now allows augmentation of spontaneous breathing and application of DES with automatic feedback control in a closed circuit. Would it be possible to let all patients breathe spontaneously while being deeply sedated with DES?

Methods: After approval of IRB and informed consent, 11 patients (mean \pm SD: 59 \pm 12 yrs, 74 \pm 14 kg, sex: f/m = 5/6) after major operations were sedated with DES (Suprane[®], Baxter Deutschland, Erlangen) in the ICU to achieve rewarming and circulatory stability. Patients were kept deeply sedated as judged by Ramsay Score evaluated hourly and bispectral index monitoring (BIS-XP, Aspect Medical Systems, Leiden, Netherlands). They were ventilated with Zeus in synchronized pressure controlled mode (Δ Pi = 8–15 mbar, PEEP = 5–10 mbar). Remifentanyl (REMI; Ultiva[®], Glaxo-SmithKline, München) was started at a rate of 50 ng/kg·min. The mandatory frequency was reduced to let the endtidal CO₂ (ETCO₂) rise to \approx 50 mmHg and finally stopped. Spontaneous breathing once occurring was augmented by a pressure support (Δ PS) of 5–20 mbar (trigger 2 L/min). REMI was adjusted to keep ETCO₂ 40–50 mmHg.

Results: Patients were deeply sedated for 4.2 \pm 1.0 hours with Ramsay Scores of 5 or less in 86% of time (only reactions to painful stimuli), average BIS-XP of 60 \pm 9 and endtidal DES of 3.0 \pm 0.6 Vol% (range: 1.5–4.3 Vol%). Regular spontaneous breathing first occurred after 0.9 \pm 0.5 hours (REMI 44 \pm 9 ng/kg·min; ETCO₂ 42 \pm 3 mmHg); mandatory ventilation was stopped after 2.1 \pm 1.3 hours (REMI 35 \pm 18 ng/kg·min; ETCO₂ 42 \pm 4 mmHg). Finally patients were breathing spontaneously (12 \pm 2 bpm; VT 794 \pm 193 mL; REMI 30 \pm 16 ng/kg·min; ETCO₂ 43 \pm 4 mmHg) with Δ PS 8 \pm 6 over PEEP of 6 \pm 2 mbar until the tracheas were extubated.

Conclusions: In patients deeply sedated with DES spontaneous breathing is not impeded and can be titrated by the opioid dose. Despite being an anaesthesia ventilator with a totally closed circuit, Zeus can be used to augment spontaneous breathing just like an intensive care ventilator.

Reference:

1 Meiser A, et al. *BJA* 90: 273–80.

Acknowledgements: Financial support by Baxter.

A-707

Analgesia and sedation with remifentanyl in adult and aged ICU patients maintaining spontaneous ventilation

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Background and Goal of Study: Remifentanyl was used for analgesia and sedation in mechanically ventilated ICU patients (1–2), nevertheless there is a lack of data about the drug request for analgesia and sedation in adult and aged ICU patients spontaneously breathing. We investigated the dosage of remifentanyl for analgesia and sedation in patients maintaining spontaneous ventilation in an intensive care unit and the possible difference in the remifentanyl request between adult and aged patients.

Materials and Methods: In a series of adult (<60 yrs) and aged (>60 yrs) patients in spontaneous ventilation admitted in ICU (no brain trauma), a continuous infusion of remifentanyl alone was administered to obtain the required analgesia (VAS \leq 3) and sedation (Ramsay sedation score \leq 2).

Results: Data (mean \pm SD) are shown in the table:

	N	Age	Kg	Remifentanyl, microg kg ⁻¹ min ⁻¹	
				Analgesia (range)	Sedation (range)
ICU Patients	39	52.7 \pm 24	66.3	0.06 (0.02–0.11)	0.09 (0.04–0.15)
Adult	18	36.1 \pm 12	69.1	0.07 (0.05–0.11)	0.1 (0.07–0.15)
Aged	21	69.3 \pm 8	63.5	0.04 (0.02–0.06)	0.07 (0.04–1.1)

Conclusions: Remifentanyl provided effective analgesia and sedation in both adult and aged ICU patients in spontaneous ventilation with no intracranial pathology. A large variation in the request of remifentanyl to obtain analgesia and sedation was our main finding. Aged patients showed to be more sensitive than younger population to analgesic and sedative effects of remifentanyl. The difference in remifentanyl dose between adult and aged groups was significant. No hypo-ventilation (respiratory rate \leq 8 breaths/min), apnea or request of mechanical ventilation occurred.

References:

1 Soltesz S. *Br J Anaesth* 2001; 86: 763–8.
2 Wilhelm W. *Anaesthesist* 1999; 48: 625–9.

A-708

Use of the AnaConDa (Anesthesia Conserving Device) with sevoflurane in critical care patients

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Background and Goals: The Anesthetic Conserving Device (AnaConDa; Hudson RCI, Sweden) is a modified heat and moisture filter connected to the breathing circuit at the endotracheal tube. A syringe pump delivers sevoflurane to ACD where is vaporised through a rod. Most of exhaled sevoflurane is retained in the filter's chamber and delivered to the patient in the following inspiration (1). We studied the clinical features of the ACD when used with sevoflurane for sedation of post surgical critical patients during a 6-hour period.

Material and Methods: 9 patients after surgery were included. Mechanical ventilation was delivered through an Evita respirator (Dräger, Germany). Infusion rate of Sevoflurane to the ACD was adjusted following a prediction equation previously obtained, in order to reach an End-tidal concentration of 0.5%. We evaluated: Infusion rate stability, Quality of sedation, Hemodynamic stability, Temperature and humidity of respiratory gas mixture, Time from discontinuation of infusion until the patient followed verbal commands and complications. Anesthetic concentrations were measured using a standard clinical monitor (Vamos, Dräger, Germany). Ramsay scale was used hourly. Temperature and humidity of respiratory gases were measured with a Humidity meter (KM8006, Comark, UK).

Results: Infusion rates to maintain a constant Et-Sevoflurane concentration were directly related to body weight and minute volume ventilation. Mean rate was of 2.8 \pm 0.9 ml/h (range 1.8 to 4.1 ml/h). Twelve additional bolus doses of 0.2 ml were necessary to obtain the desired End-tidal concentration. Mean Ramsay scale was of 3 in 7 patients and 2 in 2 patients. Temperature of the inspired gas was of 29 \pm 0.8°C and Humidity of 100%. Time spent to respond to verbal commands was of 34 \pm 12 in. No changes in hemodynamics and complications were noted.

Conclusions: These results confirm the interest and safety for the potential application of the AnaConDa with sevoflurane in the ICU settings. Infusion rate can be maintained without further adjustments and sevoflurane consumption is low. However, 0.5% sevoflurane concentrations could not reach adequate sedation levels.

Reference:

1 *Anaesthesia* 2001; 56:429–32.

A-709

Comparison of midazolam, remifentanyl and dexmedetomidine sedation in intensive care unit

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Background and Goal of Study: In this study, midazolam, remifentanyl and dexmedetomidine which were used for sedation were compared regarding the hemodynamic parameters and the cost.

Materials and Methods: 33 patients who received mechanical ventilation were included in this study. The patients were intubated with propofol 2–2.5 mg/kg⁻¹ and vecuronium 0.1 mg/kg⁻¹. When the Ramsay Sedation Scale (RSS) was 2 or 3, the infusion of the sedative agent was started. Group M (n = 11), received midazolam 0.15 mg/kg⁻¹ bolus and 0.1–0.25 mg/kg⁻¹hr⁻¹; Group R (n = 11) received remifentanyl 1 μ g/kg⁻¹ (over 1 min) bolus and 0.15–0.25 μ g/kg⁻¹min⁻¹ and Group D (n = 11) received dexmedetomidine 1 μ g/kg⁻¹ (over 10 min) bolus and 0.2–0.7 μ g/kg⁻¹hr⁻¹. Sedation levels were maintained in the range of RSS 2 and 3. If additional dose of sedation (although highest infusion rate; RSS >3) was required, 5 mg midazolam were given in each group. Systolic and diastolic blood pressures, the heart rate and RSS were recorded in 1st, 2nd, 3rd, 4th hour and after this time in every 2 hours for 24 hours. The costs were also recorded.

Results and Discussion: Following the bolus doses, hypotension was recorded in 3 patients of each group. There were no statistically significant difference between groups according to systolic and diastolic arterial pressures during sedation. No patient required inotropes. Heart rate (HR) was significantly lower in the Group D than Group M at 12th and 14th hour (p < 0.05, p < 0.01). Additionally sedation was required in 3 patients of Groups M and R, and in 5 patients of Group D (p > 0.05). The cost results; Group M: 1,051 \pm 0.26 \$/hr⁻¹, Group R: 2,375 \pm 0.67 \$/hr⁻¹, Group D: 5,297 \pm 1,218 \$/hr⁻¹ (p < 0.001).

Dexmedetomidine has been associated with decreases in HR, in part because of the sympatholytic effects (1–2). In our study; Group D had significantly lower HR when compared with Group M, only at 12th and 14th hour, but there were no differences regarding arterial pressure between these three groups.

Conclusion: Midazolam, remifentanyl and dexmedetomidine were all found to be useful for sedation in the ICU while dexmedetomidine was the most expensive one.

References:

- 1 R Venn et al. *Br J Anaesth* 2001; 87: 684–90.
- 2 R Shahbaz et al. *Anesth Analg* 2002; 95: 461–6.

A-710

Is the intraabdominal pressure at intensive care admission predictor of mortality?

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Background and Goal of Study: The intraabdominal pressure (IAP) is an important indicator of the patient's physiologic status because even slight increase of IAP can have deleterious effects.

Aim of this study was to evaluate in all the new patients admitted to general ICUs, during four weeks, the incidence of IAP and if IAP at admission could be an independent risk factor for the ICU mortality. At admission: APACHE II, etiologic factors (abdominal surgery, hemoperitoneum, abdominal infection, massive fluid resuscitation, ileus, pneumonia, bacteraemia), predisposing conditions (acidosis, polytransfusion, coagulopathy, sepsis and liver dysfunction) and type of admission were evaluated. The IAP was measured twice every day, for seven days or less if ICU discharged or dead occurred.

Materials and Methods: 265 patients were enrolled from ICUs, mean age 62.8 ± 17.7 y, BMI 25.9 ± 17.7 kg/m², APACHE II 17.8 ± 8.7 , IAP 9.7 ± 5.0 mmHg, medical patients 132 (49.8%), surgical patients 71 (26.8%), emergency patients 42 (15.8%), trauma patients 20 (7.6%) and ICU stay 9.5 ± 11.2 die.

Results and Discussions: The incidence of IAH (defined as a mean IAP of 12 mmHg or more at admission) was 23.7%, 62 patients (23.4%) died in ICU.

The only independent risk factors for death in ICU were mean IAP at admission (OR 1.5 CI 1.0–2.3), APACHE II (OR 1.1 CI 1.0–1.1) and liver dysfunction (OR 4.0 CI 1.6–9.8).

Conclusion(s): These data suggest that in a mixed population of critically ill patients the IAH is a quite common problem and moreover the IAP is independently associated ICU death.

A-711

Intensive care follow-up consultation: perception by the patients and the general practitioners

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Background and Goal of Study: After a stay in intensive care unit (ICU), intensive care follow-up consultation (ICC) should assess and improve quality of care. In order to guarantee ICC success, close collaboration between general practitioners seems to be necessary. Before implanting ICC, we studied general practitioner's and patient's perceptions.

Materials and Methods: The survey was conducted amongst patients hospitalized in 2001 for more than 48 hours and who were discharged from a surgical ICU. A questionnaire was mailed to patients and general practitioners. A phone follow-up was made after 6 weeks. Questions dealt with the quality of information relating to their ICU stay, what they expected from ICC, their desire to take part in a ICC, and the organization of ICC. One year after leaving ICU, autonomy was evaluated by the GOS score. The statistical tests used were the Chi-Square test and Student test.

Results and Discussion: 222 questionnaires were sent to patients and 189 to general practitioners. The response rates were 61% and 64% respectively. ICC was considered as useful by 66% of patients and 86% of doctors. 72% of the latter were ready to require ICC for their patients. When patients were not interested, they gave the following reasons: total recovery (10%) or their attending doctor's competence level (17%). Medical information quality during their stay, length of the stay, initial severity (IGS2 score) and 1 year outcome (GOS) did not influence ICC perception. The main patient's expectations with ICC were to receive information on their illness (56%), and to have the opportunity to see their medical records (51%). General practitioners expected information on possible complications (67%), after-effects evaluation through specialized exams (63%) and quality of life assessment (68%). For them, optimum time-scale for ICC seemed to be 3 months.

Conclusion: General practitioner's and patient's good perception of ICC should facilitate its implantation. This should lead to quality of care improvement.

A-712

Physicians perceptions of inappropriate admissions to intensive care units

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Background and Goal of Study: The decision to admit a patient to an intensive care unit (ICU) may be influenced by many non-medical factors [1, 2]. There are no data regarding inappropriate admissions to Italian ICUs, we therefore investigated ICU physicians' attitudes to such admissions.

Materials and Methods: We approached all ICU physicians (except interns) employed in the 20 ICUs in Milan (Italy) attached to a university or general hospital and asked them to complete an anonymous questionnaire.

Results and Discussions: Response rate was 87% (225/259). 86% replied they had made inappropriate admissions. The most common reasons given (percentages refer to respondents who marked 9 or 10 on a 10-point scale, where 1 is "least usual reason" and 10 is "most usual reason") were clinical doubt (33%), limited decision time (32%), assessment error (25%), pressure "from above" (13%) and pressure from referring clinician (11%). Low frequency reasons were: pressure from family (5%), threat of legal action (5%) and economically advantageous DRG (1%).

Conclusions: In the urban setting of Milan, inappropriate ICU admissions are perceived by the physicians involved as a common event. These physicians were aware, on one hand of the difficulties in assessing the appropriateness of an admission, and on the other hand that their decision process was not a purely objective one based on medical necessity but was often influenced by external factors. Hence patients too sick or too well to benefit from intensive care [3] may be admitted, resulting in inappropriate allocation of limited ICU resources.

References:

- 1 Levin PD, Sprung CL. *Intensive Care Med* 2001;27:1441–1445.
- 2 Marshall MF, Schwenzler KJ, Orsina M et al. *Crit Care Med* 1992;20:387–394.
- 3 Task Force of the American College of Critical Care Medicine. *Crit Care Med* 1999;27:633–638.

Acknowledgements: This study was partly supported by the Catholic University of Milan.

A-713

Identification of surgical patients in need for postoperative active support treatment

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Background and Goal of Study: To develop a method to predict the need for postoperative intensive care (ICU) in surgical patients.

Materials and Methods: We studied 40 surgical patients admitted in ICU who underwent major vascular surgery, neurosurgery and major intraabdominal surgery. We calculated the preoperative and the immediate postoperative APACHE III score just before admission to the ICU. All patients who were admitted to the ICU received active support treatment consisting of mechanical ventilation, use of vasoactive or antiarrhythmic drugs, use of intracranial pressure lowering agents, rapid blood transfusion, pericardiotomy and other emergency interventions. We used as a control group 40 patients with similar group characteristics who were not admitted to ICU.

Results and Discussions: The preoperative mean APACHE III score for the patients in the ICU group was 36 ± 5.85 with respective physiologic subscore: 26.14 ± 4.94 whereas in the control group mean APACHE III score was 35.8 ± 6.26 with respective physiologic subscore: 24.4 ± 3.56 . The postoperative APACHE III score for the ICU group was 49.29 ± 5.85 with respective physiologic subscore: 32.29 ± 3.78 whereas in the control group mean APACHE III score was 31.4 ± 3.86 with respective physiologic subscore: 19 ± 2.01 .

Conclusion(s): The perioperative computation of APACHE III score may prove to be a useful method for detecting people requiring postoperative intensive care and will probably need active support treatment. A postoperative reduction of APACHE III score (especially the acute physiologic subscore) may be predictive of a reduction of need for postoperative care, less postoperative complications and a more favorable outcome of surgical patients.

Reference:

- Chest* 1995; 108:490–499.

Acknowledgements: We wish to acknowledge the contribution of personnel of the intensive care units of Evangelismos Medical Hospital.

A-714

Double kidney transplantation: the importance of the maintenance of possible donors of marginal kidneys

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Background and Goal of Study: Organ shortage is a major limitation in transplantation. The increasing imbalance between available renal allografts and number of patients on waiting lists has been the reason for the use of kidneys from elderly, hypertensive, or diabetic donors. In these cases, double kidney transplantation could improve graft survival. The aim of our study was to compare graft outcome of transplantation of two marginal kidneys (DKT) versus single renal transplants (SKT).

Material and Methods: We have studied all patients scheduled for kidney transplantation during a four-year period. 41 patients received double kidney transplantation. In DKT, kidneys were transplanted with a double iliac incision, donor biopsy revealed the presence of moderate chronic renal damage. Immunosuppression was the same in all patients. We evaluate renal function, graft survival and patient outcome.

Results and Discussion: Main results are expressed in the table.

	DKT (n = 41)	SKT (n = 181)
	Donor/recipient	Donor/recipient
Age	72 ± 5/65 ± 7.2	33.7 ± 10/45.4 ± 12.9*
HTA (%)	51.2/-	-/-
DM (%)	7.3/-	-/-
Proteinuria (%)	26.8/-	-/-
Delayed graft function (%)	-/29.3	-/15.3 [#]
Graft rejection (%)	-/7.3	-/24.7 [#]
Creatinine at week	-/345 ± 285	-/326 ± 275
Creatinine at year	-/133.9 ± 28.1	-/144.15 ± 89.9
Exitus (%)	-/5	-/4.3

Mean ± SD *Anova, [#]chi-square *p* < 0.05

Conclusions: Our results suggest that kidneys from marginal donors not considered adequate for standard single renal transplantation can be used for double kidney transplantation. Longer follow-up of these patients will allow for better defined indication for this kind of transplantation but these results emphasize the importance of the maintenance of those patients that could be donors of suboptimal kidneys.

A-715

Patients with haematological malignancies in intensive care unit – differences between survivors and non-survivors on admission

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Background and Goal of Study: Haematological malignancies (HM) are believed to be a poor prognostic factor in assessment of patients admitted to ICUs. Bad prognosis is especially connected with the necessity of mechanical ventilation and high values of SOFA score on admission^{1,2}. It was interesting for us, if there are any differences between survivors and non-survivors with haematological malignancies on admission to ICU.

Materials and Methods: 36 patients (16 men and 20 women) with haematological neoplasms were included to the study. Mean age was 43.25 years (STD 15.8). 14 of patients survived and was discharged from ICU to Dpt. of Haematology (average period of surviving after discharge was 6.03 months). All of the patients required ventilatory support. There were analyzed various clinical and laboratory data and compared with t-Student or U-Mann-Whitney test after normality of distribution verifying with Shapiro-Wilk test. Additionally chi-square test was used if appropriate. Parameters with significant differences (*p* < 0.05) are presented in table below.

Results and Discussions: Data are shown in table as mean (STD) (if they have normal distribution) or as median and range (without normal distribution)

Parameter	Survivors	Non-survivors	<i>p</i>
SOFA score	10.31 (2.93)	13.77 (3.84)	0.009
SAPS score	52.46 (10.95)	68.27 (24.22)	0.04
Thrombocyte number	72 (12–155)	25 (0–217)	0.008
Mean arterial blood pressure	83.0 (51.7–140.0)	56.8 (30.0–133.3)	0.003
Necessity of catecholamines using on admission	5 vs 9	17 vs 5	0.013

There were not differences between survivors and non-survivors in age, period of hospitalization, leukocyte and neutrocyte number; RBC, HGB and HCT amount, presence of renal insufficiency on admission.

Conclusion(s): Using of SOFA, SAPS (but not APACHE II) scoring systems is useful tool for early estimation of outcome in patients with haematological malignancies admitting to ICU. Another helpful parameters are mean thrombocytes amount and RR values (with subsequent necessity of catecholamines using).

References:

- 1 Kroschinsky F. et al. *Intensive Care Med* 2002; 28:1294–1300.
- 2 Silfvast T. et al. *Acta Anaesth Scand* 2003; 47:301–306.

A-716

Patients' recollections of stressful experiences in the intensive care unit

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Background and Goal of Study: The objective of this study was to describe stressful experiences of patients who stayed ≥24 hrs in the ICU and to investigate whether adequate sedation decreases these stressful experiences.

Materials and Methods: After receiving ethical committee approval, all the patients who stayed ≥24 hrs in our ICU within 6 months were included. Patients with dementia, psychiatric disease were excluded. The overall rating of the sedation and patient ability to tolerate the ICU setting was recorded (between 1–5) every shift by the nurses and the physicians. 32 item questionnaire was used to collect data about patients' stressful ICU experiences by interviews after discharge from the ICU (1).

Results and Discussions: 35 patients were interviewed. 4 (11%) patients did not remember being in an ICU. The mean ± SD of the age of the patients was 37 ± 22 yrs, the weight was 60 ± 17 kg and the SAPS II score on admission was 34.5 ± 19. 23 (66%) patients were female. The duration of ICU stay and mechanical ventilation were 4 ± 3 days and 1286 ± 767 hrs, respectively. The items that were bothersome include not being able to speak (88% of the patients who remembered the experience), discomfort due to endotracheal tube (ETT) (74%), feeling choked by ETT (80%), ETT interference with sleep (82%), not getting enough air from the ETT (68%), being thirsty (75%), difficulty swallowing (69%), noise (74%), pain (80%), feeling something bad will happen (100%), tense (71%), depressed (78%), fearful (89%), nervous (81%), missing loved ones (88%), nightmares (87.5%), headaches (90%). The patients who had adequate sedation (average rating ≥ 4) were bothered less by remembering choked by ETT (median score (95%CI) of the item, 1(0–5)) not getting enough air from the ETT (0(0–4.6)), difficulty swallowing (2(0–5)), and being restrained (0(0–4)) compared to the patients with inadequate sedation (medians of the items, 4(0–5), 3.5(0–5), 4(0–4), 2.5(0–5) respectively) (*p* < 0.05).

Conclusion(s): Patients in the ICU remember numerous stressful experiences. Adequate sedation decreases some of the physical symptoms. More improvements are needed to further decrease the stressful experiences in the ICU.

Reference:

- 1 Rotondi AJ, et al. *Crit Care Med* 2002; 30:746–52.

A-718

Examination of the upper airway after percutaneous tracheostomy with the virtual laryngo-tracheoscopy

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Background and Goal of Study: The aim of this study is to evaluate the possibilities of virtual laryngo-tracheoscopy (VLT) technique for diagnosis of different deformations in the laryngo-tracheal region after percutaneous tracheostomy (PCT). PCT is a well-established procedure for the treatment of critically ill patients, who need prolonged mechanical ventilation. Fiberoptic laryngo-tracheoscopy (FOLT) is often required for the follow-up of these patients. This procedure, however, involves discomfort and cannot always be used in critically ill patients.

Materials and Methods: We examined 28 patients (19 males and 9 females) who were recruited from ICU patients after PCT. Examinations were performed between a few days and 12 months following PCT and

decannulation on a multidetector CT scanner (General Electric Medical System Lightspeed) using the following parameters: 120 kV, 80 mA, rotation: 0.8 sec, pitch: 6, slice thickness: 2.5 mm, overlap: 1.8 mm, acquisition time: 10–12 sec. Navigation through the laryngo-tracheal lumen as well as reformatted coronal and sagittal images were performed on GE AW 4 workstation. The diameters of the larynx and cervical trachea were accurately measured.

Results and Discussions: The pathological changes were: mural granulations, polypoid mass in the tracheal wall, tracheal wall flap and flap with a persistent tract. When the FOLT was performed it showed the same findings.

Conclusion(s): VLT allows the dynamic assessment of the central airway and the diagnosis of mural deformities and stenosis. Being non-invasive and short in time, requiring no patient preparation, VLT is ideal for studying the larynx and trachea in former critically ill patients. This technique may offer an alternative to the FOLT examination.

A-719

Comparison of percutaneous dilatational tracheostomy with single-step rotating dilatation

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Background and Goal of Study: Tracheostomy is a frequent surgical procedure which is used in ICU patients for prolong mechanical ventilation. In our study aimed to compare the early complication and safety of percutaneous dilatational tracheostomy (PDT) with single-step rotating dilatation tracheostomy.

Materials and Methods: We studied 28 patients under the guide of fiberoptic bronchoscope, Group D (n: 15) with PDT technique and Group R (n: 13) with single-step rotating dilatation tracheostomy technique. Pre-operative and postoperative hemodynamic parameters, arterial blood gas analysis, intraoperative and postoperative complications were examined. Statistical analyses were performed using the Mann-Whitney U test.

Results: There was no significant difference in demographic characteristics of Group D and Group R. Intra operative and postoperative hypoxia was not determined. In Group D, there was two subcutaneous emphysema, three minor bleeding, three stomal infection. In Group R, there was only one subcutaneous emphysema, one minor bleeding and one stomal infection.

Discussion and Conclusion: Most studies that compare surgical tracheostomy with percutaneous techniques, showed that percutaneous techniques were safer. But there are differences in safety between these percutaneous techniques (1,2). Although single-step rotating dilatation tracheostomy is a new procedure, we suggested that is safer than the PDT.

References:

- 1 Frova G, Qintel M. *Intensive Care Med.* 2002; 28: 299–303.
- 2 Jeffrey L, Johnson MD, Michael L. *Critical Care Med.* 2001; 29: 1251–1254.

A-720

Monitoring of tracheal tube cuff pressure in patients treated in intensive therapy unit and intensive care units

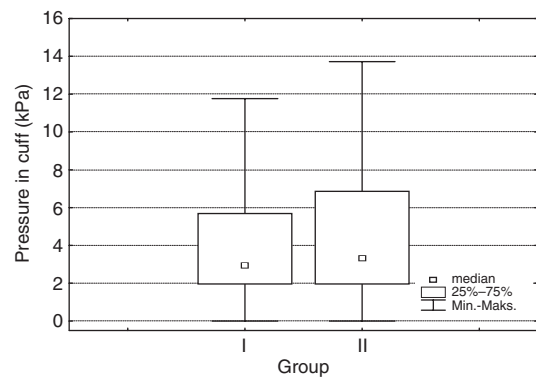
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Background and Goal of Study: Excessive tracheal tube cuff pressure (CP) causes ischaemic changes in the tracheal mucosa¹. In case of prolonged intubation, it may lead to tracheal stenosis, tracheo-oesophageal fistulae or granuloma. Too low cuff pressure is also undesirable – it increases the risk of leakage of colonized subglottic secretions around the cuff of the tracheal tube, which is the risk factor of ventilatory associated pneumonia². The aim of the study was to find out if there were any differences in maintenance of the proper CP between the intensive therapy unit (ITU) led by anaesthesiologists and intensive care units (ICUs) led by non-anaesthesiologists.

Materials and Methods: We measured the CP of the low-pressure high-volume (LPHV) tracheal tubes in 219 patients. 107 were hospitalized in ITU (group I), 112 were patients of ICUs (group II). The cuffs were filled with air. We used the manometer PORTEX designed for LPHV tracheal tubes. The recommended range of CP was 1.56–2.54 kPa. The teams were unaware that the audit was taking place. If the CP was out of range, it was to corrected to proper values.

Results and Discussions: Results are presented in the figure.



The data analysis with U-Mann-Whitney test didn't reveal any differences between values of CP in both groups. Overinflation was more frequent than underinflation in both groups. Regular measurement of tracheal cuff pressure is not an everyday procedure in controlled units.

Conclusion: Regular measurement of CP should be an everyday procedure in intubated patients.

References:

- 1 Seegobin DR. *Br Med J* 1984;288(6422):965–968.
- 2 Rello J et al. *Am J Respir Crit Care Med* 1996;154:111–115.

A-721

Developmental expression of hypoxia-induced mitogenic factor (HIMF) in mouse lung

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Background and Goal of Study: A functional hypoxia genomics screen led to the assignment of a major new portfolio to a resistin-like molecule which mnemonically was renamed hypoxia-induced mitogenic factor (HIMF). HIMF has potent pulmonary vasoconstrictive, proliferative and angiogenic properties and shows a robust induction through hypoxia in vivo (1). In order to investigate the functional role of HIMF in lung development, we determined the spatial and temporal distribution of HIMF in embryonic lung.

Materials and Methods: A microarray study was performed using RNAs extracted from mouse lungs that were exposed to either room air or 10% O₂ for 4 days. A gene (AA712003, HIMF) was upregulated 4 fold in hypoxic lung. The HIMF gene bears a hypoxia-induced transcription factor (HIF) binding site. For the functional analysis of the role of HIMF in pulmonary development, lungs were isolated from 14 to 20 days of pregnant mice and HIMF protein and HIF transcription factor expression were examined with western analysis and immunohisto-chemical staining. In addition, apoptosis was quantified in embryonic lungs with or without recombinant HIMF present.

Results and Discussions: HIMF was markedly increased during the development of the lung, especially in the latter stage of gestation. HIMF protein first appeared at gestation day (GD) 16 and rapidly increased at GD 17 and 20. It peaked at day 3 after birth and reduced to a low level in adult lung. Immunohistochemical staining showed that HIMF was localized mainly in developing airway epithelial cells and pulmonary arterial smooth muscle cells. HIMF reduced apoptosis in embryonic lungs. Localization, timing and anti-apoptotic action suggest a role of HIMF in lung maturation during late gestation.

Conclusion(s): These findings showed that HIMF is not only a mitogenic, and angiogenic factor but also an agent that may play an important role in lung maturation, particularly alveolar formation and thus may open new avenues for the treatment of the chronic lung disease of prematurity.

Reference:

- 1 Teng X, Li D, Champion H, Johns R. *Circ Res.* 2003;92:1065–1067.

Acknowledgements: Supported by the Max Kade Foundation.

A-722

Ultrasound guided puncture of trachea with «stopper»: a new supporting device for percutaneous tracheostomy and Pathology

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Background and Goal: Percutaneous tracheostomy (PT) is an established and safe intervention for tracheal access in intensive care. However, the

«blind» technique is burdened with potential complications and relative as well as absolute contraindications. To diminish those bronchoscopically or ultrasonography guided (USG) PT is suggested. Although ultrasonography has certain advantages over endoscopy, the main objection is the impossibility to avert the injury of posterior tracheal wall during the initial puncture of trachea. With the purpose to control the «depth» of the puncture, we have designed special «stopper» which unable unwounded lesion of the posterior tracheal wall with puncture cannula. The aim of this study is to evaluate the safety of the «stopper» to avoid unintentional lesion of the posterior tracheal wall.

Materials and Methods: We have performed USG puncture of the trachea in 20 adult cadavers in earlier described way adding the use of the «stopper». With linear ultrasonography transducer (7.5 MHz) trachea was presented by vertical medial section. Following a clear ultrasound verification of thyroid and cricoid cartilage and tracheal rings, the site of puncture is determined. Then the ultrasound transducer is pulled cranially until the lower edge of transducer is placed above the tracheal ring, below which the puncture of trachea will be performed. Then the distance from transducer to the echo of anterior tracheal wall was measured and signed on puncture cannula. The «stopper» was positioned 5 mm distally from the signed place on cannula and the puncture was performed up to the depth permitted by «stopper». Finally «guide-wire» was placed through the cannula. After removing cannula and guide-wire autopsical examination of the trachea was done. The trachea was removed «en block» and opened along the anterior wall with further detailed macroscopical examination of the posterior wall of the trachea.

Results: Examining the autopsy material in any case we did not find macroscopic signs of tracheal lesion with puncture cannula or «guide-wire».

Conclusion: The authors maintain that by using USG puncture of trachea with special device «stopper» the unintentional puncture and lesion of the posterior tracheal wall can be entirely avoided.

A-723

Use of Laryngeal Mask Airway (LMA) during Percutaneous Dilatation Tracheostomy (PDT)

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Background and Goal: In the ICU of Hvidovre University Hospital we have used the Percutaneous Dilatation Tracheostomy (PDT) technique since 1996. It is a general 6-bed intensive ward. Since 2000 the technique has been standardized as to the patient being extubated and subsequently ventilated with a Laryngeal Mask Airway (LMA) during the procedure and the PDT being single-dilatation (COOK or Blue Rhino). We changed the technique because we experienced technical problems with the endotracheal tube in situ.

Materials and Methods: This is a retrospective study of the clinical histories of 69 ICU patients undergoing PDT from June 2001 till September 2003 at Hvidovre University Hospital. They were found by extracting the computerized dismissal notes containing the code for tracheostomy. 36 males and 33 females ranging in age from 32 to 86 years (median 66), weight from 50 to 160 kilograms (median 74). Settings of FiO_2 before PDT from 0,25 to 1,0 (median 0,45), PEAK pressure ranging from 10 to 40 (median 22). The patients were tracheostomized between day 1 and 22 (median 7).

Results and Discussion: Complications:

- 1 case of difficulty introducing the guide-wire.
- 1 case were the LMA could not be placed correctly.
- 1 case of bleeding perioperatively, hemostasis was acquired with a suture. No infection, no aspiration, no desaturation, no surgical intervention.

Conclusion: PDT in an ICU setting using a technique by extubating the patient first and ventilating him or her during the procedure with LMA is a safe procedure where one can avoid technical complications such as cuff puncture, tube transection and accidental extubation.

A-724

Changes of mitochondrial membrane potential and intracellular pH as an early indicator of acute lung injury

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Background and Goal of Study: Acute pulmonary disease (ARDS) are associated with direct or indirect injury of lung parenchyma leading to subsequent necrosis and/or apoptosis. Mitochondria have been demonstrated to play a crucial role in signal transduction of apoptosis pathways (1). In a model of cell damage, our studies focused on changes of mitochondrial membrane potential, pH and apoptose, so that we can understand this processes.

Materials and Methods: We used an established cell line of human type II pneumocytes (A549). Cell injury was induced by addition of hydrogen

peroxide (200 to 3200 μM), early response cytokine (TNF- α , IL1- β), staurosporin (apoptosis model), and ethanol (necrosis model). Depolarisation of the mitochondrial membrane was assessed intravitaly by means of the potential-sensitive fluorescent dye JC-1. For intracellular pH-measurements cells were incubated with BCECF-AM. For detection of apoptotic cells we used the intravital dye YO-PRO and the immunohistochemical labeling with caspase-3-antibody.

Results and Discussions: After treatment with H_2O_2 , the portion of depolarized mitochondrial membranes increased along with the severity and duration of oxidative stress. Remarkably, this was associated with an altered location of the organelles within the cells. In the model of necrotic cell injury, all mitochondrial membranes were found to be depolarized whereas in apoptotic cells both depolarization and hyperpolarization could be observed. After incubation with ascending concentration of H_2O_2 increase the intracellular acidification. The control of the apoptosis with 1 μM Staurosporin showed a significant intracellular acidification. The membrane permeability assay with YO-PRO showed increasing permeability with longer incubation time and ascending concentration of H_2O_2 . By this staining we detected single cells with stained nuclei too, as a sign for early and late nuclear changes identified by nuclear fragmentation. The active caspase-3-antibody reaction was positive after treatment with staurosporin and only by high concentration of H_2O_2 .

Conclusion: The alteration of mitochondrial membrane potential and intracellular pH represents an early and sensitive marker of cellular injury caused by oxidative stress.

Reference:

- 1 Green DR, Reed JC; *Science* 1998;281:1309-1312.

A-725

Measurement of indocyanine green plasma disappearance rate by two different dosages

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Background and Goal of Study: Monitoring of organ function is often crucial for guiding therapy in critically ill patients. Most recently, indocyanine green plasma disappearance rate (ICG-PDR) has been suggested for assessment of liver function and a transcutaneous systems has been clinically introduced and validated [1]. In this study, we analyzed the agreement between ICG-PDR measured with the recommended dosage (0.5 mg/kg) and a reduced dosage (0.25 mg/kg).

Materials and Methods: We studied 16 critically ill patients (5 female, 11 male) who underwent monitoring of ICG-PDR for clinical indication (LiMon[®], Pulsion Medical Systems, FRG). For each comparative measurement, in a random fashion, either 0.5 mg/kg or 0.25 mg/kg of ICG were injected and followed by the corresponding dosage 60 minutes later. We analyzed 31 pairs of ICG-PDR measurements by applying the recommended dosage (0.5 mg/kg, ICG-PDR_{0.5}) and a reduced dosage (0.25 mg/kg, ICG-PDR_{0.25}). Respirator settings and dosages of vasoactive drugs remained unchanged during the study. No drugs which may influence hepatic blood flow were administered during the study period. There were no changes in fluid status and central venous pressure was unchanged at the two time points.

Results and Discussions: ICG-PDR_{0.25} was between 2.7 and 25.0 [%/min] and ICG-PDR_{0.5} between 4.5 and 24.5 [%/min], respectively. Linear regression analysis revealed ICG-PDR_{0.25} = 1.13 · ICG-PDR_{0.5} - 0.66 [%/min] ($r = 0.95$, $p < 0.0001$) with a mean bias 1.0 [%/min] (standard deviation 2.5 [%/min]). The 15-minutes residual rates were also highly correlated ($r = 0.92$, $p < 0.0001$) with a mean bias of 0.3%.

Conclusion: A reduced dosage of ICG (0.25 mg/kg) is sufficiently accurate for transcutaneous measurement of ICG-PDR in critically ill patients.

Reference:

- 1 Sakka SG, Reinhart K, Meier-Hellmann A. Comparison of invasive and noninvasive measurements of indocyanine green plasma disappearance rate in critically ill patients with mechanical ventilation and stable hemodynamics. *Intensive Care Medicine* 2001; 26:1553-1556.

A-726

The effect of different temperature and amount of fluid on the intravascular pressure measurements

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Background and Goal of Study: An increase in intraabdominal pressure (IAP) can have deleterious consequences in several organs and increase the mortality. Consequently an accurate measurement of IAP is recommended.

Due to its simplicity and low cost, the bladder technique is the gold standard. This technique assumes that the bladder act as a passive pressure transducer, indeed the intravesical pressure (IVP) estimates the IAP.

Aim of this study is to evaluate the effect of different temperature and amount of fluid, infused in the bladder trough the Foley catheter, on the IVP. **Materials and Methods:** Nine sedated patients (8 with ALI and sepsis, 1 with only sepsis, mean age 68 ± 14 y, weight 73 ± 16 kg, $\text{PaO}_2/\text{FiO}_2$ 249 ± 61 , PEEP 11 ± 5 cmH₂O) were enrolled. The IVP was measured at different amount of saline infused (from 50 to 200 ml) and at room (22°C) and 37°C of temperature respectively. The IVP was recorded after one minute for stabilization.

Data are expressed as mean \pm SD.

Results and Discussions:

Amount of saline (ml)	Temperature of saline	
	22°C IVP (mmHg)	37°C IVP (mmHg)
50	8.6 ± 2.9	6.4 ± 3.3
100	12.5 ± 3.5	$8.9 \pm 3.3^*$
150	$22.9 \pm 11.7^{\wedge}$	$11.6 \pm 4.8^*$
200	$30.1 \pm 17.6^{\S}$	$22.2 \pm 20^{\S*}$

* $P < 0.05$ Two way RM Analysis of variance vs 22°C of temperature;

$\S P < 0.05$ vs 50, 100 ml; $\wedge P < 0.05$ vs 50 ml

Conclusion(s): Our results suggest to use at the bedside an amount of saline from 50 to 100 ml at a temperature of 37°C to avoid an overestimation of the IAP.

A-728

The effects of low and high intraabdominal pressure on immune response during general anaesthesia

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Background and Goal of Study: Anaesthesia and surgical trauma depress many of the normal function of the immune system and lead to postoperative infection. Immunosuppression is directly related to the degree of trauma. The aim of this study was to compare the effect of low and high intraabdominal pressure on immune response by measuring the level of IL-2, a marker of trauma induced immunodeficiency and IL-6, a marker of tissue trauma, under general anaesthesia (1).

Materials and Methods: 22 adult patients, ASA grade 1–2 scheduled for laparoscopic cholecystectomy were included. Patients were randomly allocated to one of two groups according to the intraabdominal pressure: [low intraabdominal pressure (10 mmHg) $n = 11$, high intraabdominal pressure (14 mmHg) $n = 11$]. General anaesthesia was induced with thiopental and vecuronium, maintenance was achieved with nitrous oxide in oxygen/sevoflurane. Venous blood samples were taken immediately before induction of anaesthesia, before the skin incision, at the end of anaesthesia and surgery and 24 hr postoperatively. Serum IL-2, IL-6 levels were measured. Data were analysed by using student's t test, paired t test and ANOVA for repeated measurements. $P < 0.05$ was considered to be statistically significant.

Results and Discussions: Serum IL-2 showed a significant increase before incision in low intraabdominal pressure group and showed a significant decrease before incision in high intraabdominal group. The increase of serum IL-6 at the end of anaesthesia and surgery and 24 hr postoperatively was less in low intraabdominal pressure group. As a result postoperative immunosuppression is less in low intraabdominal pressure group.

Conclusion(s): These results can be interpreted as the immune system is less depressed with lower intraabdominal pressure. This may have clinical implications in immunocompromised patients.

Reference:

- Mealy K, Gallagher H, Barry M, Lennon F, Traynor O, Hyland J. Physiological and metabolic responses to open and laparoscopic cholecystectomy. *Br J Surg.* 1992;79:1061–4.

A-729

Accuracy and precision of pulse oximetry in ventilated patients of an intensive care unit

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Background and Goal of Study: Pulse oximetry is the standard technique to monitor oxygen saturation (SpO_2) in the intensive care unit continuously. These readings may deviate from the "gold standard" arterial blood gas analysis (SaO_2) due to multiple influencing factors [1,2]. The aim of this study

was to evaluate the discrepancy between these two techniques (accuracy and precision) for ventilated patients in the ICU.

Materials and Methods: A retrospective analysis of routine patients' records was performed. During clinical routine oxygen saturation was monitored continuously with a pulse oximeter (Siemens SC1281, Danvers/USA) and cross-checked every 4 hours with arterial blood gas analysis (Radiometer ABL 625, Copenhagen/Denmark). The error of measurement was calculated as Bias ($B = \text{SaO}_2 - \text{SpO}_2$) for each pair of values [1]. Hereby the bias was interpreted as accuracy and the standard deviation as precision. For the statistical analysis the t-test for paired values was used, $P < 0.05$ was defined as significant. An approval of the local ethics committee was not necessary to perform this study.

Results and Discussions: 500 data sets of patients (309 male, 191 female, 57 ± 17 years old) were analyzed. Hereby the mean SaO_2 (96.1 ± 5.76 [42.8 to 100.0%]) correlated well with the mean SpO_2 (96.0 ± 5.99 [54 to 100%]). There were no significant differences between SaO_2 and SpO_2 ($P = 0.0005$, $R^2 = 0.7816$). The calculated overall bias was $B = +0.1 \pm 2.02$ [–11.2 to +14.0%]. The standard deviation for the two techniques was statistically not different ($P > 0.05$).

Conclusion(s): Pulse oximetry slightly underestimates the oxygen saturation determined by arterial blood gas analysis. The overall accuracy of pulse oximetry is good compared to arterial blood gas analysis. Although some outliers were found, there are no clinically relevant differences between the two methods to determine oxygen saturation.

References:

- Severinghaus JW et al. *Anesthesiology* 1992; 76:1018–1038.
- Hinkelbein J et al. *Abstracts ASA* 2003; A-452.

Acknowledgements: We received no financial support for this study.

A-730

The Paratrend sensor as a tool for continuous measurement of arterial blood gases

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Background and Goals: Management of critically ill patients requires frequent measurements of arterial blood gases. Based on the results, we assess pulmonary situation and adjust ventilator settings and also do therapeutic maneuvers to improve these parameters. Continuous arterial blood gas measurement is a valuable tool for detecting and therefore treating adverse pulmonary effects.

Material and Method: Paratrend 7+, is an intravascular, multiparameter sensor, using a fiberoptic sensor system for continuous blood gas monitoring. We compared Paratrend's measurement performance to a conventional bench blood gas analyzer, by simultaneous measurements in 179 patients.

Results: As long as PaO_2 was over a range of 10 to 50 kPa, the bias was small (within the limits of agreement). If the arterial pO_2 was higher than 50 kPa the bias was a little higher but still within agreement limits.

Conclusions: The Paratrend catheter is a useful tool, because it gives rapid confirmation of ventilator setting changes and helps to estimate if the followed therapy is adequate or needs adjustments.

Reference:

- Menzel, D. Henze, J. Soukup, K. Engelbrecht, M. Senderreck, J. Radke Experiences with continuous intra arterial blood gas monitoring: *Minerva Anesthesiol.* 2001 Apr;67(4):325–31.

A-731

Monitoring severe head injured patients treated by barbiturate with bispectral index (BIS-XP: Aspect Medical Systems)

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Background and Goal of Study: Severe head injured patients (SHI) with high intracranial pressure may be treated by barbiturates. The goal of the sedation is to obtain an electro-encephalography (EEG) pattern of burst-suppression: from 2 to 5 bursts per minute (*Neurosurgery* 1991; 29: 739–742). The BIS-XP® (Aspect Medical Systems) monitor gives real time data from the EEG: the BIS (bispectral index) et the SR (suppression ratio). Data from the BIS are derived from the analysis of the EEGs from healthy patients under sedation but have never been studied in SHI. The aim of this study was to assess if the level of BIS and SR would be used to predict an overdosage and a therapeutic sedation level in SHI treated by barbiturates.

Materials and Methods: Consecutive SHI treated by barbiturates in our intensive care unit have prospectively been included from May to October

2003. Digitalized EEG were recorded once a day for one hour and read by a neurologist. Every five minutes, one minute of data was used to record the number of bursts and the percentage of time with electrical silence (SR/EEG). At the same time, the values of BIS and SR were recorded. An analysis in terms of sensibility (se), specificity (sp), positive and negative predictive value (PPV, NPV) has been made for different levels of BIS or SR.

Results: 12 patients have been studied: 31 EEG (1 to 4 per patient have been recorded; 575 elements of data kept for analysis).

Best levels for prediction of barbiturate overdosage (number of burst less than 2 per minute)

	Sensibility	Specificity	PPV	NPV
BIS < 5	91.3	84.0	77.8	94.0
SR > 89	90.9	84.5	78.4	93.8

Best levels for prediction of deep sedation (burst less than 6 per minute)

	Sensibility	Specificity	PPV	NPV
4 < BIS < 16	90.1	90.3	89.5	90.8
90 > SR > 64	85.7	91.5	90.7	86.7

A BIS = 0 or a SR = 100 always corresponded to a barbiturate overdosage. **Conclusion(s):** The best indicator to predict a barbiturate overdosage in SHI might be a BIS inferior to 5 or a SR superior to 89. For a deep sedation, the indicators might be a BIS between 5 and 15 or a SR between 89 and 65.

A-732

Acute Physiology and Chronic Health Evaluation II (APACHE II) score predicts early surgical complications in head and neck cancer patients admitted to critical care

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Background and Goal of Study: The surgical treatment of head and neck cancer can be limited by the risk of postoperative complications. Early identification of risk factors based on clinical characteristics may assist therapeutic planning. We assessed the value of the APACHE II (Acute Physiology and Chronic Health Evaluation II) score in predicting early surgical complications.

Materials and Methods: 461 free flap operations from January 1995 to December 2002 were evaluated using the APACHE II score. Preliminary data was available on 338 (73.3%) operations. The outcome measure was early surgical complications (haematoma, bleeding, flap failure) within 72 hours. Chi squared test for linear trend was used to assess the association.

Results and Discussions: 57/461 (12.3%) operations had early surgical complications. Overall flap failure was 23/461 (5.0%). Both the number of immediate surgical complications ($P = 0.01$) and flap failures ($P = 0.002$) had a highly significant correlation with APACHE II scores.

APACHE II Score	n (%)	Early surgical complication	
		No (%)	Yes (%)
1-9	127 (28)	109 (24)	18 (4)
10-14	122 (27)	107 (23)	15 (4)
15-19	69 (15)	52 (11)	17 (4)
20+	20 (4)	13 (3)	7 (1)

Conclusion: The APACHE II scores are strongly predictive of early surgical complications in the perioperative period. The reasons for this are unclear but may be related to the degree of surgical tissue trauma leading to physiological derangement.

Reference:

Riberio K, Kowalski LP. APACHE II, POSSUM and ASA scores and the risk of perioperative complications in patients with oral or oropharyngeal cancer. *Arch Otolaryngol Head Neck Surg.* 2003;129:739-45.

A-733

Cerebral oxygen metabolism and EEG frequency pattern during moderate hypothermia (32°C) in piglets

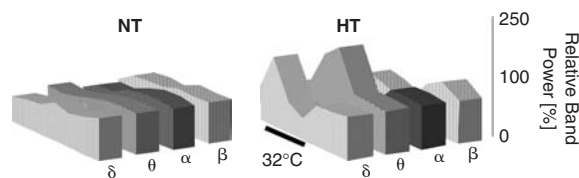
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Background and Goals of Study: The neuroprotective effect hypothermia is mainly caused by a reduction of cerebral oxygen metabolism (CMRO₂) (1). The hypothermic decline in cerebral metabolism has been more closely linked to temperature effects on physicochemical processes than cerebral function, as represented by the electroencephalogram (EEG) (2). We, therefore, investigated the changes in electrocortical activity and CMRO₂ under hypothermic conditions.

Materials and Methods: After IRB approval 12 female piglets (6 weeks old; body weight: 12,0-14,5 kg) were anaesthetised (Fentanyl/Midazolam/Pancuronium) and maintained either at a brain temperature of 38°C (NT) or cooled to 32°C (HT) for 6h, starting 1h after baseline data collection. The EEG was monitored for 24 hours and quantified using the Fast-Fourier-Transformation. The spectral band power was summarized for every 4 seconds (total band: 1-30 Hz; δ : 1-4 Hz; θ : 4-8 Hz; α : 8-13 Hz; β : 13-30 Hz). The CMRO₂ was measured at control, start of cooling, before rewarming (end of hypothermia) and end of the experiment (24 hours) using colored microspheres.

Results: During hypothermia the CMRO₂ decreased by 50% ($p < 0.01$) and the total band power by 30% ($p < 0.05$) from baseline. The relative changes in frequency pattern are shown in Fig. 1.



Conclusions: At a moderate hypothermia level (32°C brain temperature) the cerebral oxygen metabolism is more depressed in comparison to the electrocortical function. The reduced total electrocortical activity is accompanied by a deceleration of the frequency pattern (relative increase of the θ - and δ -band).

References:

- Clifton GL et al., *J Cereb Blood Flow Metab* 1991; 11: 114-121.
- Nemoto EM et al., *J Neurosurg Anesthesiol* 1996; 8: 52-56.

A-734

Tissue oxygenation monitoring using microdialysis and Nuclear Magnetic Resonance Spectroscopy

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Background and Goal of Study: Currently there is no gold standard in regional tissue oxygen monitoring (1). Microdialysis (CMA, Solna, Sweden) is a technique that collects localized tissue fluid reflecting intracellular processes. Proton Nuclear Magnetic Resonance (NMR) Spectroscopy employs the magnetic properties of protons to produce a spectrum of proton-containing molecules within a sample. We utilized both methods to monitor local tissue oxygenation via lactate quantification.

Materials and Methods: Microdialysis samples were collected from 5 healthy volunteers' and 5 critically ill patients' brachioradialis muscle. Perfusion fluid was circulated within the catheter where diffusion occurs across a 20 KDa Dalton dialysis membrane. Samples were collected at 0.3 microlitres/min over 10 hours allowing virtually 100% recovery of small molecules. The sample was then split to allow comparison and assessment of reliability of lactate quantification when using NMR Spectroscopy compared with the CMA enzymatic method.

Results and Discussions: 10 samples could be analysed by both methods. One sample had to be excluded due to haemoglobin contamination. The Bland and Altman plot in Figure 1 demonstrates a good level of agreement between the two methods of measurement.

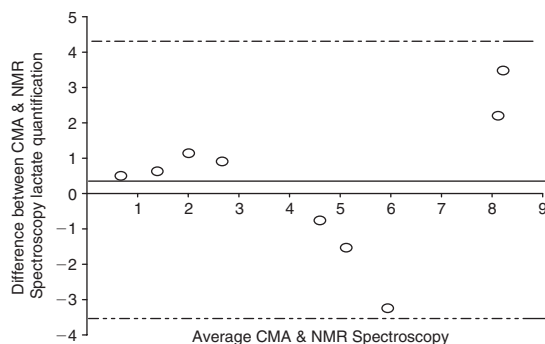


Figure 1. Bland and Altman of both methods of lactate measurement.

Conclusion(s): Tissue oxygenation monitoring requires more discreet methods of measurement. We have demonstrated the feasibility to collect local tissue fluid using microdialysis and NMR spectroscopy as an analysis technique that is reliable when compared to enzymatic methods.

Reference:

- Dantzker DR. *Chest* 2001; 120: 701-2.

Resuscitation and Emergency Medicine

A-735

A comparison of touch sensitivity through microthin, latex free and standard surgical gloves

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Background and Goal of Study: Sterile gloves should be worn for all invasive procedures (1). However, compliance amongst anaesthetists has been persistently poor (2,3). One explanation is that gloves reduce touch sensation, making performing such procedures more difficult. The aim of this study is to investigate whether new glove types such as "microthin" or latex free gloves offer better touch sensitivity than standard surgical gloves.

Materials and Methods: Nine modified von Frey filaments producing forces from 0.5 mN to 17 mN were constructed. Each subject was tested with standard Biogel (SB), "microthin" Ansell Microthin (AM), latex free Biogel Neotech (BN) gloves ordered with a counter-balancing algorithm to eliminate learning bias from the analysis. Twenty-four subjects wore gloves of appropriate size and were blinded to glove type. Filaments were applied perpendicularly to the pulp of the dominant index finger. Non-parametric repeated measure analysis was by the Friedman statistic with follow-up by the Wilcoxon Signed Rank Test.

Results and Discussion: The median (IQR) threshold forces to touch were SB 0.65 (0.45–0.75), AM 0.45 (0.32–0.65), BN 0.70 (0.55–1.3) mN. AM gloves had a significantly lower threshold force to touch than SB ($p = 0.014$) and BN gloves ($p = 0.001$). Both differences remained significant at $p < 0.05$ after Bonferroni correction for multiple comparisons. Lower threshold force with Ansell microthin gloves indicates greater touch sensitivity during glove use.

Conclusion: This study showed that microthin gloves allowed significantly better touch sensitivity than standard latex gloves. We found no difference in the reduction in touch sensitivity caused by latex free when compared to standard latex gloves despite anecdotal reports of poor performance. Our findings should encourage more widespread glove use in normal and latex sensitive patients.

References:

- 1 The Association of Anaesthetists of Great Britain and Ireland. *Infection Control in Anaesthesia*. London, UK: 2002.
- 2 O'Donnell N, Asbury AJ. *Anaesthesia* 1992; **47**: 923–8.
- 3 Mikatti N, Dillon P, Healy TE. *Anaesthesia* 1999; **54**: 13–18.

A-736

Low rate of repeated inappropriate emergency physician use in a German urban emergency medical service

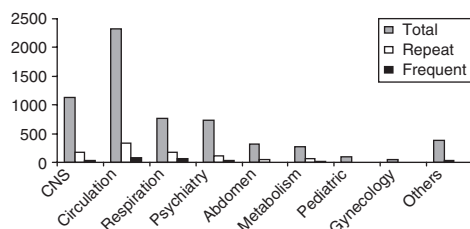
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Background and Goal of the Study: Repeated inappropriate use of emergency medical services results in excessive costs [1]. Accordingly, this retrospective survey focused on patients who requested on-the-scene emergency medical service (EMS) including emergency physician (EP) interventions in a city with 250,000 inhabitants.

Material and Methods: Following data from the local EMS computerised database were retrospectively analysed for the period from January to December of 2002: total number of EP interventions, number of repeat EP-users with two to three calls, number of frequent EP-users with more than three calls, intervention duration on-the-scene. Inappropriate users were defined as patients with no apparent underlying distress on-the-scene, no medical history matching the cause of distress, lack of preclinical findings which could explain the symptoms initially mentioned, and refuse of hospital referral by the patient.

Results: 6064 EP interventions were analysed. The rate of the repeated use was 15.5% including 3.6% frequent users. The main medical causes of repeat EP use were cardiovascular, neurological, respiratory, and psychiatric (see figure). The rate of repeated inappropriate use was 0.2% associated with total costs of about 2400 € per year.



The figure shows total case numbers (all) including repeated (2–3/year), and frequent (more than 3/year) EP-use in 2002 divided into different organ systems of patients complaint. CNS = central nervous system.

Conclusion: The rate of repeated inappropriate EP use in this middle sized town was low. More than four fifths of all repeated calls were for cardiovascular, respiratory, neurological, and psychiatric distresses.

Reference:

- 1 Chi CH, Lee HL, Wang SM, et al. *Formos Med Assoc* 2001; **100**: 14–19.

A-737

Emergency Department thoracotomy – life saving procedure – case report

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Background and Goals: We did not come across specific protocols in the literature data concerning the indications for Emergency Department thoracotomy. Our goal was to present our experience of successful treatment of the patient with isolated penetrant chest injury.

Material and Methods: 25-year-old male patient with a left hemithorax injury was admitted to our hospital. His injury was caused by shrapnel of exploded shell and he received no medical aid prior to his admission to hospital. He was in the state of severe haemorrhagic shock, somnolent, vital signs were present and cardiac arrest occurred immediately after the admission. We initiated resuscitation measures, fluid replacement and endotracheal intubation. For a purpose of direct heart massage and bleeding control we decided to perform a thoracotomy in the Emergency Department. A vascular clamp was placed on the ruptured right lung's hilum. After successful resuscitation patient was transferred in the operating room to receive his definite surgical treatment.

Results: On the second postoperative day the patient was conscious, breathing spontaneously, extubated and mobilised. Pleural effusion in the right hemithorax was an early complication and bronchial fistula developed later on. He was discharged without any neurological sequela.

Conclusion: Emergency Department thoracotomy as a "life saving procedure" justified its place in the emergencies like isolated penetrant chest injury with threatening cardiac arrest.

A-738

Onset time and effectiveness of drugs after intraosseous bolus administration in adults – a model investigation using succinylcholine in a clinical setting

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Background and Goal of Study: In recent years, the intraosseous (IO) route for administration of drugs and fluids receives attention, since a variety of devices to facilitate the procedure is available for use in adult victims of e.g. hemorrhagic shock, mass and combat casualties, severe hypothermia or burns, where intravenous access may not be immediately obtainable. It was the aim of this study to determine whether IO administration of succinylcholine as a model substance for fast acting drugs in emergency medical care would result in delayed or reduced onset of action.

Materials and Methods: After IRB approval and written informed consent, 16 patients (8 males and 8 females, mean age 63.25 (37–83) yrs, ASA II–III) scheduled for perioperative bone marrow aspiration according to a surgical study protocol were included. General anaesthesia was induced with sufentanil (0.3 µg/kg) and propofol (2.5 mg/kg). Airways were secured by mask ventilation while the iliac crest was punctured with a 12-G bone marrow aspiration device (MDT, Gainesville, FLA, USA). After aspiration of blood samples 1 mg/kg of succinylcholine was injected as a rapid intraosseous bolus. Decline of neuromuscular response was monitored by acceleromyography (Organon Teknika, Boxtel, NL; single-twitch-stimulation, 1 Hz/60 mA) of the m. adductor pollicis after calibration (initial reading before injection of succinylcholine set to 100%). The trachea was intubated when the twitch response had declined to 0% or a stable minimum reading. Intubating conditions were assessed according to current scores (1).

Results and Discussion: IO access was possible in all patients. Intubation of the trachea was easily accomplished in all patients with acceptable (1)

intubating conditions. The mean onset time of succinylcholine was 52 sec (SD \pm 16.35, 30–97 sec), thus reflecting data for its onset time on IV use (2). **Conclusions:** IO bolus application of drugs is possible without a clinically relevant delay or reduction of effect.

References:

- 1 Heir T, Feiner JR, Lin J, Brown R, Caldwell JE. *Anesthesiology* 2001; 94:754–9.
- 2 Donati, F. *Anesthesiology* 2003; 99:1037–8.

A-739

Deteriorating renal function in the first 24 h following emergency abdominal surgery is an independent predictor of outcome

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Background and Goal of Study: Mortality following emergency abdominal surgery is high. We tested the hypothesis that a deterioration in renal function from pre (Day 0) to post (Day 1) emergency abdominal surgery is associated with an increased 30-day mortality.

Methods: Retrospective cohort study of 262 patients aged over 50 who underwent emergency abdominal surgery. The variables analysed included, age, sex, severity of surgery, Day 0 and Day 1 urea and electrolytes and 30-day mortality. Appropriate statistical analysis was carried out using logistical regression analysis and Chi-square test.

Results and Discussions: The median age was 68. Over half were female (55%). 30-day mortality was 28%. Age, severity of surgery and changes in bicarbonate, urea and creatinine predicted 30-day mortality on univariate analysis (table).

Baseline characteristics	Odds ratio (95%CI)	p-value
Age <70/ \geq 70 years	1.84 (1.06–3.22)	0.032
Male/female	1.45 (0.83–2.52)	0.19
Severity of surgery	2.92 (1.76–4.85)	<0.001
Change Day 0 to 1		
Bicarbonate (mmol/l)	0.88 (0.82–0.96)	0.004
Urea (mmol/l)	1.18 (1.06–1.32)	0.002
Creatinine (μ mol/l)	1.02 (1.01–1.03)	<0.001

Severity of surgery (2.24, 95%CI 1.16–4.3, $p = 0.016$) and change in creatinine (1.02, 95%CI 1.01–1.03, $p < 0.001$) remained independent variables on multivariate analysis.

Conclusion: In addition to the severity of surgery deteriorating renal function in the first 24 h following emergency abdominal surgery is an independent predictor of outcome.

A-741

Hypertonic saline attenuates end organ damage in the setting of lower torso ischaemia reperfusion injury

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Background and Goal of Study: The reperfusion injury that occurs following an episode of acute lower torso ischaemia, may be associated with both local and systemic pro-inflammatory responses which can be detrimental to either limb or patient survival. The associated systemic inflammatory response, of which lung is the most pertinent manifestation, represent the complex interplay between cytokine production and pro-inflammatory mediators resulting in neutrophil recruitment and activation. Resuscitation with hypertonic saline restores the circulating volume and has favourable effects on tissue perfusion and blood pressure as well as attenuating neutrophil activation. The purpose of our study was to evaluate the effects of hypertonic saline resuscitation on end organ and skeletal muscle damage produced by ischaemia reperfusion injury.

Methods: Adult male Sprague Dawley rats ($n = 27$) were randomised into three groups: control group, I/R group treated with normal saline and I/R group treated with hypertonic saline. Bilateral hind-limb ischaemia was induced by rubber band application proximal to the level of the greater trochanters for 2.5 hours. Treatment groups received either normal saline or hypertonic saline prior to tourniquet release. Following twelve hours reperfusion, muscle function was assessed electrophysiologically. The animals were sacrificed and skeletal muscle and lung tissue harvested for evaluation histologically and immunochemically.

Results: Hypertonic saline significantly attenuated skeletal muscle reperfusion injury as shown by reduced myeloperoxidase content, wet to dry ratio and electrical properties of skeletal muscle. There was a corresponding reduction in lung injury as demonstrated by reduced myeloperoxidase content, wet to dry ratio and histological analysis. In addition, a significant reduction in serum IL-6 levels was observed in the hypertonic saline resuscitated group.

	Control	I/R saline	I/R hypertonic saline
MPO lung (U/kg)	2.69 \pm 0.55	4.37 \pm 0.23	3.83 \pm 0.39 ($P < 0.026$)
Wet/dry lung	3.08 \pm 0.12	3.55 \pm 0.24	3.29 \pm 0.23 ($P < 0.027$)
IL-6 (pg/ml)	100 \pm 12	206 \pm 41	165 \pm 32 ($P < 0.04$)

Conclusion: Resuscitation with HTS attenuates both end organ and skeletal muscle damage associated with ischaemia reperfusion injury.

A-742

Effects of small volume resuscitation alone or in combination with vasopressin on brain tissue oxygenation in uncontrolled haemorrhagic shock after penetrating liver trauma

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Background and Goal of Study: Hypotensive patients with penetrating torso injuries may have a better chance to survive when aggressive fluid resuscitation is replaced by small volume resuscitation until surgical intervention (1). Vasopressin may be an alternative vasopressor to control hypotension (2). The purpose of this study was to evaluate the effects of a hypertonic-isooncotic starch solution alone or in combination with vasopressin, on haemodynamic variables and brain tissue oxygenation in an animal model of uncontrolled haemorrhagic shock with near fatal hypotension.

Materials and Methods: Following approval of the Animal Investigational Committee, 16 anaesthetised piglets (12 to 16 weeks, 38 to 42 kg) underwent a simulated penetrating liver trauma. When mean arterial pressure was less than 20 mmHg, and heart rate declined progressively for more than 30% of its peak value, all animals were randomly assigned to receive either a hypertonic saline starch solution (HHS; 4 ml/kg over 2 min; $n = 8$) or a bolus dose of vasopressin (0.4 U/kg) combined with HHS (Vaso/HHS; $n = 8$). FiO_2 was raised to 100%. Thirty minutes after drug administration, bleeding was controlled by manual compression of the liver. All surviving animals were observed for one hour, while ventilated with a FiO_2 of 50%.

Results: Mean arterial blood pressure (MAP), cerebral perfusion pressure (CPP), end-tidal PCO_2 , and brain tissue oxygen pressure (PbtO₂) decreased significantly ($P < .05$) with haemorrhage in both groups. Apart from a transient peak of MAP and CPP after Vaso/HHS, resuscitation with both HHS and Vaso/HHS resulted in a comparable restoration of MAP, CPP and et PCO_2 . PbtO₂ increased significantly ($P < .05$) after treatment with both HHS and Vaso/HHS; the increase of PbtO₂ after Vaso/HHS was delayed but of longer duration when compared to HHS alone.

Conclusion: Following uncontrolled haemorrhagic shock in this porcine model, small volume resuscitation with hypertonic-isooncotic starch solution alone or in combination with vasopressin rapidly restored haemodynamic parameters and, in particular, brain tissue oxygen pressure.

References:

- 1 *Acta Anaesthesiol Scand.* 2002; 46:625–38.
- 2 *Crit Care Med.* 2003; 31:1160–5.

A-743

Improved outcome in prehospital resuscitation with norepinephrine in uncontrolled hemorrhagic shock

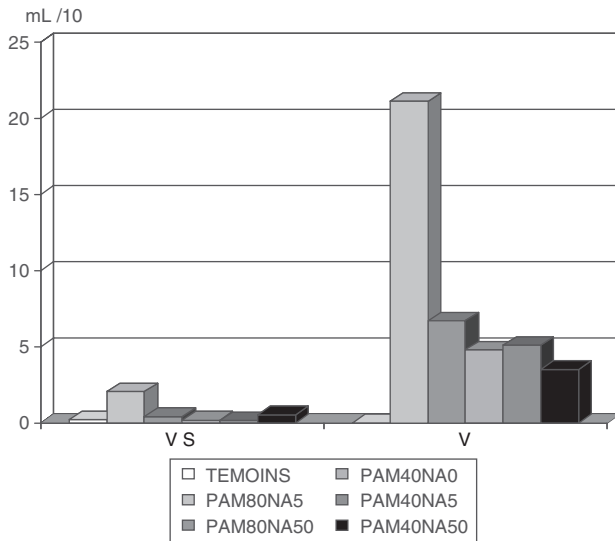
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Background: This study was done to examine the effects of using norepinephrine in the treatment of uncontrolled hemorrhage.

Methods: 60 rats had a 3 mL per 100 g of blood withdrawn, followed by an uncontrolled hemorrhage produced by tail amputation. Experimental design consisted of three phases: a "prehospital phase" (uncontrolled bleeding), followed by a "hospital phase" (control of hemorrhage and resuscitation with blood transfusion), and a three day-observation. Rats were randomly assigned to different groups: Group 1 consisted of untreated controls; Groups 2, 3, 4, and 5 had prehospital resuscitation to a mean arterial pressure (MAP) of 40 mmHg; Groups 6, 7, 8, and 9 had prehospital resuscitation to a MAP

of 80 mmHg. Group 10 was made out of shams. Each group received one of the four norepinephrine (NE) adjunction regimens: 0 $\mu\text{g}/100\text{g/h}$ for Groups 2, 6; 5 $\mu\text{g}/100\text{g/h}$ for Groups 3, 7; 50 $\mu\text{g}/100\text{g/h}$ for Groups 4, 8, and 500 $\mu\text{g}/100\text{g/h}$ for Groups 5, 9.



Results: Attempts to achieve normal MAP without using NE during uncontrolled bleeding increased blood loss, and mortality. All rats treated with high rates of NE (Groups 4 and 9) died during the prehospital phase. However, using intermediate NE (5 and 50 $\mu\text{g}/100\text{g/h}$) in either hypotensive or normotensive resuscitation resulted in improved survival.

Conclusion: Normotensive resuscitation seems to be possible without increasing neither mortality nor blood loss, by using NE (50 $\mu\text{g}/100\text{g/h}$).

A-744

Influence of the impedance threshold valve (ITV) on ventilation with different airway devices

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Background and Goal of Study: The use of an impedance threshold valve (ITV) improves cerebral and myocardial perfusion by more than 80% during cardiopulmonary resuscitation by preventing air from passively entering the thorax and therefore increasing venous return to the heart (1). The effect on airway resistance has not been addressed so far. An ITV (ResQPOD, Zoll Medical Corp.) is tested in different airway devices provided frequently for emergency airway management in physician-staffed ambulance systems (2).

Materials and Methods: In a bench model consisting of a Ambu Megacode Station connected to a PC (Megacode software 2.23), standardized ventilation (IPPV, respiratory rate 12/min, tidal volume 750 ml) was performed with a Draeger Oxylog 3000 (Draeger medical). Tidal volumes and peak airway pressures were measured. 3-minute cycles (10 per device) were performed with facemask, tracheal tube (7.5), Combitube (37 Fr., oesophageal position), LMA-Classic (#4) and Laryngeal Tube (#4). Ventilation cycles were repeated with the ITV (total 50 cycles without, 50 cycles with ITV). Cuff pressures were adjusted to 80 cmH₂O were applicable. For statistical analysis, the t-test was used.

Results and Discussions: Tidal volumes (mean \pm SD) and peak airway pressures for the airway devices without/with ITV were 588 \pm 22/579 \pm 17 ml and 13.4/14.9* cmH₂O for facemask, 730 \pm 7/690* \pm 3 ml and 15.8/16.0 cmH₂O for tracheal tube, 733 \pm 6/707* \pm 3 ml and 16.7/16.8 cmH₂O for Combitube, 540 \pm 12/530 \pm 12 ml and 12.8/13.6* cmH₂O for LMA-Classic and 713 \pm 6/691* \pm 3 ml and 15.6/16.1* for Laryngeal Tube (* = $p < 0.01$ compared to ventilation without ITV). Tidal volume with ITV decreased by 1.5% for facemask, 5.5% for tracheal tube, 3.5% for Combitube, 1.9% for LMA-Classic and 3.1% for Laryngeal Tube.

Conclusion(s): While the ITV has significant influence on ventilation with several of the airway devices tested, the changes in tidal volume are of little clinical relevance. The small adverse effect on ventilation is by far outweighed by the ITV's positive effect on cardiac output.

References:

- 1 Lurie KG, Crit Care Med. 2002;30(Suppl.):S162-165.
- 2 Genzwuerker HV, Anaesthesist 2002;51:367-373.

Acknowledgements: ITV and airway devices were provided by the respective manufacturers.

A-746

Prehospital airway management with the Laryngeal Tube Suction (LTS®) during CPR in a patient with known difficult airway

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Introduction: Endotracheal Intubation remains the gold standard for securing the airway, but fails in 1% of prehospital patients. (1) In-hospital face mask ventilation proves difficult in 5% of patients, in 0,1% adequate ventilation is not possible. (2) Alternatives to intubation and facemask ventilation must be part of the standard equipment of services providing advanced life support to allow management of out-of-hospital difficulties. The Laryngeal Tube Suction LTS® has been discussed as an alternative device for airway management. (3) It was introduced in our physician-staffed ACLS system in 2002 as part of a prehospital difficult airway concept. The successful use of the LTS® in a patient with known difficult airway during out-of-hospital CPR is described.

Case Report: The emergency physician (5 years experience in anaesthesiology) responds to a 63-year-old male patient (175 cm, ca. 100 kg) found unconscious on the floor by his wife. The initial ECG shows ventricular fibrillation and CPR is started immediately following ILCOR guidelines. Face mask ventilation is possible but difficult. After two intubation attempts by the emergency physician that fail due to inability to visualize the epiglottis, the wife remembers that she was told by an anaesthetist during a prior hospital stay that her husband cannot be intubated. When face mask ventilation becomes increasingly difficult, the emergency physician decides to place a LTS® (Size #4). Placement is successful in the first attempt, followed by sufficient bag ventilation (bilateral breath sounds, no gastric insufflation of air detectable by auscultation, positive capnometry reading). A gastric tube is placed through the second lumen of the LTS, air and gastric contents can be suctioned. After approximately 15 minutes of CPR (defibrillation twice with 200 J, 4 \times 1 mg epinephrine i.v.), return of spontaneous circulation is achieved (pulse 80/min, blood pressure 100/50 mmHg, SpO₂ 96%). The patient is transported to the ICU where nasotracheal fiberoptic intubation is performed at the ICU with the deflated LTS in place. The patient dies 12 hours later due to the massive myocardial infarction that caused the cardiac arrest.

References:

- 1 Adnet F. Ann Emerg Med 1998;32:454-60.
- 2 Langeron O. Anesthesiology 2000;92:1229-36.
- 3 Genzwuerker HV. Resuscitation 2002;55:62.

A-748

Predictors of survival following in-hospital cardiac arrest

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Background and Goals: A still open issue in the National and International scientific literature is to answer this question: "if an adult is admitted to hospital and suffers a cardiac arrest how likely is the patient to survive to initial resuscitation and which are the predictors of survival?" (1).

Materials and Methods: The study was conducted in a 980-beds teaching hospital about patients admitted to either monitored areas (critical care beds) or non monitored areas (general wards). All the patients who suffered from an in-hospital cardiac arrest during a 31-month period, January 2001-July 2003, were recorded and described according to Utstein Style (2). The χ^2 -test was used for categorical and Fisher test for continuous data.

Results and Discussion: 100 patients (age 64.58 \pm 18.61 yrs) were included. Of the 100 patients, 55% weren't able to be resuscitated (Restoration Of Spontaneous Circulation [ROSC] not obtained), 45% survived to initial resuscitation of which 21% died subsequently in ICU (Intensive Care Unit) and 24% survived to ICU discharge.

Survival was significantly increased for patients with primary cardiac disease ($\chi^2 = 9.38, P < .001$), for patients in monitored areas ($\chi^2 = 8.97, P < .05$), in case of ventricular fibrillation or ventricular tachycardia as initial rhythm ($\chi^2 = 14.97, P < .001$), for short time intervals between collapse and first cardio-pulmonary resuscitation (CPR) procedures ($F = 3.76, P < .05$) and in case of short duration of CPR ($F = 32.39, P < .001$).

Conclusions: Statistical analysis has shown an initial survival rate of 45% (21% patients died after ICU admission + 24% patients survived to ICU discharge). Primary cardiac disease, monitored areas, initial ventricular fibrillation or tachycardia, short time interval from collapse to treatment and short CPR duration can be considered as positive predictive factors of survival to initial resuscitation.

References:

- 1 Brindley P.G., Markland D.M., Mayers I. et al *CMAJ* 2002; 167(4): 343–348.
- 2 Skogvoll E., Isern E., Sangolt G.K. et al *Acta Anaesthesiol Scand* 1999; 43(2): 177–184.

A-749

Concentration of hormones regulating water and electrolytes balance in patients after cardiac arrest

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Background and Goals: The aim of our study was the assessment of level of hormones paying main biological functions in regulation of water and electrolyte balance in patients after cardiac arrest (CA).

Material: 45 patients (pts) divided in 2 groups. Group I – 22 pts after CA, 17 men and 5 women, in the age 64 ± 13 ys. CA was caused by ventricular fibrillation in 14 cases and by asystolia in 8. In 16 pts CA appeared in acute coronary syndrome. 50% pts died during hospital treatment. Group II – 23 pts, aged 60 ± 11 ys, 20 men and 3 women, with stable coronary artery disease.

Methods: In Group I vein blood samples were taken just after CA and in 2 consecutive days at 8.00 a.m. In them we assessed the concentrations (Conc) of hormones (horm): adrenocorticotrophic hormone (ACTH), cortisol (Cort), renin, aldosterone (Aldo), vasopressin (AVP) and N-terminated natriuretic propeptide type B (NT-pBNP). In pts of Group II concentrations of above mentioned hormones were assessed once from blood sample taken at 8.00 a.m. Results were analyzed by statistical methods.

Results: Data (mean \pm SD) are shown in the table:

Conc. of horm. just after CA	ACTH (pmol/l)	Cort (nmol/l)	Renin (pmol/l)
Group I	36,6 \pm 39,4	3007 \pm 5104	33 \pm 85,6
Group II	8,1 \pm 4,4	414 \pm 138	2,42 \pm 1,8
p	<0,004	<0,000001	<0,0006

Conc. of horm. just after CA	Aldo (pmol/l)	AVP (pmol/l)	NT-pBNP (pmol/l)
Group I	1442 \pm 1803	846 \pm 437	43266 \pm 81642
Group II	527 \pm 527	70 \pm 46	2092 \pm 2375
p	<0,02	<0,000001	<0,0002

In pts after CA, died in hospital, compared to pts after CA, survived, remarkable higher concentration of Cort and Renin and lower ACTH and AVP were found.

Conclusions: 1) There is strong activation of hormonal mechanisms regulating water–electrolyte balance and controlling blood pressure in pts after CA. 2) High concentration of cortisol with concomitant improper increase of ACTH suggests bad resolution in pts after CA.

References:

- 1 Mysiak A. *Pol Merkuriusz Lek* 2000; 8: 424–429.
- 2 Yilmazlar A, et al. *J Emerg Med* 2000; 18: 405–408.

A-750

Administration of vasopressin during cardiopulmonary resuscitation improves cerebral histopathological outcome after CA in rats

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Background and Goal of Study: Successful cardiopulmonary resuscitation (CPR) after cardiac arrest (CA) requires the use of vasoconstrictors. Intravenous adrenaline (epinephrine) has been used as first line drug since 1906, but evidence of effectiveness remains unclear (Class intermediate, (1)). Upcoming evidence rises hope that vasopressin could be more effective in CPR after CA. In order to assess possible benefits, vasopressin versus

adrenaline and the combination of both was tested against placebo in a CA model with rats.

Materials and Methods: After institutional approval was obtained from the Governmental Animal Care Committee, global cerebral ischaemia was initiated by ventricular fibrillation in rats during general anaesthesia. After 6 minutes, the animals (n = 8 per group) were resuscitated by external cardiac massage combined with defibrillation and divided into four groups receiving different vasoconstrictors (G1: 0.4 U/kg vasopressin, G2: 20 μ g/kg adrenaline and G3: 0.2 U/kg vasopressin combined with 10 μ g/kg adrenaline vs. G4: placebo) in a randomized and blinded setting. Primary survival rate and long-term survival was determined. After 7 days of reperfusion surviving animals were reanaesthetised and decapitated. Coronal brain sections were analyzed by Nissl-staining and viable neurons were counted in the hippocampal CA1 sector. Statistical analysis was performed using the Kuskal-Wallis, the Wilcoxon and Chi-square test (mean \pm SD; p < 0.05 = significant).

Results and Discussions: All animals of the groups 1–3 (versus none in G4) could initially be stabilized. Seven day survival did not differ significantly (G1 5/8; G2 4/8; G3 4/8; p = 0.86). Nissl-staining of the hippocampal CA1 sector revealed significantly more viable neurons in the vasopressin group (G1; 49 \pm 14; p = 0.0001) than in the adrenaline group (G2; 23 \pm 1; p < 0.01) and combined group (G3; 18 \pm 6; p < 0.01).

Conclusion(s): Administration of vasopressin during CPR improves cerebral histopathological outcome after CA in rats, in comparison to adrenaline or adrenaline combined with vasopressin.

Reference:

- 1 Handley AJ et al. *Resuscitation* 2001; 48: 199–205.

A-751

Myocardial function following cardiopulmonary resuscitation in a pig model of myocardial infarction

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Background and Goal of Study: Results in research on cardiopulmonary resuscitation (CPR) in different animal models and outcome in humans undergoing CPR, still differ. One reason for this discrepancy could be that experimental studies use young and healthy animals while in most cases humans undergoing CPR suffer from acute or chronic myocardial dysfunction [1]. To overcome this problem, we developed a pig model of myocardial infarction which compromises myocardial function significantly without rendering CPR impossible.

Materials and Methods: A median thoracostomy was performed in 12 pigs and they were instrumented for measurement of mean arterial pressure (MAP), left ventricular pressure (LVP) and cardiac index (CI). LVP was processed for maximal contractility (dP/dt). Animals in group 1 (G1, n = 6) received no further preparation. In group 2 (G2, n = 6) myocardial infarction was induced by clipping the circumflex artery (RCX) close to its origin, which was performed immediately after induction of a four minute cardiac arrest by ventricular fibrillation. CPR was carried out according to the AHA guidelines. Statistical analysis: Mann-Whitney-U-test, p < 0.05 considered significant, data expressed as mean \pm SD.

Results and Discussions: At baseline there were no significant differences between G1 and G2. All animals were resuscitated successfully. Myocardial infarction affected 39 \pm 5% (G2) of the mass of the left ventricle and resulted in a significantly reduced cardiac index and myocardial contractility after return of spontaneous circulation (ROSC).

#p < 0.05	dP/dt (mmHg/sec)		CI (ml/min/kg)	
	G1	G2	G1	G2
Baseline	1198 \pm 99	1331 \pm 223	119 \pm 19	131 \pm 19
ROSC + 8	1695 \pm 208	1642 \pm 602	133 \pm 34	98 \pm 35
ROSC + 15	1324 \pm 229	937 \pm 483	110 \pm 30	49 \pm 37 [#]
ROSC + 20	1279 \pm 219	507 \pm 146 [#]	100 \pm 24	45 \pm 30 [#]
ROSC + 30	1323 \pm 305	587 \pm 92 [#]	87 \pm 19	34 \pm 32 [#]

Conclusion: Clipping of the RCX provides reproducible myocardial infarction in pigs and leads to a significant decreased myocardial function after CPR. Therefore, this setup provides a clinically highly relevant model for future CPR studies.

Reference:

- 1 Wennerblom, B. and S. Holmberg. *Eur Heart J*, 1984. 5(4): p. 266–74.

Acute and Chronic Pain Management

A-752

Can dexmedetomidine substitute sufentanil in anesthesia for abdominal surgery in elderly patients?

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Background and Goal of Study: Dexmedetomidine, an alpha 2 specific agonist, induced the curiosity of the anesthesiologists about the possibility of its intraoperative use, because of its sedative and analgesic potential¹. This drug has been utilized always combined to opioids with the purpose of reducing other analgesic consumption, avoiding hemodynamic changes during intubation or in procedures where lower pressure and/or cardiac frequency are required. Persist, however, a doubt about the possibility of its use as the only analgesic agent (without any opioid) during surgery with a high pain stimuli, as abdominal surgery and in elderly. Answering this questions was the purpose of this research.

Materials and Methods: 41 patients were divided into two groups – Gs (n = 21) who received sufentanil, and Gd (n = 20) who received dexmedetomidine for induction and maintenance. Isoflurane and N₂O were also utilized during maintenance. Hemodynamic attributes (medium arterial blood pressure and heart rate), awareness and extubation times, local of extubation (OR) operation room or (RR) recovery room, RR stay time, Aldrete-Kroulik index, complication in both ambients, additional analgesia and antiemesis during RR time, were evaluated.

Results and Discussion: The groups were homogeneous. There wasn't any difference considering hemodynamic stability in both groups and Gd had a smaller awareness, extubation and RR time, effects of the lack of residual respiratory depression² and superficial sedation³ of the dexmedetomidine when compared to sufentanil. The patients who received dexmedetomidine had a smaller need of antiemetic drugs in RR and a tendency to receive higher Aldrete-Kroulik scores.

Conclusions: Dexmedetomidine can be used as isolated analgesic agent in anesthesia for abdominal surgery in elderly, with hemodynamic stability, smaller recovering time and better recovering characteristics after anesthesia when compared to sufentanil.

References:

- 1 Eisenach JC, DeKock M, Klimscha W. *Anesthesiology* 1996; 85:655–74.
- 2 Belleville JP, Wards DS, Bloor BC, et al. *Anesthesiology* 1992; 77:1125–33.
- 3 Aantaa R, Kallio A, Virtanen R. *Drugs Future* 1993; 18:49–56.

A-753

Pain tolerance and patient satisfaction with extracorporeal shock wave lithotripsy (ESWL) treatment

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Background and Goal of Study: Pain is an important side effect of ESWL. The new generation of piezoelectric lithotriptors produces less pain. For this reason, some urosurgeons tend to omit analgesic prescription for their patients. The aim of this study is to evaluate if ESWL is well accepted and tolerated without analgesia.

Materials and Methods: This prospective study included 51 outpatients treated for renal stones using the EDAP LTO2 piezoelectric lithotripter and to whom no analgesic treatment was prescribed by urosurgeons. Urosurgeons and patients were not informed about the aim of this study. At the end of ESWL session, patients and ESWL nurses were asked to evaluate pain and tolerance to the session and their wish for analgesia if another ESWL session was scheduled. Treatment was considered satisfactory by the urosurgeon if session duration was >30 minutes with a shock wave intensity >70% maximal power. Pain was considered "unacceptable" if there was 1 criteria GIII (G = grade) or 2 criteria GII, as "tolerable" if there was 1 criteria GII.

Results and Discussions: 19 females and 32 males were treated (mean age was 45 years), for a mean duration of 41 minutes with a mean of 80% of maximal power. Treatment was satisfactory in only 80% of patients.

Patient evaluation of pain:

Verbal Numerical Scale			If another ESWL, analgesia is:		
4	4–6	6	Unneeded	Preferred	Essential
G I	G II	G III	G I	G II	G III
67%	14%	20%	75%	14%	12%

Nurse evaluation of patient tolerance:

Patient tolerance			If another ESWL, analgesia is:		
Calm	Moving	Agitated	Unneeded	Preferred	Essential
G I	G II	G III	G I	G II	G III
88%	6%	8%	80%	8%	12%

From the above parameters, 13 patients (25%) had "unacceptable pain", 11 patients (22%) had "tolerable pain" and 27 patients (53%) had "no pain". Patient wish for analgesia was well correlated to Verbal Numerical Scale (linear regression test, R = 0.5 and p < 0.0001).

Conclusion: Although new generation lithotriptors are known to produce less pain, analgesic therapy is necessary for patient comfort and for good course and success of ESWL session.

A-754

Thoracic epidural opioids infusion versus spinal analgesia for thoracotomy pain

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Background and Goal of Study: The aim of this study is to compare the efficacy and safety of continuous thoracic epidural opioids infusion with spinal opioid analgesia after thoracotomy.

Materials and Methods: Elective thoracotomy planned 90 cases were allocated in three groups. While thoracic (T7–T8 or T8–T9) epidural infusion of fentanyl 5.8 µg/ml, morphine 0.07 mg/ml with levobupivacaine 1.25 mg/ml was given to group I, whereas fentanyl 25 µg and morphine 0.5 mg and Atropine 0.2 mg given through a spinal way (one single shot) to those in group II. This group received also continuous infusion of morphine (i.v.) beginning 18 hours after the surgery. The third group received lumbar (L2–L3) epidural infusion of fentanyl 5.8 µg/ml and morphine 0.07 mg/ml with levobupivacaine 1.25 mg/ml. The VQS (Verbal Quantitative Score), Ramsey sedation score, haemodynamic parameters and side effects of the cases were recorded at 4, 8, 12 and 24 hours after surgery.

Results and Discussion: Mean VQS value at 4 hours was significantly lower in group II (I vs II = 2.32 vs 1.32, p < 0.05). Mean VQS value at 12 hours was very similar in all three groups (I vs II = 2.13 vs 2.32), (III vs II = 2.56 vs 2.32) and at 24 hours was mean VQS lower in group I + III (I vs II = 1.98 vs 2.26), (III vs II = 2.20 vs 2.26). There was no difference in the incidence of vomiting between the groups rate of nausea and sedation were lower in the group I, however rate of pruritus was lower in group I. We have one case of severe respiratory depression in the group II.

Conclusion(s): All three methods provided good postthoracotomy analgesia. In our study spinal analgesia provided better analgesia with less side effects, but with shorter duration. This technique is also simple and easy to perform. It's only necessary to ensure the supplement of intravenous analgesia after 18 hours from the end of the surgery. It's preferable to check patient's with spinal subarachnoid analgesia in ICU because of possibility of respiratory depression.

Reference:

Baron CM., Kowalski SE., Greengrass R. *Anaesth Analg* 1996; 82(4):760–768.

A-755

Infusion with Ketoprofen (Profenid) and infusion with Parecoxib sodium (Dynastat) for postoperative pain relief in Gynecology

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Background and Goal of Study: The aim of our study is to find a method with better analgesic results and fewer adverse effects, which can be easily used for the postoperative treatment in Gynecology.

Material and Methods: After institutional approval 60 ASA I–II patients, undergoing elective gynecological operations were randomized in two groups. The groups were similar in age, weight and type of operations. All patients received the same induction and maintenance of anesthesia – group A (n = 30) and group B (n = 30). In all groups the infusions started after the extubation and transfer to the postoperative care unit for 12 hours at VAS > 5. In group A the patients received a loading dose of Profenid 100 mg, followed by maintenance infusion rate of Profenid in range: 16.5–18 mg/h up to 300 mg per day. Group B received 40 mg Dynastat i.v. bolus, followed by infusion of Dynastat with rate 3.2–4.0 mg/h up to 80 mg per day. The infusion rates of

both medicines were titrated until an effective analgesia was obtained (VAS < 3). Visual analogue scale (VAS) was used for postoperative pain degree (0–10). Pain intensity, heart rate, arterial pressure, and incidence of adverse effects of drug (nausea, vomiting) were assessed. The statistical analysis was performed by Student's t-test, Mann-Whitney U-test and Kolmogorov-Smirnov test.

Results and Discussion: Satisfactory analgesia was obtained by group A (VAS = 2.7) and by group B (VAS = 2.6). Haemodynamics was stable during the whole period of infusion. There was no significant difference between the treatment groups in total number of nausea and vomiting episodes.

Conclusion: The infusions of Dynastat and Profenid were safe and effective for postoperative analgesia in gynecological surgery.

A-756

Effect of oral dextromethorphan premedication on the intraoperative morphine requirement

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Background and Goals: Intraoperative pain has untoward effects on hemodynamic parameters. Due to complications of opioids for pain relief, use of nonopioids medication is preferred. The purpose of this study was to investigate the effect of oral dextromethorphan premedication on intraoperative morphine requirement.

Material and Methods: After approval of the Ethics committee and informed consent, 40 ASA-PS I and II adult patients under general anesthesia and elective laparotomy were selected and classified into two equal groups randomly. In group A, oral dextromethorphan (60 mg/dose) was administered at 10 P.M. and 6 A.M. preoperatively. In group B, placebo (dextrose) was administered. After induction of general anesthesia and before skin incision, morphine (0.01 mg/kg) was administered intravenously. During surgery, when systolic blood pressure or heart rate was increased more than 20% of the preoperative baseline, 0.01 mg/kg morphine was administered. At the end of surgery, the totally prescribed morphine (mg/kg) and maximal increase in systolic, diastolic, mean arterial blood pressure and heart rate relative to the baseline values were calculated and statistically compared with Student's t-test.

Results: Mean dosage of morphine administration during surgery was significantly less in group A ($P < 0.0001$). Also, maximal increase in systolic, diastolic and mean arterial blood pressure was significantly less in group A ($P < 0.003$, $P < 0.004$, $P < 0.0001$ respectively). There was no significant differences in maximal heart rate increase between two groups ($P < 0.114$).

Conclusions: This study showed that oral dextromethorphan premedication may decrease intraoperative morphine requirement and reduce maximal increase in systolic, diastolic and mean arterial blood pressure during surgery.

A-757

Epidural Morphine with Ropivacaine is superior to intravenous PCA with Morphine in alleviating pain after lumbar laminectomy

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Background: We compared the postoperative analgesic effect, the side effects and patients' satisfaction between Epidural Morphine with Ropivacaine and Intravenous Patient Controlled Analgesia (PCA) with Morphine after Lumbar Laminectomy (LL).

Material and Methods: 35 patients, 19 male and 16 female, aged 25–73 yrs, ASA I–II, scheduled for LL were randomized in two groups to receive either Morphine 3 mg with I Ropivacaine 0.2% 4 ml every twelve hours post-operatively via an 18 G epidural catheter inserted intraoperatively by the surgeon (group E, $n = 19$) or an intravenous PCA containing Morphine 1 mg/ml started immediately after recovery (group PCA, $n = 16$). All patients received Tropisetron 5 mg IV/24 h and Ketoprofen 100 mg IM/12 h. In the postoperative 72 hours, pain scores at rest, at cough and during mobilization were evaluated by the visual analogue scale (VAS1–10) every 6 hours. The following data were also recorded and documented every 6 hours: The need of rescue analgesia, nausea and vomiting, pruritus, sedation, respiratory depression, hemodynamic instability and urinary retention, Systolic, Mean and Diastolic Arterial Pressure, Heart Rate, and Oxygen saturation (SpO_2) and the patients' satisfaction regarding the effectiveness of the postoperative analgesia. Statistical Analysis: Parametric data were analyzed using the unpaired Student's "t" test and repeated measures analysis of variance

was used to analyze VAS scores for pain and side effects. Differences were statistically significant when $P < 0.05$.

Results: Demographic data were statistically comparable. Group E had lower ($P < 0.05$) VAS scores at rest, at cough and during mobilization. Side effects were slightly higher in group E but with no statistical or clinical significance. No respiratory depression or hemodynamic instability was recorded in any group. Patients in group E were more satisfied ($P < 0.05$) than the patients in group PCA.

Conclusions: Epidural Morphine with Ropivacaine is superior to intravenous PCA with Morphine in alleviating pain after lumbar laminectomy.

A-758

Ketamine has no preemptive analgesic effect in patients undergoing abdominal hysterectomy

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Background and Goal of Study: Preemptive analgesia with the NMDA-receptor antagonist ketamine is recommended for preventing central hyperalgesia and decreasing the intensity of postoperative pain (1). The aim of this study was to determine if preemptive administration of ketamine decreases postoperative pain when compared with administration of ketamine after skin closure in patients undergoing abdominal hysterectomy.

Material and Methods: After ethics committee approval, sixty patients aged 18–65 years, ASA grades I and II, undergoing elective abdominal hysterectomy were included in this prospective study. Anaesthesia was induced with 2 μ g/kg fentanyl, 2 mg/kg propofol, 0.5 mg/kg atracurium and maintained with 1–2% sevoflurane and 35% oxygen in N_2O . Patients were randomized into three groups according to a placebo-controlled, double-blinded protocol. Patients in Group 1 ($n = 20$) received saline IV (5 mL) before incision and after skin closure; patients in Group 2 ($n = 20$) received ketamine IV (0.4 mg/kg) before incision and saline IV (5 mL) after skin closure; patients in Group 3 ($n = 20$) received saline IV (5 mL) before incision and ketamine IV (0.4 mg/kg) after skin closure. All patients were started on IV morphine patient-controlled analgesia during the postoperative period. Postoperative pain was assessed by visual analogue scale (VAS), verbal rating scale (VRS), the time to first analgesic dose and morphine consumption. Patients were evaluated for sedation, quality of sleep and activity during the first 72 h. Student's t-test, Chi-square and Anova tests were used for statistical analysis. $P < 0.05$ was accepted as significant.

Results and Discussion: There were no significant differences between groups with respect to demographic data. No significant intergroup differences were seen in the time to first analgesic dose, VAS/VRS scores and morphine consumption. Patients in Group 1 (control group) had significantly lower sedation scores than either of the ketamine treated groups.

Conclusion: A single dose of ketamin 0.4 mg/kg had no preemptive analgesic effects when given before incision in patients undergoing abdominal hysterectomy.

Reference:

- 1 Power I, Barratt S. Analgesic agents for the postoperative period. Nonopioids. Surg Clin North Am. 1999; 79: 275–95.

A-759

Comparison of meperidine, tramadol and ketamine for analgesia and recovery after tonsillectomy

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Background and Goal of Study: Tonsillectomy is commonly performed in children, but unfortunately it is associated with intense postoperative pain. The purpose in this study was to evaluate the effects of ketamine, tramadol or meperidine on postoperative pain and recovery in children undergoing tonsillectomy.

Material and Methods: After approval of the local Ethics committee and written informed consent were obtained, we studied 45 patients, ASA I–II, aged 1–7 yr. Anaesthesia was induced with thiopental i.v. or 8% sevoflurane; Sch 1.5 mg kg^{-1} i.v. was given to facilitate endotracheal intubation. Patients were allocated to receive i.m. ketamine (group K; 0.5 mg kg^{-1}), i.m. meperidine (group M; 1 mg kg^{-1}) or i.m. tramadol (group T; 1 mg kg^{-1}) after induction of anaesthesia. Heart rate and mean arterial pressure were recorded at regular intervals. The time to opening to command, postoperative vomiting and agitation during emergence periods of anaesthesia were recorded. Postoperative pain was assessed by using the modified TPPPS pain score

(a maximum score of 10) in the recovery room at 30, 60, 120 and 240 min after tracheal extubation. Postoperative agitation was assessed by using the three point scale. Statistical analysis were performed by using Kruskal-Wallis test, Mann Whitney U test, Chi-Square test and Independent Samples t test. $p < 0.05$ was considered as statistically significant.

Results: Postoperative analgesia scores were very similar (Table 1). The incidence of vomiting was not statistically different. Agitation scores were higher in the ketamine group (2 ± 0.65) compared with the meperidine (1.26 ± 0.45 ; $p = 0.005$) and tramadol group (1.21 ± 0.42 ; $p = 0.002$).

Table 1. Mean (SD) postoperative pain (TPPPS) scores

	Group K (n = 15)	Group M (n = 15)	Group T (n = 15)	p value
30.dk	2.93 \pm 0.70	2.66 \pm 0.75	3.07 \pm 0.73	0.28
60.dk	1.80 \pm 0.67	1.60 \pm 0.82	2.07 \pm 0.73	0.25
120.dk	1.73 \pm 0.70	1.46 \pm 0.83*	2.14 \pm 0.36	0.010
240.dk	1.13 \pm 0.83	0.93 \pm 0.70	1.28 \pm 0.91	0.45

* $p < 0.05$ compared with group T

Conclusion: During the emergence, the higher agitation scores may be a limiting factor in the use of ketamine after tonsilloadenoidectomy in children.

A-760

Postoperative epidural analgesia with morphine plus ropivacaine vs. sufentanil plus ropivacaine. Which treatment is better?

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Background and Aim of Study: Many study show that combined epidural use of local anaesthetics and opioids improve the efficacy of postoperative analgesia. We investigate the differences in postoperative analgesia and in nausea between epidural administration of ropivacaine with two types of opioids (sufentanil or morphine).

Materials and Methods: In this prospective study we enrolled 56 patients (average age 57 years) operated for abdominal, thoracic or urologic surgery. We analysed the difference of postoperative pain control, with Visual Analogue Scale, at rest (VAS) and during movement (VASm), between epidural administration (5 ml/h) of ropivacaine 0.2% plus sufentanil 0.75 mcg/ml (30 patients) versus ropivacaine 0.2% plus morphine 0.1 mg/h (26 patients). The treatment lasted for 48 hours and the controls are taken at the moment of discharge from the recovery room and then 3, 6, 12, 24, 36 and 48 hours later. We analysed if there was a statistical difference in the mean of VAS and VASm between two groups with Mann-Whitney U test ($p < 0.05$). We also register if patients complains nausea.

Results: The results are shown in the table.

Time (hours)	0	3	6	12	24	36	48
VAS							
Morphine	1.2	1.3	1.1	1.3	1.3	0.9	1.1
Sufentanil	0.5*	0.8*	0.7	1.3	0.9	0.4	0.8
VASm							
Morphine	1.6	1.9	1.7	1.7	2.9	2.5	2.6
Sufentanil	0.9	1.3	1.2	1.8	1.7	0.9*	1.2*

* $p < 0.05$

Despite of the better pain control, the patients treated with sufentanil complained more nausea than those treated with morphine (16% vs. 7%).

Conclusions: The treatment with sufentanil has showed better results than morphine, with a good significance in the second postoperative day. It could be probably due to the more systemic effect related to its more lipophilic characteristics¹; this could justify also the high frequency of nausea in the patients treated with sufentanil.

Reference:

1 Bernards CM et al. Anesthesiology. 2003 Aug; 99(2):455-65.

A-761

Comparison of caudal ropivacaine and ropivacaine plus tramadol administration for postoperative analgesia in children

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Background and Goal of Study: The main disadvantage of caudal anaesthesia is the short duration action after a single injection of local anaesthetic solution (1). Aim of this study was to compare the addition of tramadol (T) on the duration of caudal block produced by 0.2% ropivacaine 1 ml kg⁻¹.

Material and Methods: After approval by the Ethics Committee and informed consent from parents was undertaken, 24 ASA status I-II, aged between 1-7, undergoing herniotomy, circumcison, hipospadias or orsiopexy. Anaesthesia was induced via face mask, with inhaled sevoflurane 8% concentration and 50% N₂O in oxygen. Patients were randomly divided into two group to receive either caudal R alone (0.2%, 1 ml kg⁻¹) in group R (n = 12) or R (0.2%, 1 ml kg⁻¹) plus tramadol (1.5 mg kg⁻¹) in group T (n = 12). Heart rate, mean arterial pressure and pulse oximetry were recorded before induction, after induction and during surgery. Pain score and sedation score values were recorded at hours 2, 4, 6 and 12. Pain was evaluated using the modified TPPPS score; sedation was evaluated by using the four-point sedation score. Statistical analysis were performed Independent Samples t test, Mann Whitney U test and Chi-square test. $p < 0.05$ was considered at statistically significant.

Results: Pain scores were every similar at 2 and 4 hours but lower in group T than group R at 6 and 12 hours (Table 1). Sedation scores were not significantly different at the same time ($p > 0.05$). The mean duration of caudal analgesia (time to first analgesic requirement) was 10.72 \pm 4.77 hour (h) in group T compared with 6.54 \pm 2.01 hour in group R ($p = 0.037$). The incidence of vomiting was higher in group T (n = 5; % 41.7) than group R (n = 2; % 16.7) ($p = 0.37$).

Table 1. Postoperative pain scores (mean \pm SD)

	Group R (n = 12)	Group T (n = 12)	p value
At 2 h	3 \pm 0.95	2.50 \pm 0.67	0.16
At 4 h	1.91 \pm 0.79	1.58 \pm 0.66	0.28
At 6 h	1.83 \pm 0.57	1 \pm 0.42	0.001
At 12 h	1 \pm 0.73	0.33 \pm 0.49	0.023

Conclusion: We concluded that a single caudal injection of tramadol when added to ropivacaine provide an advantage over ropivacaine alone for postoperative pain relief in children undergoing lower abdominal surgery.

Reference:

1 I. Constant. Br. J. Anaesth. 1998; 80:294-298.

A-762

Epidural clonidine, bupivacaine or methadone as the sole analgesic agent after thoracotomy for lung resection

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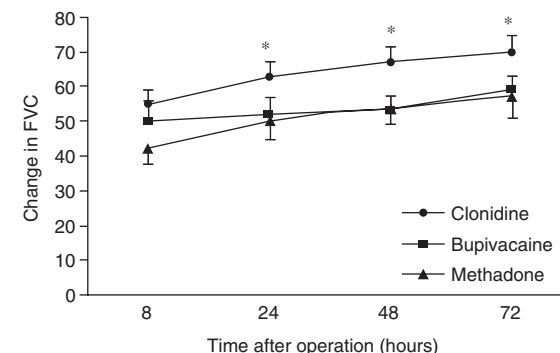
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Background and Goal of Study: Thoracic epidural analgesia can effectively relieve postthoracotomy pain but may also adversely affect pulmonary function. This randomized, double-blind, prospective study compared the effects on pulmonary function of epidural analgesics that act through different mechanisms.

Materials and Methods: Forty-seven patients undergoing thoracotomy were treated postoperatively for 72 hours with continuous administration of one of the drugs: clonidine (n = 16), bupivacaine (n = 17) or methadone (n = 14). Doses were titrated to maintain VAS values < 4 .

Results and Discussions: In all groups, throughout the postoperative period, reductions in FVC, FEV₁, and PEFR to $< 70\%$ of the preoperative values were observed. The recovery rates of FVC were significantly faster for the clonidine group compared to the other two groups (figure). Likewise, the clonidine group showed significantly faster recovery rates of FEV₁ and PEFR compared to the other groups, and by the third postoperative day significantly higher spirometry values (10-15%) were recorded.

	Clonidine	Bupivacaine	Methadone
Sex (M/F)	10/6	9/8	10/4
Age (yr)	61 (11)	58 (8)	55 (12)
Weight (Kg)	74 (14)	77 (17)	76 (12)



Postoperative forced vital capacity (FVC) as a fraction of preoperative value. * $p < 0.05$.

Conclusion(s): When titrated to comparable VAS scores, epidural clonidine as compared to epidural local anaesthetic or opioid had beneficial effects on the preservation of pulmonary function, as indicated by spirometry. These data suggest that epidural narcotics and local anaesthetics may be replaced or supplemented by clonidine in postthoracotomy patients.

A-763

Intravenous ketoprofen improves opioid based analgesia after major abdominal surgery

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Background and Goals: Multimodal analgesia (e.g. opioids and NSAIDs or local anaesthetics) is recommended for effective postoperative pain relief. There are few data on the use of NSAIDs in analgesia after abdominal surgery (1). The goal of the study was to compare efficacy of i.v. ketoprofen and tramadol/metamizol infusion (K-TM) relative to tramadol/metamizol infusion (TM) alone in patients undergoing major abdominal surgery.

Materials and Methods: Forty-four adult patients were randomly assigned to TM (n = 22) or K-TM group (n = 21). Patients with NSAID allergy, history of ulcer disease, coagulopathy or renal insufficiency were excluded. Postoperatively continuous infusion of tramadol 200 mg and metamizol 5 g over 24 h was started with 25 mg i.v. tramadol in case of inadequate analgesia. In addition, the patients received 100 mg of i.v. ketoprofen or placebo one and 9 h following surgery. Pain was assessed by the numeric rating scale (NRS) at rest and at deep breath 3, 6, 12 and 24 h postoperatively. The dose of tramadol used in the first 24 h and the occurrence of nausea/vomiting were recorded. Data are expressed as mean (SD). NRS score and 24-h tramadol were tested for normality and analysed by Student's t-test, with p < 0.05 considered significant.

Results: The two groups were comparable in terms of age, sex, weight, ASA grade and type of surgery. K-TM group had significantly lower pain scores both at rest and at deep breath 3, 6, and 12 h postoperatively.

h	NRS at rest		NRS at deep breath	
	TM	K-TM	TM	K-TM
3	4.8 (2.0)	3.0 (1.7)**	5.9 (1.7)	4.3 (1.8)**
6	3.7 (2.1)	2.5 (1.8)*	4.9 (1.7)	3.6 (1.8)*
12	2.9 (2.6)	1.5 (1.2)*	4.2 (2.1)	2.8 (1.4)*
24	0.7 (1.0)	0.4 (0.8)	2.2 (1.3)	1.6 (1.5)

** p < 0.01 vs TM group * p < 0.05 vs TM group

The 24-hour tramadol was significantly lower (p < 0.01) in K-TM, 193 (31) mg, than TM group, 235 (40) mg. Fewer patients in K-TM group had nausea/vomiting. There were no adverse events related to ketoprofen therapy.

Conclusion: The study showed the short-term use of ketoprofen to improve the quality of analgesia after major abdominal surgery without significant side effects.

Reference:

1 Jin F, Chung F. *J. Clin. Anesth.* 2001; 13:524–39.

A-764

Benefits of intravenous lidocaine in an acute rehabilitation program after laparoscopic colectomy

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Background and Goals: The concept of postoperative (postop) acute rehabilitation was introduced by Kehlet's group as a mean to accelerate recovery after open and laparoscopic colectomy.^{1,2} Intravenous (iv) lidocaine (LIDO) during surgery decreases postop pain and speeds the return of bowel function.³ This study investigated the effects of iv LIDO in an acute rehabilitation protocol for patients undergoing laparoscopic colectomy.

Material and Methods: After approval of our institution Ethics Committee 30 patients scheduled for laparoscopic colectomy gave their consent to be included in this randomised double-blind placebo-controlled study. Patients were allocated in two groups: iv LIDO or saline (bolus = 1.5 mg/kg, intraop infusion 2 mg/kg/h, then postop infusion of 1.33 mg/kg/h for 24 h). Anaesthesia (sevoflurane in O₂/air 80%) and postop analgesia (propacetamol, ketorolac, and PCA piritramide [a synthetic opioid]) were standardised. Patients were allowed to drink 6 h postop and to eat a normal breakfast the day after surgery. Postop iv infusion was stopped 24 h after surgery if po intake was well tolerated. Enforced mobilisation and ambulation were requested from the patients. Our goal was to discharge patients 3 days after surgery or sooner.

Postop pain at rest, during mobilisation and coughing during 48 h, postop piritramide consumption during 24 h, time to first flatus, time to defecation and hospital stay were recorded. Data (means ± SD) were analysed using ANOVA or Students' t test.

Results: Patient data were similar in the two groups. LIDO significantly reduced piritramide consumption (15 ± 15 mg vs 40 ± 40 mg, P = 0.02), postop pain during mobilisation (P = 0.02), coughing (P = 0.03). LIDO significantly reduced postop ileus and shortened hospital stay (Table).

	Flatus (h)	Defecation (h)	Hospital stay (d)
Placebo	30 ± 12	48 ± 19	3.8 ± 1.9
Lidocaine	20 ± 9*	32 ± 13*	2.8 ± 0.6*

*p < 0.05

Conclusions: Intra- and postop iv infusion of LIDO reduces postop pain, opioid consumption, and ileus. Intravenous LIDO facilitates postop rehabilitation protocol and allows for a one day reduction in hospital stay.

References:

- 1 Basse et al., *Ann Surg*: 2000: 232,51–7.
- 2 Bardram et al., *Br J Surg*: 2000: 87,540–5.
- 3 Groudine et al., *Anesth Analg*: 1998: 86,235–9.

A-765

Prevention of postoperative pain by wound infiltration with levobupivacaine 0.5% during thyroidectomies

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Background and Goal: Thyroidectomy has become a common day-case operation. Many patients experience significant pain after surgery. There are few clinical data as to whether wound infiltration with local anaesthetics provides alleviation of postoperative pain. We tested the efficacy of levobupivacaine wound infiltration for postoperative pain management.

Material and Methods: We studied 33 patients ASA I–II, aged 32–67 years old undergoing thyroidectomy. All patients received standard general anaesthesia. At completion of the thyroidectomy patients were randomly allocated in a double blind manner to one of the two groups: Group A was the control group and was infiltrated into the skin, subcutaneous tissue and platysma with 15 ml of normal saline and group B was infiltrated with 15 ml of levobupivacaine 0.5%. The patient rated wound pain at rest, during swallowing and head movement. Visual Analogue Scale (VAS 0–100) was used to evaluate the pain score. Pain assessment was performed 30 min, 4, 8, 12, 24 h after skin infiltration. If the pain score exceeded 40, patients received dextropropoxyphene 75 mg i.m. as rescue analgesia.

Results and Discussion: The two groups were comparable. VAS pain score (mean ± SD) is shown in the following table.

Time	Group A		Group B	
	Rest	Movement	Rest	Movement
30 min	26 ± 14	31 ± 8	20 ± 13	26 ± 16
4 h	32 ± 13	43 ± 10	16 ± 8*	29 ± 10*
8 h	33 ± 16	40 ± 16	14 ± 8*	27 ± 12*
12 h	36 ± 13	55 ± 5	19 ± 12*	34 ± 5*
24 h	25 ± 20	42 ± 20	16 ± 10	29 ± 8*

*P < 0.05 between two groups

A larger number of patients in group A (66%) received rescue analgesia compared to group B (29%).

Conclusions: The findings of the study suggested that wound infiltration with levobupivacaine 0.5% in thyroidectomies provides alleviation of pain and reduces opioid consumption during the first 24 postoperative hours.

A-766

Antihyperalgesic effect of intrathecal clonidine in postoperative pain patients

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Background and Goal of Study: The present prospective double-blinded study investigated whether intraoperative IT clonidine has significant postoperative (PO) antihyperalgesic and analgesic properties.

Materials and Methods: After Ethical Committee approval and informed consent, 60, ASA II, patients scheduled for colonic resection were studied. Exclusion criteria included: cardiovascular, coagulation disorders or pre-existing pain syndrome. All the patients were randomized to receive before

general anesthesia a 2 ml IT injection of either 10 mg bupivacaine (Group **Bu**) or 300 µg clonidine (Group **Clo**) or saline (Group **Sal**). General anesthesia was achieved using a target concentration propofol infusion and monitored using BIS index. Intraoperatively, increased blood pressure and/or heart rate not responding to additional propofol bolus (0.5 mg/kg) was treated with sufentanil (2.5 µg). Postoperatively, morphine IV boluses (1.5 mg) were given through a PCA device. PO analgesia was assessed by morphine requirements and pain scores (VAS) at rest, cough, and movements during the first 72 hours. Wound mechanical hyperalgesia was measured by application of von Frey filaments (1). Patients were also asked for residual pain at 1 month. Statistical analysis used ANOVA and ANOVA for repeated measures and χ^2 . A *P* value <0.05 was considered significant.

Results and Discussions: VAS scores at cough and movements were significantly lower in group **Clo**. The number of PCA requirements was significantly lower in this group ($n = 18 \pm 8$ vs 36 ± 10 and 49 ± 17 respectively in groups **Clo**, **Bu** and **Sal**; $P < 0.05$ at 72 PO hours). Area of hyperalgesia assessed at 72 hours was 15 ± 5 cm² in **Clo** group vs 75 ± 25 and 95 ± 30 cm² in **Bu** and **Sal** groups respectively; $P < 0.05$. At one month, less patients in group **Clo** experienced residual pain than in group **Sal** (0/20 vs 8/20; $P < 0.05$). A greater incidence of intraoperative hypotensive events was recorded in group **Clo**.

Conclusion(s): Our results clearly confirm in humans in PO pain condition the potent antihyperalgesic effect of IT clonidine observed in animal models (2).

References:

- 1 Acta Anaesthesiol Scand 1997; 41:1124–32.
- 2 Anesthesiology 2000; 92:1740–5.

A-768

Effects of epidural neostigmine on postoperative analgesia and stress response after gastrectomy

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Background and Goals: Intrathecal (1) or epidural (2) neostigmine has produced postoperative analgesia. In this study we evaluated the effects of pre-emptively used epidural neostigmine on postoperative analgesia and stress responses after gastrectomy.

Material and Methods: Eighty ASA physical status I and II patients scheduled for gastrectomy were randomly assigned into one ($n = 20$) to four groups. Patients received 5 mL of 0.25% bupivacaine with either saline (N0 group), neostigmine 5 µg/kg (N5 group), neostigmine 10 µg/kg (N10 group), neostigmine 15 µg/kg (N15 group) epidurally 30 minutes before the operation. All patients received identical general anesthesia. Patient-controlled epidural analgesia (PCEA) was provided with bupivacaine (0.05%) and fentanyl (4 µg/ml) for postoperative analgesia.

Results: The N10 and N15 groups reduced 24-h PCEA consumptions compared with the N0 and N5 groups ($P < 0.05$). There were no differences in visual analog pain scores at rest and with movement among the groups. The incidence of postoperative adverse effects was similar among groups. The concentration of plasma cortisol, epinephrine, norepinephrine and glucose did not differ among the four groups.

Conclusions: Epidural neostigmine 10 and 15 µg/kg in bupivacaine uses less PCEA consumptions than does bupivacaine alone and with 5 µg/kg of neostigmine after gastrectomy.

References:

- 1 Lauretti GR, Hood DD, Eisenach JC, et al. Anesthesiology 1998; 89: 913–918.
- 2 Nakayama M, Ichinose H, Nakabayashi K, et al. J Clin Anesth 2001; 13: 86–89.

A-769

The effect of dexmedetomidine premedication on postoperative pain score and morphine consumption in patients receiving patient controlled morphine

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Background: This prospective, randomized, double-blind, controlled study was designed to test the effect of single dose intravenous (IV) dexmedetomidine premedication on postoperative pain score and morphine consumption in patients receiving patient controlled morphine.

Methods: Sixty patients were allocated randomly to receive IV dexmedetomidine (1 µg · kg⁻¹) (D), or saline (S) 10 minutes before induction of anaesthesia. At the end of surgery, a standardised (0.1 mg · kg⁻¹) morphine loading dose was given to all patients for postoperative pain management. Patients

were allowed to use a patient-controlled analgesia (PCA) device giving bolus doses of morphine 0.02 mg · kg⁻¹. Discomfort, sedation, pain scores, cumulative morphine consumption, time to extubation, time to recovery and any side effects were recorded after recovery and at 1, 2, 6, 12 and 24 hours after the start of PCA.

Results: There were no differences between groups in patient characteristics (sex, age and weight). The mean time to extubation at the end of anaesthesia, and time to recovery were similar between groups. Comparing within groups, VRS, discomfort and sedation scores decreased significantly with time in each group ($p < 0.05$). There were no significant differences between groups in mean pain, discomfort and sedation scores at any study period. Cumulative morphine consumption was significantly lower in group D at 6, 12 and 24 hours after starting the PCA than in group S ($p < 0.05$). A similar incidence of side effects was noted between groups.

Conclusion: Single dose IV dexmedetomidine (1 mg · kg⁻¹), administered 10 minutes before induction of anaesthesia, led to a significantly lower consumption of morphine, similar postoperative pain relief, and recovery times compared to giving saline.

A-770

Morphine requirements during early recovery from Remifentanyl-based anaesthesia for gynecological surgery

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Background and Goal of Study: Comparison of the effect on postoperative pain and sedation of two different intraoperative timings of morphine administration during remifentanyl-based anaesthesia.

Materials and Methods: Twenty women (ASA I–II) undergoing total abdominal hysterectomy were studied. Anaesthesia was induced with remifentanyl/etomidate and maintained with remifentanyl and desflurane/nitrous oxide. Intraoperative morphine (0.2 mg · kg⁻¹) was given randomly at two different times: upon anaesthetic induction in group A and upon removal of the uterus in group B. Times of morphine administration until remifentanyl closure were recorded in both groups. Times to eye opening, extubation and first words were measured. Pain and sedation were evaluated using VAS and Ramsay scores, respectively. Morphine rescue doses were given when VAS ≥ 45 mm. Time of first iv bolus, total morphine requirements, and adverse effects were recorded. Differences were assessed with *t* tests and χ^2 tests.

Results and Discussion: Demographic data, surgery duration, remifentanyl consumption, recovery from anaesthesia, and VAS and sedation scores were similar in both groups. Mean (SD) time elapsed from intraoperative morphine administration until remifentanyl closure was 68(27) min and 51(14) min for groups A and B, respectively. Total morphine requirement in the PACU was greater (5.7[4.3] mg) in group A than group B (3.7[4.8] mg), but the difference was not significant. However, more patients (7vs2) required extra morphine in group A than in B and need appeared earlier 30(10) min vs 50(12) min after the end of surgery, respectively. There was no pre-emptive analgesic sparing effect but more patients required analgesic rescue in group A.¹ Nausea and vomiting appeared in half the patients, with no significant differences between groups.

Conclusion: These preliminary results seem to indicate that morphine administration during remifentanyl-based anaesthesia for total abdominal hysterectomy might be preferable at the moment of uterine removal, 45–55 minutes before the end of surgery.

Reference:

- 1 Muñoz HR, Guerrero ME, Brandes V et al. Br J Anaesth 2002; 88(6):814–18.

A-771

Intensity and duration of pain after total hip arthroplasty

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Background and Goal of Study: Analgesia after total hip arthroplasty (THA) remain controversial. Several analgesia techniques have been assessed. But is this surgery painful? The aim of this study was to evaluate the intensity and duration of pain after THA.

Materials and Methods: Forty patients scheduled for THA under general anaesthesia were included in this prospective study. Before the end of surgery 1 g paracetamol, 100 mg ketoprofene and 0.15 mg/kg morphine IV were administered. After extubation (Ext), patients received initial intravenous morphine titration if visual analog scale pain values (VAS) was greater than 30 mm. Then PCA device was initiated with paracetamol (1 g every 6 h) and

ketorprofene (100 mg every 12 h) during 48 hours. Lower limb passive rehabilitation was initiated on the day after surgery. Pain was evaluated using VAS pain scores and hourly morphine consumption. Data were compared using Friedman test. The box represent the 25th–75th percentiles; the dark line is the median; the extended bars represent the 10th–90th percentiles, and the circles the values outside this range.

Results and Discussions: Figure 1: VAS pain scores. H0 is defined as the end of surgery. There was no significant difference between VAS pain scores during all the period. Figure 2: hourly morphine consumption. Hourly morphine consumption was different between each study period ($p < 0.05$). Forty eight hours after the end of surgery, total mean morphine consumption was $22.4 \text{ mg} \pm 23.6$.

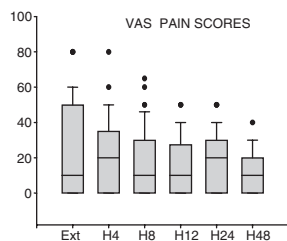


Figure 1

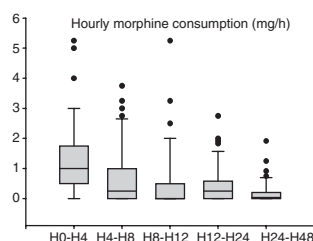


Figure 2

Conclusion: After THA, morphine consumption and VAS pain scores were low during the first 48 hours. Effective analgesia was achieved with PCA morphine associated with paracetamol and ketorprofene.

A-773

Post operative continuous epidural analgesia with ropivacaine 0.2% (RO.2) in infants: clinical tolerance

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Background and Goal of Study: The post operative continuous epidural analgesia (POCEA) is an usual practice in infants, but the use of 0.2% ropivacaine (RO.2) is not yet well documented. The aim of this study is to describe the clinical tolerance of a POCEA with RO.2 in infants under 1 year old.

Materials and Methods: We realized a retrospective observational study of all POCEA between 2001 and 2003 in infants after an urological or visceral surgery procedure ($n = 29$). The POCEA's protocol included an initial bolus of RO.2 ($2.7 \pm 0.16 \text{ mg/kg}$) before the incision followed by a continuous infusion of RO.2 at the rate of $0.28 \pm 0.02 \text{ mg/kg/h}$ during 48 h. Criteria of well clinical tolerance were: adequate analgesia, maintenance of the epidural catheter (EC) more than 48 hours, absence of vomiting and early realimentation ($< 24 \text{ h}$).

Results and Discussions: 29 charts were studied, the mean age was 5.3 ± 0.4 months, the mean weight was $7 \pm 0.3 \text{ kg}$.

	Parameters
No adjunction of nalbuphin	62%
Maintenance of EC > 48 h	83%
Absence of vomiting	96%
Early realimentation	64%

Any manifestation of systemic toxicity (cardiac or neurological) has been observed.

Conclusion(s): POCEA with RO.2 provides an adequate analgesia, often without resort to an other analgesic, thanks to maintaining the EC during at least 48 h. POCEA allows an early realimentation and is an interesting alternative technique to iv morphine, with less post-operative vomiting.

Reference:

Esmail Z., Montgomery C., Court C. et al Paediatr Anaesth 1999; 9: 321–7.

A-774

Causes of premature withdrawal of epidural catheter in infants and children

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Background and Goal of Study: The failure of a continuous epidural analgesia (CEA) in infants and children is often due to a premature withdrawal of

the catheter. The goal of this study is to describe the reasons of this premature withdrawal.

Materials and Methods: A retrospective observational study of all CEA realised between 2001 and 2003 in infants and children undergoing an orthopaedic or visceral surgery procedure. The post-operative observation was realised in the intensive care unit for the infants younger than one year old, in the surgery ward for those older. Age, and reasons of premature withdrawal of the epidural catheter (EC) (before 48 hours after the surgery) have been noticed and analysed.

Results and Discussions: 79 CEA withdrawal have been analysed. The mean duration CEA was 40 ± 18 hours. 28 EC have been withdrawn before the 48th hour.

Cause of withdrawal	n	%
Material	15	51
Other	13	49

Material causes of premature withdrawal were: spontaneous loss ($n = 6$), instillation pressure too high ($n = 5$), leak of local anaesthetic ($n = 4$). The other causes were failure to obtain analgesia ($n = 3$), loss of the i.v. line ($n = 1$), fever ($n = 3$), refused of the patient ($n = 1$). In 5 cases, the cause of premature withdrawal was unknown.

A withdrawal of the EC before the 48th hour, was more frequent in children above 1 year old (17% vs 46%; $p < 0.05$). Neither the duration of the surgical procedure nor the presence of fever influenced the duration of CEA.

Conclusion(s): Practical problems are the main cause of premature withdrawal of the EC. For children under one year old, a close observation in an intensive care unit should be recommended.

Reference:

CE Wood, GV Goresky, KA Klassen et al. Can J Anesth 1994 41: 613–620.

A-775

Effects of preoperatively administered Rofecoxib on postoperative pain scores and morphine consumption in total hip arthroplasty

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Background and Goal of Study: Patients undergoing total hip arthroplasty operation may experience moderate to severe pain in the postoperative period. This randomized, controlled trial evaluated the analgesic efficacy and postoperative morphine consumption of preoperatively administered rofecoxib in patients undergoing total hip arthroplasty (THA).

Material and Methods: Following Local Hospital Ethic Committee approval and informed patient consent eighty patients scheduled for THA were randomized into two groups. The rofecoxib group (Group R) ($n = 40$) patients received 50 mg 2 hrs before surgery. The other group ($n = 40$) received placebo tablet (Group P) 2 hrs before surgery. All patient received remifentanyl-sevoflurane anesthesia for the surgery. Intraoperative and postoperative hemodynamic variables, coagulation tests (PT, PTT, and INR) were recorded. All patients received PCA morphine. Pain scores, range of motion (ROM) and morphine consumption were recorded during the first 24 hr post-operatively.

Results and Discussion: Intraoperative and postoperative hemodynamic variables and coagulation tests were similar in two groups. Cumulative morphine consumption was significantly higher in the P group than in the R group ($35.4 \pm 14 \text{ mg}$ vs $13.64 \pm 5.2 \text{ mg}$) during the first 24 h ($p < 0.05$). Lower pain scores were achieved in the R group than in the P group ($p < 0.05$). Range of motion in postoperative period was significantly better in the R group than in the P group ($p < 0.05$).

Conclusion: Preoperatively administered rofecoxib (50 mg) offered lower pain scores, morphine consumption, and range of motion in patients undergoing total hip arthroplasty compared to giving placebo.

A-776

Analogue chromatic continuous scale: a better evaluation of grading pain and analgesic demand than others

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Background and Goal of Study: To determinate the presence of a correlation between Visual analogue scale VAS, Analogue chromatic continuous scale (ACCS)⁽¹⁾, Box Scale (11-BS) and VAS modified in obstetrics patients.

To verify which of these scales offers a better postoperative acute pain measurement. To evaluate the additional analgesic demand in relation with the scales, which is more accepted by the patients.

Materials and Methods: We investigated in a randomized trial 93 obstetric patients age 35 ± 8 yrs; that underwent cesarean section with intrathecal⁽²⁾ administration of morphine 0.2 mg and hyperbaric bupivacaine 0.5% 10 mg. We controlled each hour until 24 hr and at 48 hr, asking them periodically the presence and the score of pain, evaluated with VAS, ACCS, 11-BS and VAS modified.

Results and Discussions: After the evaluation of the score, we demonstrated that there is a significant positive correlation between VAS and ACCS ($r = 0.76$; $p < 0.01$); VAS and 11-BS ($r = 0.78$; $p < 0.01$); VAS and VAS modified ($r = 0.64$; $p < 0.01$). Even if there is statistically significant correlation of the four scales, only between VAS and ACCS the means values of pain (test T-student) did not differ significantly. We found that very few patients (5) wanted additional analgesic medication (tramadol), corresponding with high ACCS score and not with other scales.

Conclusion(s): Therefore we have found that ACCS is more accepted especially for lower social economic classes, and easy to use more than other scales allowing a greater discrimination of grades of pain, furthermore the ACCS is more useful to the clinician when to give additional analgesic medication.

References:

- 1 DeLoach LJ, Anesth Analg. 1998 Jan;86(1):102.
- 2 Rauck RL, J Pain. 2003 Oct;4(8):441-7.

A-777

How does a preoperative medication of trans-dermal fentanyl influence postoperative pain and pain management after palliative surgery?

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Background and Goal of Study: Surgical intervention in palliative care is common. In a study by Krouse et al. (2001) palliative surgeries comprised 12.5% of surgical procedures in one year at an American surgical department. Many of these patients have a standard medication with strong opioids, but the influence, this medication has on perioperative management, especially on postoperative pain, is still not known. We explored the postoperative pain of patients after palliative surgery and compared them with patient undergoing non-palliative surgical procedures.

Materials and Methods: We studied 40 patients after surgery. 20 patients had palliative surgical interventions and a preoperative medication of trans-dermal fentanyl longer than two weeks. The control group of 20 patients had no opioid standard medication and non-palliative surgery. Both groups received a balanced anaesthesia and a standard patient controlled analgesia (PCA) after surgery. Pain scores (VAS = visual analogue score; 0-10), presence and intensity of side effects and patient satisfaction was enquired the first three days after surgery, vital parameters and medication (PCA and other) were monitored.

Results and Discussions: There was a higher postoperative demand of PCA in the palliative group (63 ± 12 mg piritramide/day vs. 38 ± 9 mg). Still the palliative patients had higher pain scores (5.7 ± 1.8 vs. 3.8 ± 1.2 at 1st day, U-test: $p < 0.05$). There was no difference in the incidence of side effects and in the patients' satisfaction.

Conclusion(s): Standard patient controlled analgesia is less effective in palliative patients with a medication of trans-dermal fentanyl, in spite of a higher piritramide-demand in this group. An adjustment of this method for palliative patients is needed.

A-778

Comparison of postoperative analgesia and recovery after open and laparoscopic radical prostatectomy

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Background and Goal of Study: Open radical prostatectomy (ORP) is the surgical technique of reference for treatment of early prostatic carcinoma. Laparoscopic radical prostatectomy (LRP) was recently introduced; it seems to produce an easier recovery. This study compares the postoperative recovery and requirement of analgesia between both techniques.

Materials and Methods: This retrospective study included 174 patients who underwent radical prostatectomy from 8/1999 to 3/2003 in two hospitals. Postoperative analgesia was regularly maintained with 8 g of propacetamol daily completed as required by patient with morphine (PCA or subcutaneously).

Student's t test was used for statistical analysis.

Results and Discussions:

	ORP (n = 115)	LRP (n = 59)	p
Age (yrs)	63.3 ± 5.7	64.4 ± 5.9	n.s.
Operative time (mn)	161.5 ± 37.5	201.4 ± 46.2	<0.001
Hospitalisation stay (days)	10.8 ± 2.9	7.9 ± 3.1	<0.001
Morphine (mg)	48.6 ± 54.2	37.7 ± 24.5	n.s.
PCA duration (hr)	34.4 ± 13.9	36.4 ± 18.2	n.s.

n.s. = not significant

Although LRP needs a significant longer operative time than ORP, it allows a more rapid patient recovery and earlier hospital discharge. Postoperative pain, as assessed by adjuvant morphine consumption was less in LRP group, but surprisingly, this difference was not significant. Other studies had found a significant lower need of analgesia with laparoscopic procedures. This difference could be explained by the small transverse suprapubic incision regularly used for ORP in our department.

Conclusion: LRP is a comparable technique to ORP as regards postoperative need of analgesia. But it associated with a shorter postoperative recovery and hospital stay.

A-779

Procedure-specific practice for managing pain following primary total hip arthroplasty: recommendations on peripheral nerve blocks and neuraxial analgesia from the PROSPECT working group

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Background and Goal: A systematic review was conducted to compare the efficacy and safety of analgesic, anaesthetic and operative techniques in influencing postoperative pain in adult patients undergoing primary total hip arthroplasty, to produce procedure-specific recommendations for patient care.

Materials and Methods: The review was conducted according to the methods of the Cochrane Collaboration. MEDLINE was searched from 1966-Sept 2003 and EmBASE from 1988-Sept 2003. Randomised trials of interventions vs. placebo or other interventions conducted to examine their effect on postoperative pain were included. The use of VAS, NRS or VRS pain scales was required for inclusion. Qualitative- and meta-analysis was conducted. Recommendations were based on procedure-specific evidence, and from data derived from other orthopaedic procedures and clinical practice where THR-specific data were lacking.

Results: Twenty-nine studies were identified examining peripheral and neuraxial analgesia. *Epidural analgesia (12 studies):* Bolus or infused clonidine was superior to local anaesthetic (LA) for VAS scores; adding LA to clonidine was no better than clonidine alone. Adding bolus or infused clonidine to morphine or LA was superior to morphine or LA alone. *Spinal analgesia (14 studies):* Combining morphine with LA was superior to LA alone for VAS scores, supplementary analgesia use, and time to first analgesia request. Adding clonidine or morphine to LA was superior to LA alone for VAS scores. The combination of morphine and LA was superior to clonidine alone. Spinal was more effective than epidural for reducing VAS scores. *Femoral/lumbar plexus block (2 studies):* 1/2 studies showed superiority for postoperative pain scores and for time to supplementary analgesic use, and 1/1 for time to first analgesia request vs. placebo.

Conclusions: Epidural LA, morphine and clonidine, and spinal morphine and clonidine, are effective. The choice of agents and route should depend on patient comorbidity and the anaesthetic strategy. For spinal administration, single-shot LA ± morphine is preferable. The routine use of clonidine is not preferred due to its less favourable risk/benefit profile. Peripheral neural block is recommended, and has advantages in its side effect profile over epidural and spinal techniques.

A-780

Procedure-specific practice for managing pain following primary total hip arthroplasty: recommendations on systemic analgesia from the PROSPECT working group

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Background and Goal: A systematic review was conducted to compare the efficacy and safety of analgesic, anaesthetic and operative techniques in

influencing postoperative pain in adult patients undergoing primary total hip arthroplasty, to produce procedure-specific recommendations for patient care.

Materials and Methods: The review was conducted according to the methods of the Cochrane Collaboration. MEDLINE was searched from 1966–Sept 2003 and Embase from 1988–Sept 2003. Randomised trials of interventions vs. placebo or other interventions conducted to examine their effect on postoperative pain were included. The use of VAS, NRS or VRS pain scales was required for inclusion. Qualitative- and meta-analysis was conducted. Recommendations were based on procedure-specific evidence, and from data derived from other orthopaedic procedures and clinical practice where THR-specific data were lacking.

Results: Twenty-two studies were identified examining systemic analgesia. *NSAIDs (7 studies):* 6 of 7 studies showed superiority for postoperative pain scores and a reduction in supplementary analgesic use vs. placebo. VAS 0–8 hrs: -9.48 [$-18.06, -0.90$] $p = 0.03$. VAS 8–16 hrs: -4.12 [$-7.56, -0.68$] $p = 0.02$. VAS 16–32 hrs: -8.46 [$-14.88, -2.05$] $p = 0.01$. Morphine consumption: (WMD -9.07 mg [$-14.16, -3.97$], $p = 0.0005$). *Coxibs (1 study):* Valdecoxib was superior to placebo for VRS scores ($p < 0.05$ for 6, 12 and 18 h) and for the requirement for supplementary analgesia ($p < 0.001$). *Strong opioids (1 study):* This small study did not show any significant benefit for pre-operative morphine or buprenorphine for VAS scores vs. placebo. *Weak opioids (1 study):* Tramadol 50–100 mg was not significantly different vs. placebo for VAS scores or time to first analgesia request. *Paracetamol (1 study):* Propacetamol 2 g was not significantly different vs. placebo for VAS or VRS scores, but significantly reduced the time to first analgesia request ($p < 0.001$).

Conclusions: NSAIDs or coxibs (if warranted by patient disposition) in combination with strong opioids (i.v. patient-controlled or fixed-interval) for high-intensity pain, and NSAIDs or coxibs with paracetamol \pm weak opioids for low-intensity pain, can be recommended. P.R.N. rescue i.v. strong opioids during mobilisation are recommended.

A-781

Effect of local amitriptyline combined to bupivacaine on the development of hyperalgesia after plantar incision in rats

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Background: Peripheral sensitization contributes to pain after an incision. Local wound infiltration with bupivacaine (bupi) provides shortlasting analgesia (1). Amitriptyline (AMIT), a tricyclic antidepressant, acts as a long-lasting local anesthetic (2) and produces peripheral antihyperalgesic or analgesic effect, according to the dose in animal models (3). The study evaluates whether local AMIT could potentiate peripheral bupi and prevent the development of postoperative pain in rats.

Material and Methods: Under anesthesia, adult male Wistar rats ($n = 6$ per group) underwent a plantar incision. Before wound closure, local infiltration (0.2 mL) was realized with 0.5% bupi alone or combined to AMIT 50, 100 or 250 μ g. Postoperative pain was assessed at day D0 (2 h and 6 h), 1, 2, 5 and 7 after surgery: primary and secondary mechanical hyperalgesia (MH) evaluated by paw withdrawal threshold (PWT, in g) to application of von Frey hairs and primary thermal hyperalgesia (TH) by paw withdrawal latency (PWL, in sec) to a radiant heat. Statistical analysis used ANOVA and posthoc tests, $p < 0.05$ was significant from bupi. Results are mean \pm SD.

Results: In bupi group, initial PWT 35.9 ± 5.5 g dropped to 7.7 ± 4.5 D0 (2 h), 3.9 ± 2.4 (6 h), 6.9 ± 4.8 D1, 7.3 ± 4.1 D2, 13 ± 8.3 D5 and 15 ± 7 g D7. Only AMIT 100 μ g significantly reduced primary MH at D2 (16.3 ± 6.3 g), D5 (27.6 ± 6.6 g) and D7 (28.6 ± 7.3 g). Secondary MH (12 ± 9 g D0 and 17 ± 9 g D7) was not modified by any local treatment. In bupi group (PWL 13.5 ± 1.6 sec), TH was 7.9 ± 1.2 D0 (2 h), 8.8 ± 1.5 (6 h), 10.5 ± 1.1 D1, 9.5 ± 0.6 D2, 9.3 ± 0.5 D5 and 9.6 ± 0.7 sec D7. Only AMIT 100 μ g normalized PWL from D1 (11.9 ± 2.1 sec) to D7. Local AMIT 250 μ g induced paw edema lasting for 2 days and worsening TH at D0 (2 h and 6 h: 5.9 ± 1.1 and 6.4 ± 2.3 sec).

Conclusion: In contrast with other models (2) (3), peripheral AMIT 250 μ g does not potentiate bupi analgesia in the incisional pain model, maybe in relation with development of paw edema. However, at lower antihyperalgesic dose (100 μ g), AMIT reduces primary MH and TH, features which represent pain at movement and spontaneous pain in postoperative conditions.

References:

- 1 Pogatski et al, Pain 2002; 97: 151–61.
- 2 Khan et al, Anesthesiol 2002; 96: 109–16.
- 3 Oatway et al, Anesth Analg 2003; 97: 168–73.

A-782

Role of peripheral glutamate receptors in the development of hyperalgesia after plantar incision in rats

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Background: Peripheral sensory terminals express both ionotropic (iGluR) and metabotropic (mGluR) glutamate receptors (1) which mediate inflammatory hyperalgesia. Using an animal model of incisional pain where local bupivacaine is ineffective (2), the study evaluates the role of peripheral GluR in postoperative hyperalgesia by plantar injection of bupivacaine with GluR antagonists.

Material and Methods: Under anesthesia, adult male Wistar rats ($n = 6$ per group) underwent a paw incision (2). Before wound closure, a plantar (ipl, 0.2 mL) infiltration was realized with 0.5% bupivacaine (bupi) alone or combined to 250 μ g of ketamine (KET; non selective iGluR antagonist), MK801 (selective iGluR antagonist) or MPEP (selective mGluR5 antagonist). Local bupi was also administered with systemic (IM) MK801 or MPEP. Postoperative pain was assessed from day D0 (2 h and 6 h) to D7 after surgery. Primary and secondary mechanical hyperalgesia (MH) was evaluated by paw withdrawal threshold (PWT, in g) to plantar application of von Frey hairs and thermal hyperalgesia (TH) by paw withdrawal latency (PWL, in sec) to a radiant heat. Statistical analysis used ANOVA and posthoc tests, $p < 0.05$ was significant from bupi. Results are mean \pm SD.

Results: In bupi group (basal PWT: 36.5 ± 8.1 g), animals developed, from D0 (2 h) to D7, significant primary MH (7.7 ± 4.5 to 15 ± 7 g) and secondary MH (13.9 ± 9.7 to 17 ± 9 g). MK801 ipl significantly reduced primary MH at D0 (2 h) 20.7 ± 11 g and from D2 to D7 (23 ± 8.9 to 32.9 ± 3.2 g) as well as secondary MH from D2 to D7 (25.3 ± 8.2 to 31.9 ± 3.4 g). Plantar MPEP significantly decreased secondary MH from D1 to D7 (22.4 ± 9 to 29.8 ± 2.5 g). Postoperative TH was only reduced at D0 by ipl and IM MK801. KET and IM MPEP were ineffective.

Conclusion: Surgical injury activates peripheral GluR which partly contribute to peripheral sensitization and postoperative pain. Local iGluR modulates primary MH development (characteristic of pain at movement). Both peripheral iGluR and mGluR play a role in secondary MH (a feature related to central sensitization and that might be involved into chronic pain after surgical incision).

References:

- 1 Neugebauer V, Trends in Neurosci 2001; 24: 550–555.
- 2 Potgatski et al, Pain 2002; 97: 151–161.

A-783

Amitriptyline and fluoxetine inhibit human NMDA receptor signaling

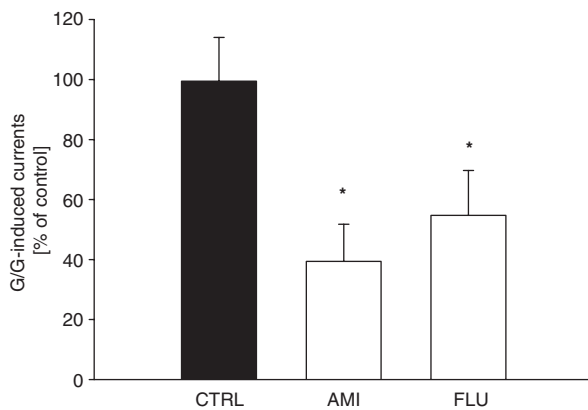
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Background and Goal of Study: Amitriptyline (AMI) has been shown effective for treatment of neuropathic pain states. However, mechanisms of action remain unclear. N-methyl-D-aspartate (NMDA) glutamate signaling plays a major role in the development of prolonged pain states. AMI was shown to inhibit NMDA-induced responses in cultured neurons and spinal cord, and other tricyclic antidepressants interact with this signaling system. However, direct inhibition of NMDA receptor function has not been demonstrated. We tested the effects of AMI and, for comparison, the non-tricyclic compound fluoxetine (FLU) on functioning of recombinantly expressed human NMDA receptors.

Materials and Methods: Human NR1/NR2a receptors were expressed in *Xenopus laevis* oocytes by microinjection of mRNA. Receptors were studied under voltage clamp, using Ba as charge carrier, and responses to the physiological co-agonists glutamate and glycine (G/G, both at 10^{-6} M) were determined in the absence and presence of either antidepressant (10^{-6} M, incubation 10 min). Results are reported as % of control \pm SEM, and were analyzed by t-test.

Results and Discussions: Oocytes injected with NMDA receptor cDNA responded with inward currents. Responses were reversibly inhibited by $61 \pm 12\%$ by AMI ($p = 0.004$) and $46 \pm 15\%$ by FLU ($p = 0.04$, Fig. 1). This demonstrates that antidepressants, in concentrations as attained after intravenous administration, significantly and reversibly inhibit functioning of human NMDA receptors. This effect is not limited to AMI, but was also exhibited by the non-tricyclic antidepressant FLU.



Conclusion(s): The results may explain, in part, the beneficial effects of antidepressants in prolonged pain states, and may also play a role in their effects on inflammatory pain.

A-785

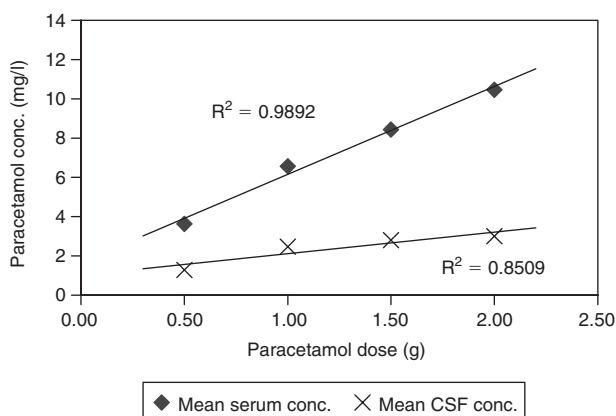
Paracetamol concentrations in plasma and cerebrospinal fluid

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Background and Goal of Study: Paracetamol has a central mechanism of action (1). The goal of this study was to assess whether the ability of paracetamol to cross a healthy blood–brain barrier (BBB) depends on its concentration in plasma and if there is a lower limit for crossing.

Materials and Methods: Intravenous paracetamol was given to 40 consecutive patients undergoing hip or knee surgery in spinal anaesthesia. A dose of 500 mg, 1000 mg, 1500 mg and 2000 mg was given to 10 patients each 1 hour before anaesthesia. A blood sample and 2 ml of cerebrospinal fluid (CSF) for detection of the paracetamol concentration were collected immediately before spinal anaesthesia. The concentration of Paracetamol was measured by isotope dilution liquid chromatography with tandem mass spectrometry (LC-MS/MS).

Results and Discussions: The mean serum- and CSF-concentrations are shown in the figure.



The concentration of paracetamol in CSF correlated significantly with the concentration in serum ($p < 0.01$).

Conclusion(s): Paracetamol was detected in CSF in all patients and no lower limit for transportation of paracetamol across the BBB was found. Protein binding or time for crossing the BBB may explain the lower concentration of paracetamol in CSF compared to serum (2).

References:

- Bannwarth B, Netter P, Lopicque E, et al. *Br J Clin Pharmacol.* 1992;34:79–81.
- Anderson BJ, Holford NH, Woollard GA, et al. *Br J Clin Pharmacol.* 1998;46:237–43.

A-786

Plasticity of spinal NMDA system mediating opioid hyperalgesia in normal and neuropathic conditions

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Background: Beyond analgesia, opioids induce tolerance and hyperalgesia, interrelated phenomena involving NMDA receptors (R) activation (1). Peripheral nerve injury also induces tonic activation of NMDA-R (1). With the MACbar of sevoflurane (SEVO) as an objective measure of opioids antinociceptive potency, we observed that a very low dose of sufentanil (SUF) surprisingly increases the MACbar SEVO in the rat, instead of reducing it (2). Using this model of opioid hyperalgesia (OH), the study evaluates the role of spinal NMDA system under normal (Control, C) and neuropathic (NP) conditions.

Material and Methods: In adult male Wistar rats ($n = 6–10$ per group), the MACbar SEVO with tail clamp stimulus was determined as previously described (2). MACbar SEVO was then evaluated during a low dose SUF infusion ($0.005 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$). NP rats (>3 months after partial ligation of sciatic nerve) underwent the same procedure. Intrathecal (IT) pretreatment with saline, ketamine (KET) 250 μg or MK801 30 μg was administered before MACbar SEVO determinations. Results are MACbar (%), mean \pm SD and % rats with OH defined as $>20\%$ increase of MACbar after SUF infusion. Statistics used ANOVA and χ^2 tests, $P < 0.05$ significant with SEVO (*), with IT saline (**), with sal C group (*).

Results:

	SEVO (%)	SEVO + SUF (%)	% OH
C group			
IT saline	1.9 ± 0.3	$3.1 \pm 0.6^*$	71%
IT KET	1.2 ± 0.8	1.7 ± 1.1	50%
IT MK801	$0.7 \pm 0.4^{**}$	$0.9 \pm 0.5^{**}$	33% ^{**}
NP group			
IT saline	1.7 ± 0.6	1.5 ± 0.8	21% [†]
IT KET	1.5 ± 0.7	1.4 ± 0.9	43%
IT MK801	$0.6 \pm 0.2^{**}$	1.0 ± 0.4	57% ^{**}

Conclusion: In this model, OH involves spinal NMDA system. In contrast with normal rats, NP rats do not display OH. Activation of spinal glutamergic pathway might have already triggered the pain facilitatory processes and therefore masked OH. Surprisingly in NP conditions, IT NMDA-R antagonists seem to increase OH development, maybe by interfering with some spinal endogenous glutamate regulatory mechanisms (3).

References:

- Proc Natl Acad Sci USA* 1999; 96: 7731–6.
- Docquier et al, *Anesth Analg* 2003; 97: 1033–9.
- Neuroscience* 2003; 116: 81–7.

A-787

Intrathecal implants of microencapsulated xenogeneic chromaffin cells alleviate cold allodynia in a neuropathic pain model of rats

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Background and Goal of Study: Intrathecal implants of adrenal medullary chromaffin cells releasing analgesic substances have been reported to reduce pain in animal model (1). The aim of the present study was to investigate the potential of intrathecal implants of microencapsulated xenogeneic chromaffin cells to induce analgesia in animal model without immunosuppressant.

Materials and Methods: Isolated bovine chromaffin cells were encapsulated with alginate and poly-L-lysine prior to implantation into rat subarachnoid space to protect them from host immune system. The animals were randomized into 2 groups, one of which received microencapsulated chromaffin cells and the other (control group) empty capsules. The effects of such implants were evaluated on the pain behavior resulting from a chronic constriction injury (CCI) of the rat sciatic nerve for 30 days. After explantation, the histology and viability of grafts were investigated using HPLC and histological method. Data (mean \pm SD) are considered significant at a $P < 0.05$ (ANOVA for repeated measure and Dunnett's test).

Results and Discussions: A significant reduction of allodynic response to cold elicited by acetone evaporation was observed in the animals implanted with encapsulated chromaffin cells ($P < 0.05$ vs control group). Microscopic examination showed abundant clusters of viable bovine chromaffin cells in

all capsules and no fibrotic and inflammatory reaction against capsule. The retrieved cells retained their function to secrete catecholamine to response to nicotine.

Conclusions: These results suggest that microencapsulated xenogenic chromaffin cells acting as biological pump can be a novel approach for the treatment of chronic neuropathic pain.

Reference:

1 Hama A.T., Sagen J. *Pain* 1993; 52: 223–231.

Acknowledgements: This work was supported by the IMT-2000 program of the Korea Ministry of Information and Communication and the Korea Ministry of Health and Welfare (01-PJ9-01NT00-0026).

A-788

Inhibition of NMDA receptor signaling by local anaesthetics is reversible

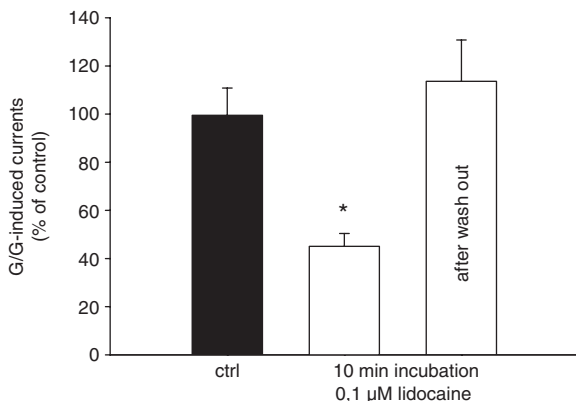
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Background and Goal of Study: NMDA-receptor activation contributes to postoperative hyperalgesia. In previous studies we could show that local anaesthetics (LA) inhibit concentration-dependently the activation of human NMDA receptors¹, which may explain their ability to prevent the development of hyperalgesic pain states². In this study we tested if this inhibitory effect of different LA (at a concentration as obtained after intravenous or epidural administration) is reversible.

Materials and Methods: Human NR1/NR2a receptors were expressed in *Xenopus laevis* oocytes by microinjection of mRNA. Receptors were studied under voltage clamp, using Ba as charge carrier, and responses to the physiological co-agonists glutamate and glycine (G/G, both at 10⁻⁶ M) were determined in the absence and presence of lidocaine (L), bupivacaine (B), levobupivacaine (LB), or ropivacaine (R) (all at 10⁻⁴ M, incubation 10 min) and after a washout period of 10 min. Results are reported as % of control ± SEM, and were analyzed by t-test (p < 0.05).

Results and Discussions: All LA inhibited NMDA receptor function after the incubation period (L: 45%, B: 61%, LB: 58%, R: 63% of control response). This effect was completely reversible after a washout period of 10 min for all LA (L: 113%, B: 121%, LB: 111%, R: 92% of control response). Fig 1 shows this effect for lidocaine.



Conclusion(s): The inhibitory effect of LA on NMDA receptor signaling at clinically relevant concentrations is reversible, which implies a noncovalent association between LA and the NMDA receptor.

References:

- Hahnenkamp K et al: *Eur J Anaesth* 2002; 19: S189.
- Koppert W et al: *Anesthesiology* 1998; 89: 1345–53.

A-790

Evidence of progress: implementing a paediatric pain service

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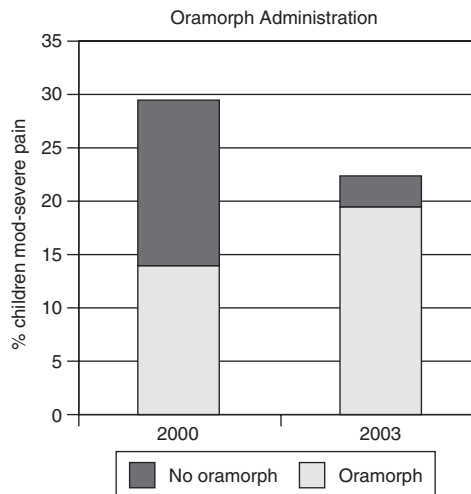
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Background and Goals: Education of staff and adherence to analgesic protocols improves paediatric pain control. Implementation of a safe and effective paediatric pain service and improvements to paediatric analgesic

protocols requires an evidence base obtained through audit of past and current practice (1,2).

Materials and Method: One retrospective (2000) and one prospective audit (2003) were analysed which covered the evolution of the paediatric pain protocols and service provision over a 4 year period. Each audit covered a 2-week period and all child in-patients were eligible. The medical notes and prescription charts for each child were examined and data recorded. Each child/parent was then interviewed using a structured questionnaire designed to assess current pain levels, pain management, side effects and overall satisfaction.

Results: In 2000, 129 children were studied 38 (29%) had moderate severe pain. Of these 18 (47%) received opiate (oramorph) whilst 20 (53%) did not. In 2003 we prospectively studied 67 patients (21 medical, 46 surgical). All medical patients had prescription charts correctly written and had a pain score of mild or no pain. Of surgical patients 10 (22%) had a moderate-severe pain score with 9 (90%) receiving opiates (oramorph) whilst 1 (10%) did not. Overall, 39 surgical patients (85%) had prescription charts adhering to protocols.



Conclusions: Structured analgesic protocols and implementation with review by a paediatric pain service can improve paediatric pain control in a DGH.

References:

- Goddard JM. *Anaesthesia* 1996; 51:588–590.
- Royal College Anaesthetists Bulletin 2001; 8:355–359.

A-791

An assessment of pain and post operative nausea and vomiting (PONV) in the recovery room

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Background and Goal of Study: The intensity of postoperative pain remains underestimated and undertreated.¹ In our hospital protocols have been devised to allow recovery nursing staff to administer morphine 10 mg and ondansetron 4 mg intravenously. Our institution has no data on pain scores on arrival and discharge from the recovery room. The purpose of this audit was to determine these and the incidence of PONV.

Materials and Methods: Data was collected by recovery nurses over a four week period on postoperative adult patients. Pain scores were assessed on arrival in the recovery room after 30 minutes and on discharge from the recovery room. These were assessed using an 11 point verbal rating scale (VRS), where 0 is 'no pain' and 10 is 'worst pain imaginable'. The incidence of nausea and vomiting was recorded. Finally the total amount of analgesia and anti-emetic medication was recorded for each patient.

Results and Discussions: A total of 595 patients were admitted to the recovery room, however data were only collected on 340 of these. VRS on arrival, after 30 minutes and on discharge from the recovery room are illustrated in Table 1.

	VRS <4 N/%	VRS of 4–7 N/%	VRS >7 N/%
On arrival	217/64	64/18.8	59/17.3
After 30 minutes	215/63.3	92/27	32/9.4
At discharge	267/78	59/17	14/4

N = number of patients

Twenty four patients (7%) complained of PONV in the recovery room.

Conclusion(s): Twenty one per cent of patients are being discharged from recovery with a VRS >4. A multidisciplinary education programme on post-operative analgesia has been instituted to change practice. This audit will be repeated in 6 months time.

Reference:

- 1 Dahl JL, Gordon D, Ward S et al. Institutionalising pain management: The Post-Operative Pain Management Quality Improvement Project. *Journal of Pain* 2003 4: 361–71.

A-792

Effect of preextubation intravenous betamethasone on postoperative antiemetic and analgesic requirement after laparoscopic surgery

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Background and Goals: Laparoscopic surgery is a diagnostic and therapeutic procedure. Postoperative nausea, vomiting and pain are common complications of laparoscopy that delay recovery and patients discharge. The purpose of this study was to investigate the effect of preextubation intravenous betamethasone on the postoperative antiemetic and analgesic requirement after laparoscopic procedures.

Material and Methods: After approval of the Ethics committee and informed consent, 70 ASA-PS II adult patients under general anesthesia and elective surgery were selected and classified in two equal groups randomly. Induction of anesthesia was done by fentanyl, thiopental and succinylcholine. At the end of surgery and just before extubation, 8 mg betamethasone was administered intravenously in study group (A). In control group (B), 2 ml normal saline as placebo was administered. Postoperative nausea, vomiting and pain were evaluated by visual analogue scale until 6 hours after operation. Quantitative and qualitative variables were analyzed by student's t-test and χ^2 (chi-square) statistically.

Results: Frequency of nausea, vomiting and antiemetic requirement were significantly less in group A ($p < 0.05$) 6 hours after operation. Analgesic requirement was not significantly different 1 and 6 hours after operation. Also, there was no significant difference in intensity of pain 1 and 6 hours after operation in two groups.

Conclusions: This study showed that preextubation intravenous betamethasone causes reduction of nausea, vomiting and antiemetic requirement 6 hours after operation.

A-793

Cervical plexus block for carotid endarterectomy: a survey 3969 patients of San Raffaele Hospital

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Background: Actually, some trials showed the benefit of surgery over the medical treatment for the carotid stenosis. Regional anaesthesia appears to be associated with a much lower morbidity and mortality rate as compared to general anaesthesia.ⁱ

Material and Methods: From January 1997 through December 2002, 3969 patients underwent CEA, aged 68.9 years (32–96). Most of the surgical patients were symptomatic, including transient ischemic attacks (5.6%), stroke (20.3%) and asymptomatic carotid artery stenosis 1699 patients (42.8%). Preoperative management needs an appropriate evaluation, because atherosclerotic process manifests in several organ systems. Our preoperative evaluation consisted in cardiac status and angina well controlled (ECG and cardiac testing as needed), hypertension treated (recommended to continue cardiovascular medications including the morning of surgery, and baseline BP noted), neurologic status (neurological deficit well characterized), smoking.

Results: We performed cervical plexus block, in the past with Mepivacaine, and now with Ropivacaine (0, 2 ml/kg), divided among C2–C4 injections. Then, surgical incision line infiltration was performed with 10 ml of Lidocaine 2%ⁱⁱ. Awake patients are the best monitor of neurological function during carotid cross-clamping. We performed regional anaesthesia in 3940 patients (96.4%) and during general anaesthesia monitored cerebral function by EEG. If a deficit occurred when the clamps are released, the surgeon placed a selective shunt (10.7%). Postoperative complications include embolic, hemorrhagic (5 patients deceased), thrombotic (1.29%) stroke, cardiac (myocardial ischemia) complications and wound hematoma with airway compromise (1 patient deceased). The patients had a short hospital stay; the

mean day discharge was 1.5 postoperative days. The perioperative mortality was 12 patients (0.35%); the perioperative neurologic morbidity was 1.29% (70 patients).

Conclusion: CEAs can be performed with a careful preoperative evaluation, under regional anaesthesia with awake monitoring and accurate post-operative monitoring of vital signs and a short hospital stay.

References:

- i Tangkenakul C. *Eur J Vasc Endovasc Surg* 1997; 13: 491–499.
- ii Leoni A. *Can J Anesth* 2000; 47:2: 185–187.

A-794

Patient controlled epidural analgesia reduces the amount of local anaesthetics and opioids administered in patients undergoing major urologic surgery

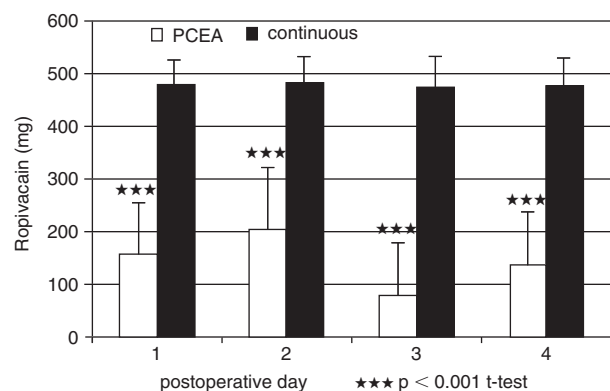
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Background and Goal of Study: Thoracic epidural analgesia (TEA) with local anesthetic and opioids demonstrated superior pain relief after major surgery (1). The same applies in patients undergoing open radical prostatectomy, in particular when relevant cardiopulmonary comorbidity exists (2). For postoperative TEA patient controlled epidural analgesia (PCEA) has become popular but continuous application (CEA) as well as single bolus application are also in use. We evaluated the utilization of analgesics, patient satisfaction and quality of pain relief during CEA and PCEA.

Materials and Methods: After institutional approval 82 consecutive patients undergoing radical prostatectomy in a combination of general anesthesia and TEA were enrolled receiving either PCEA or CEA. Catheters were inserted at the T_{7/8} level preoperatively and in both groups a mixture of ropivacaine 0.2% and sufentanil 0.5 µg/ml was administered. CEA was provided with an infusion rate of 10 ml/h and additional boli of 10 ml were given on demand. PCEA was provided without basal infusion rate and boli of 5 ml. Utilization of analgesics, quality of analgesia and side effects were recorded.

Results and Discussions: There were no differences regarding demographic data, quality of analgesia and side effects between groups. However, on all days drug requirement was significantly lower in the PCEA group ($p < 0.001$) (Fig. 1) resulting in significantly reduced costs ($p < 0.001$).



Conclusion(s): Compared to CEA drug consumption during PCEA is reduced. Although initial costs for PCEA infusion devices must be considered lower personal binding makes PCEA an interesting and cost-effective alternative to CEA.

References:

- 1 Jorgensen H, Wetterslev J, Moiniche S, et al. *Cochrane Database Syst Rev.* 2000;(4):CD001893.
- 2 Heller AR, Litz RJ, Djonlagic I, et al. *Anaesthesist* 2000;49:949–59.

A-795

Thoracic epidural analgesia reduces incidence and duration of postoperative ileus in patients undergoing radical cystectomy

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Background and Goal of Study: Postoperative ileus is a common early complication appearing in up to 30% in patients undergoing radical cystectomy

being the major cause of prolonged hospital stay (1). Underlying pathogenetic factors are type of surgery as well as the degree of the systemic inflammatory response (surgical stress response). Multimodal approaches including sympathicolysis by postoperative analgesia like thoracic epidural analgesia (TEA) in contrast to intravenous opioid analgesia can attenuate or prevent this surgical stress response. The purpose of this study was to evaluate the impact of TEA and patient controlled intravenous analgesia (PCIA) on incidence and duration of post-operative ileus in patients undergoing radical cystectomy

Materials and Methods: In 314 consecutive patients undergoing radical cystectomy for bladder cancer between 1993 and 2001 all ICU and anaesthetic records were reviewed regarding incidence and duration of post-operative ileus with respect to the analgetic regimen. Absence of bowel sounds and defecation longer than 4 postoperative days was considered to be postoperative ileus (1).

Results and Discussions: After plausibility control 302 out of 314 patients were included in the study. TEA with local anesthetics (and lipophilic opioid) was performed in 198 patients and PCIA with piritramide in 104 patients. The major causes for the different regimen were contraindications or refusal for central neuraxial blocks or the loss of the epidural catheter on the day of operation. Groups did not differ regarding demographic data, comorbidity, kind of urinary diversion and quality of analgesia. Duration until first defecation was shorter in the TEA group (2.4 ± 1.4 d vs. 4.1 ± 1.6 d; $p < 0.0005$). First oral intake was also faster in TEA group (2.9 ± 0.96 d vs. 4.3 ± 1.6 d; $p < 0.01$).

Conclusion(s): Despite comparable quality of analgesia there was a striking benefit in the TEA group regarding normalisation of gastrointestinal function and time to first oral intake indicating TEA to be more than just analgesia. These results implicate the integration of the method of postoperative analgesia within multimodal strategies aiming in the future in effective and fast rehabilitation.

Reference:

- 1 Chang SS, Baumgartner RG, Wells N, et al. *J Urol*. 2002;167:208–11.

A-796

Relationship between severity of impairment and health related quality of life in CRPS I

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Background and Goal of Study: Complex Regional Pain Syndrome type I (CRPS I) is a multidimensional complaint, with problems exhibited on impairment, disability and handicap level. However, relationships between severity of impairments and Health Related Quality of Life (HRQL) have not yet been established for CRPS I.

Materials and Methods: Patients with CRPS I of one upper extremity participating in a randomized clinical trial were assessed on the severity of CRPS as measured by the Impairment level Sum Score (ISS) [1], and their HRQL profile, determined with the COOP/WONCA [2] charts. Assessments took place at 0, 6, 17, 32 and 52 weeks. The ISS consists of the measurement of the severity of pain, temperature, volume, and active range of motion. The COOP/WONCA measures Physical Fitness (PF), Daily Activities (DA), Feelings (F), Social Activities (SA), Changes in Health (CiH) and Overall Health (OH). Patients were treated with Dimethylsulphoxide 50% or n-acetylcysteine 600 mg, and received occupational therapy and pain therapy according to protocol. Spearman's r was used to assess relationships between the ISS and different subscales of the COOP/WONCA.

Results and Discussions: 145 patients (mean age 49.9, SD 14.8 years; median duration of CRPS I 89.0, IQR 62.3–135.8 days) were evaluated.

Table 1. Correlation matrix

	ISS 0	ISS 6	ISS 17	ISS 32	ISS 52
OH	.195	.404	.367	.479	.429
DA	.384	.492	.464	.534	.605
PF	.458	.283	.372	.371	.404
SA	.244	.319	.375	.434	.511
F	.153	.333	.311	.361	.383
CiH	.156	.176	.177	.124	.168

Overall, correlation coefficients were highest for the OH, DA and SA subscales. Correlation tended to increase with the duration of complaint (table 1).

Conclusions: The severity of impairment appears to have a stronger relationship with problems experienced in daily activities, social activities and overall health. This relationship tends to become more outspoken in later stages of the disease.

References:

- 1 Arch. Phys. Med. Rehabil. 1998; 79: 979–90.
- 2 Med. Care 1997; 35: 522–37.

A-797

Spinal cord stimulation for CRPS: pain relief may depend on increased peripheral blood flow

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Background and Goal: Spinal cord stimulation (SCS) has been successfully used in a variety of painful conditions including angina pectoris and complex regional pain syndrome (CRPS) [1]. Both syndromes may – at least in part – be attributed to vasoconstriction by an increased sympathetic tone. There is circumstantial evidence that SCS increases peripheral blood flow [2]. The exact mechanisms, however, remain unclear. We report the case of a 49 years old patient suffering from CRPS II following surgical lesion of the left median nerve with heavy spontaneous pain (VAS 9), substantial swelling, and badly restricted motion of the left hand. With implantation of the SCS he was pain-free and recovered from motor deficiency. We evaluated skin blood flow changes during and after stop of SCS.

Methods: We used laser Doppler imaging (LDI, Moor Instruments, UK; arbitrary perfusion units [aU]) to evaluate changes in superficial skin blood flow as surrogate for microcirculatory changes in the affected hand and VAS to determine spontaneous pain. To demonstrate a potential habituation two study days (3 and 60 days post SCS implantation) were scheduled. On each of the two study days, baseline measurements during continuous SCS were carried out after a resting period of 30 minutes. Subsequently, the patient was asked to switch off the stimulator for 1 hour and the measurements were repeated and averaged. This on-off paradigm was done 3 times at intervals of 1 hour.

Results and Discussion: Skin blood flow was significantly higher during SCS as compared to the “off-periods”. This effect was observed on both study days without evidence for habituation.

Table. Blood flow after SCS implantation, values (aU) are presented as Mean \pm SD

	3 days	60 days
on-periods	272,4 \pm 11,4	303,9 \pm 14,9
off-periods	202,6 \pm 12,2	234,9 \pm 10,1

Conclusion: In this CRPS patient with excellent pain relief following SCS implantation, we found evidence for a vascular response to SCS as potential mechanism for pain relief.

References:

- 1 Grabow T, Tella P, Raja S. Spinal cord stimulation for complex regional pain syndrome: an evidence based review of the literature. *Clin J Pain* 2003; 19:371-83.
- 2 Tanaka S, Barron K, Candler M, Linderth B, Foreman R. Role of primary afferents in spinal cord stimulation-induced vasodilation: characterization of fiber types. *Brain Res* 2003; 959:191-8.

A-798

Multimodal therapeutic approach in complex regional pain syndrome

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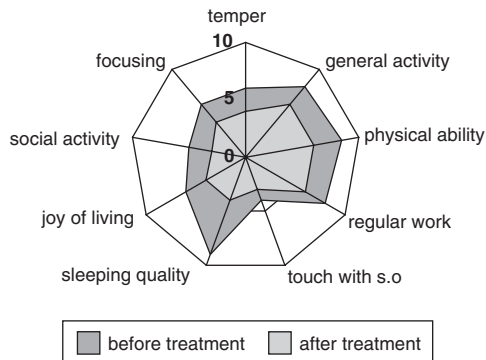
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Background and Goal of Study: In complex regional pain syndrome (CRPS), no therapeutic method used alone has shown efficiency. The aim of this study was to appreciate the benefit on patient's quality of life of a multimodal approach.

Materials and Methods: 24 patients (19 females and 5 males), 50 (31–77) years old [mean (min–max)], suffering from post-traumatic or post-surgical upper limb CRPS1 were treated with a multimodal approach including: (1) medical treatment (calcitonin, neurogenic pain treatment); (2) sympathetic blockade in the warm phase of disease; (3) troncular blockade at the cold phase, to promote physical therapy. Parameters of quality of life, shown in figure 1 were measured at the beginning and at the end or one year after using visual analogic scale (0 for maximal quality of life, and 10 for the worst quality of life).

Results and Discussions: The results are shown in figure 1. All parameters are improved by treatment. Best results are obtained on sleeping quality (9 before and 4 after treatment) and, affective or cognitive parameters.

Conclusion(s): Multimodal approach of CRPS1 improves globally the quality of life of patients. But it do not allow a complete restoration of mechanical function.

**Reference:**

- 1 Harden R.N., Baron R., Jänig W., *Complex Regional Pain Syndrome*, in Progress in Pain Research and Management, I.A.S.P. Press 2001; 22.

A-799**Lumbar intrathecal granuloma complicating a low-dose intrathecal morphine infusion**

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Introduction: Intrathecal catheter tip masses usually occur in the thoracic region in patients receiving high doses of intrathecal morphine in high concentration. We report a case of intrathecal granuloma in the lumbar region complicating intrathecal infusion of low-dose morphine.

Case Report: 73-year-old white female with history of chronic back pain s/p L5 laminectomy. After her back surgery she continued to complain of severe back pain and lower extremities radiculopathy. She didn't tolerate increasing doses of oral narcotics and she had intrathecal morphine pump implantation. She was maintained on intrathecal morphine 25 mg/ml at 3–4 mg/day for the last 4 years with good analgesia. Then she started to complain of worsening back pain with radiation to the right lower extremity. Over the next few months she required increased doses of the intrathecal morphine from 4 mg/day to 8 mg/day. MRI showed an enhancing intrathecal soft tissue at L2 level encasing the tip of the intrathecal catheter with enhancement consistent with intrathecal catheter tip granuloma. The intrathecal catheter was surgically replaced and her symptoms were gradually improving with satisfactory analgesia with intrathecal dilauidid 2.7 mg/day.

Discussions: The intradural-extramedullary mass lesion at the tip of an intrathecal drug infusion catheter was first reported in 1991. No catheter tip masses were reported in patients receiving baclofen. Intrathecal morphine dose was more than 10 mg/d and concentration was more than 25 mg/ml in most patients. Pathology of these catheter tip masses showed chronic inflammatory cells with a variable degree of granuloma formation. CSF flow dynamics within the thoracic spinal canal which is a narrow region with low CSF flow, in combination with the physicochemical properties of intrathecal opiates may be responsible for the growth of intrathecal catheter tip masses. Doses above 20 mg/day should be employed carefully since they may be associated with higher risk. The unanticipated dose escalation and the appearance of new neurological symptoms warrant further investigations.

Reference:

Pain medicine, 2002; 3(4): 313–323.

A-801**Therapy of cancer pain with opioids: is hydromorphone less constipating than morphine?**

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Background and Goal of Study: Aim of this investigation was the assessment of the prevalence of constipation and the use of laxatives in cancer pain patients with an opioid therapy either with oral morphine or oral hydromorphone.

Materials and Methods: After ethical approval of the local ethics committee and patients written consent we enrolled 70 cancer pain patients into this prospective comparative and observational study either with oral morphine (morphine group/MG) or oral hydromorphone (hydromorphone group/HMG). We assessed the symptom constipation by the criteria stool free interval, defecation rate, a Numerical Rating Scale of the subjective feeling of being constipated (NRS constipation) for a period of five consecutive

days. Other key points were cancer diagnosis, daily opioid dosage, and demographic variables.

Results and Discussions: Mean age in the MG was 57.5 (35–80), in the HMG 60.4 years (31–79). Most frequent cancer diagnoses in the MG were lung cancer (40%) and urogenital tumours (30%), in the HMG urogenital cancers (30%), gastro-intestinal cancers (24%) and lung cancer (14%). Mean daily dosage of morphine was 100.6 mg (sd ± 74.8), and of hydromorphone was 27.5 mg (23.4) (mean morphine equivalent 125.5, sd ± 117). Mean NRS for pain in the MG was 3.4 (sd ± 2.4) and in the HMG 3.6 (sd ± 2.2).

During the assessment period the mean defecation rate was 0.94 per day in the MG and 0.9 in the HMG. In the MG 15% patients had a stool free interval of more than three days, in the HMG 4% of more than three days. The NRS constipation of the MG was 3.94 (sd ± 3.3), and of the HMG 2.2 (sd ± 2.6). 80% of MG patients used laxatives, and 70% of HMG patients. Laxative use comprised polyethylene glycol (HMG 40%, MG 65%), sodium-picosulphate (HMG 24%, MG 25%), mostly (multiple answers possible).

Conclusion(s): In comparison with morphine hydromorphone seems to have less constipating effects.

Reference:

Sykes NP (1998) The relationship between opioid use and laxative use in terminally ill cancer patients. Palliat Med 12: 375.

A-802**The usefulness of side differences as intraindividual control for quantitative sensory testing in chronic pain patients**

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Background and Goal: Although established as a reliable method in pain studies quantitative sensory testing (QST) has not yet become a routine method for chronic pain patients due to a high variability of the method and lack of normative data of pain patients.

It was the aim of this prospective study to determine side differences as intraindividual control and to compare painful sites with painless control sites of pain patients.

Methods: After obtaining informed consent 80 consecutive chronic pain patients referred to our pain unit underwent thermal QST. 29 patients presented unilateral pain at the upper limb, 51 patients had pain at other sites and served as control at the painless upper limb. Using the method of limits perception thresholds to heat (HPT) and cold (CoPT) and pain thresholds to heat (HPPT) and cold (CoPPT) were assessed by means of a thermal sensory analyser (TSA 2001, Medoc) at both upper limbs. Differences between painful and non-painful sides and between right and left (control) were calculated. The average positive and negative differences (median) were classified as hypo- or hyperaesthesia and hypo- or hyperalgesia respectively. They were compared with the side differences of the controls (Mann-Whitney test).

Results and Discussion:

	HPT	HPPT	HPPT	CoPPT
	Hypoaesthesia	Hypoaesthesia	Hyperalgesia	Hyperalgesia
N	15	18	9	16
Difference to control	3,4	2,3	2,5	4,0

Calculated difference [°C] of the intraindividual differences between painful and painless sides (median) and control differences at the upper limb, *p < 0.05.

No significant differences were found for HPT (hyperaesthesia), CoPTs and hypoalgesic CoPPT compared to controls.

Conclusion: Intraindividual side differences are useful to detect significant intraindividual hyperalgesia for both heat and cold pain compared to controls.

A-803**Assessment of carotid and middle cerebral arteries blood flow velocities after stellat ganglion blockade with transcranial doppler ultrasonography**

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Background and Goal of Study: Stellat ganglion blockade (SGB) leads to vasodilation of the arteries of head and neck, as a result of regional sympathetic blockade. We investigated the influence of left SGB on bilateral carotid and middle cerebral arterial blood flow velocities, by using transcranial doppler ultrasonography (TCD).

Materials and Methods: After local ethics committee approval and obtaining informed consent from 20 patients (ages 30–55, ASA I–II) who were

undergoing coronary artery bypass surgery were included in a prospective, randomized study. The patients were divided into two groups 8 mL of 0.5% bupivacaine and 2 mL of 2% lidocaine, in group 1 (n = 10) were administered for left stellate ganglion blockade, using anterior paratracheal approach. After development of Horner syndrome in the same group, we started to measure parameters. Blood flow velocity in bilateral common carotid (CCA) and middle cerebral arteries (MCA) were measured simultaneously before and 20 minutes after SGB, using TCD. At the same time hemodynamic parameters were recorded.

Statistical analysis: Mann-Whitney U test, Wilcoxon test, Friedman to directional variance analysis.

Results and Discussions: There were no hemodynamic changes in two groups, during the study. In group 1, on the side of SGB, blood flow velocity in CCA significantly decreased ($p < 0.01$) whereas velocity in middle cerebral artery was unchanged. On the contralateral side of the SGB, significant changes were not observed in blood flow velocity in CCA and MCA.

Conclusion: These results suggests that CCA blood flow increases in the blocked side following SGB, with no effect on MCA blood flow.

Reference:

Nithara K, Dan K. *Reg Anesth Pain Med* 1998; 23(6): 600–4.

A-804

Dizziness and vasovagal syncope during epidural steroids injections

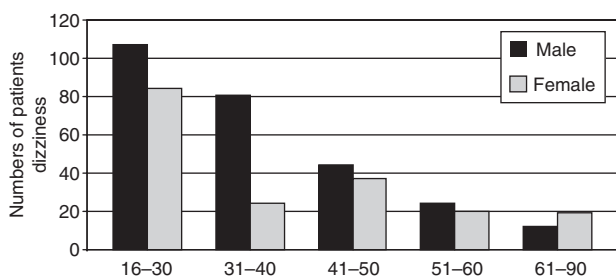
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Background and Goal of Study: As part of a quality control audit, we prospectively studied all complications, including dizziness (bradycardia with sweating and paleness), vasovagal syncope (loss of consciousness) and necessity for IV atropine, while performing epidural steroids injections for radicular pain.

Materials and Methods: In our operating room, we studied 2797 patients during a 30 months period, 49% were male patients. They were monitored with pulse oxymetry and NIBP, and an IV catheter was inserted. The mean duration of the procedure was 20 min. Epidural injections were performed in the sitting position using a standardized protocol with methyl prednisolone acetate 80 mg and xylocaine 2% 3 ml. Pain at rest and movement was evaluated by VAS (visual analog scale) and we collected hemodynamic parameters and any incident. Data are given as MEAN \pm SD. Statistical comparison was made using Pearson Chi-Square test with SPSS software.

Results and Discussions: Mean weight was 74 ± 12.7 kg, mean height 169 ± 8.2 cm, and the mean age 49 ± 12.6 years. Mean VAS at rest was 4 ± 2.45 and at movement 7 ± 1.9 . Dizziness was noted in 10.51% of cases. Incidence of dizziness was significantly more important in males (6.54%) than in females patients (3.96%, $p < 0.001$). In 0.57% of patients a vasovagal syncope occurred. An IV administration of atropine was necessary in 40 patients (1.43%). The cardiac rhythm was significantly different: 50 ± 7 for dizziness patients and 82 ± 12.7 for the others.



Conclusions: Dizziness occurred in 10.51% during epidural steroid injections and syncope in 0.57%. Men are twice more likely to faint than women, particularly in the 31–40 year old group. The presence of adequate material of resuscitation and venous access is essential.

A-805

Interaction between midazolam and epibatidine in spinally mediated analgesia in rats

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Background and Goal: Midazolam has spinally mediated analgesic effects through γ -aminobutyric acid_A receptor (1). Nicotinic cholinergic receptor agonist, epibatidine has also potent analgesic action (2). We investigated the

analgesic interaction between spinally administered midazolam and epibatidine using rats.

Materials and Methods: Sprague-Dawley rats with lumbar intrathecal catheters were tested for their thermal tail withdrawal response using the tail flick test and for their paw flinches by formalin injection after intrathecal administration of midazolam or epibatidine. The effects of the combination were tested by an isobolographic analysis using ED₅₀ (50% effective dose) values. Eight rats were used in each dose group.

Results and Discussion: ED₅₀ values are shown.

	Tail flick	Formalin phase 1	Formalin phase 2
Midazolam (μ g)	1.6 (0.4–5.1)	1.3 (0.3–3.2)	1.2 (0.3–4.2)
Epibatidine (ng)	32.0 (22.5–45.6)	37.4 (21.5–65.1)	26.8 (10.2–45.8)
Combination (Midazolam) (μ g)	3.3 (2.0–5.5)	0.15 (0.08–0.33)	5.8 (2.4–12.9)
Combination (Epibatidine) (ng)	66.7 (40.8–109.2)	3.3 (1.7–8.3)	130.4 (69–207)

(): 95% confidence interval

The ED₅₀ values in the combination administration were significantly higher than the theoretical additive values in the Tail flick test and phase 2 of the Formalin test, but were significantly lower in phase 2 of the Formalin test.

Conclusions: The analgesic effects of intrathecal midazolam and epibatidine were synergistic on inflammatory acute pain, but inhibitory on thermal induced acute and inflammatory facilitated pain.

References:

- 1 Nishiyama T. *Anesthesiology* 1999; 91: 531–537.
- 2 Sullivan JP. *Med Chem Res* 1994; 4: 502–506.

A-806

Preincisional infiltration and intraperitoneal levobupivacaine 0.25% for analgesia after laparoscopic cholecystectomy: a randomised, placebo-controlled and double blind study

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Background and Goals: The analgesic effect of infiltration of wounds with local anaesthetics and their intraperitoneal application after laparoscopic cholecystectomy still remains unclear. The aim of this study was to test the use of intraincisional and intraperitoneal levobupivacaine (L-B) 0.25% in laparoscopic cholecystectomies.

Material and Methods: 100 patients ASA I–II, aged 25–70 years old under general anaesthesia receiving local infiltration and/or peritoneal local anaesthesia were studied. Local infiltration was performed preoperatively at the trocar wounds and intraperitoneal local anaesthesia above the gall bladder bed at the end of surgery. Each patient was randomly assigned to one of four groups. Group A received local infiltration of 20 ml L-B 0.25% and intraperitoneal 20 ml L-B 0.25%. Group B received local infiltration of 20 ml L-B 0.25% and intraperitoneal 20 ml normal saline (NS). Group C received local infiltration 20 ml NS and intraperitoneal 20 ml L-B 0.25% and group D received local infiltration 20 ml NS and intraperitoneal 20 ml NS. The pain score at rest and cough was assessed at 30 min, 4, 8, 12, 24 h after surgery using a visual analogue scale (100 mm VAS). At 12 and 24 h we evaluated pain score during movement also. If pain score exceeded 40 mm additional analgesic treatment was given (dextro-propoxyphene 75 i.m.). Right shoulder pain was also recorded.

Results: The pain scores were lower ($P < 0.05$) in group A than in the other groups during rest, cough and movement. Groups B, C and D had similar pain scores.

Additional analgesic treatment was significantly lower ($P < 0.05$) in patients of group A (35%) compared to those in group B (50%), group C (55%) and group D (83%). The incidence of right shoulder pain was similar in group A (18%) and group C (22%) but significantly lower ($P < 0.05$) than in group B (65%) and group D (60%).

Conclusions: The combination of preincisional infiltration and intraperitoneal instillation of L-B 0.25% shows an advantage for postoperative analgesia after laparoscopic cholecystectomy.

A-807

Psychological factors, cultural level and consumption of analgesics in the postoperative period. Comparison between two methods of evaluation

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Background and Goals: The authors have already ascertained in previous works that psychological factors and cultural level are correlated to the pain sensitivity threshold in the post-operative period. The aim of this work is to

compare the SCL90 and BSI 18 scales used for a pre-operative screening of the degree of anxiety, somatisation and depression in order to predict the consumption of analgesics post-operatively.

Materials and Methods: 81 patients were examined between the ages of 22 and 75 with ASA risk 1–3, awaiting operations for slipped disc in neurosurgery. These patients were evaluated with regard to their degree of anxiety, somatisation and depression, using the SCL90 and BSI 18 scales, and their cultural level, on the basis of an education of more or less than 8 years. The operations lasted from 90 to 120 minutes and the pre-operative analgesic was administered in the form of 1.5 mcg. Fentanyl per kg of body weight; post-operative analgesic was administered in the form of Ketorolac trometamina and tramadol in doses varying from 30 to 60 mg and from 50 to 100 mg over the first 24 hours.

Results: Of the 81 patients under examination the 42 who required higher doses of post-operative analgesic had a score between 35 and 40 on the SCL90 scale and between 31 and 37 on the BSI 18 scale; moreover, they had an education of less than 8 years. The 30 patients who required a lower quantity of analgesic had a higher level of education a score of less than 25 on both the SCL90 and BSI 18 scales. 9 patients required a higher quantity of analgesic even though they had a score of less than 25 on both scales.

Conclusions: Both scales allowed a correct prediction of post-operative analgesic consumption in 90% of cases, however the BSI 18 scale was preferred by the patients because of its greater simplicity. The level of education is indirectly connected with the consumption of analgesics and with the scores obtained on both scales. Only in 10% of cases was there misclassification, demonstrating that the factors correlated to the post-operative pain threshold are still not completely known.

References:

- 1 Picone F e All. Anxiety, somatization, cultural factors and postoperative pain 10th ESA Anniversary meeting – Nice France 6–9 April 2002 pag. 182 A 698.
- 2 Burkhart Bromm e All. Neurophysiological evaluation of pain – Electroencephalography and clinical neurology 107 (1998) 227–253.
- 3 Bachioc V All. Analgesic efficacy in postsurgical pain – relationship with psychological factors and pain-related variables – The pain clinic vol.10 n.1 pp. 39–46 1997.

A-808

The correlation between opioid plasma concentration, PCA pump denial rates, and postoperative pain scores

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Background and Goal: To analyze the correlation between the visual analog scale (VAS), computed plasma concentrations of analgesic medication, and number of denials registered from the patient-controlled analgesia (PCA) pumps.

Materials and Methods: Patients provided written informed consent to participate in this prospective IRB approved study. Doses and administration time of intra- and postoperative opioid analgesics were entered into a pharmacokinetic simulation and infusion software STANPUMP (Steven L. Shafer, MD, Department of Anesthesia, Stanford University, Stanford, CA) to compute plasma concentrations. Values for morphine and hydromorphone were converted to fentanyl equivalents. VAS pain scores were recorded in the postoperative recovery. The archives from the PCA pumps were analyzed for registered number of denials. Statistical analysis was performed by Wilcoxon test. P-value <0.05 considered significant.

Results and Discussion: Data sets were completed for 118 of 135 patients that enrolled in the study. There was a positive correlation between post-operative pain scores with opioid plasma concentration (p-value <0.001) and number of denials (p-value <0.0001) as previously demonstrated by Hein et al (1). However, opioid plasma concentration and number of denials were not significantly correlated.

Conclusions: There was no correlation between opioid plasma concentrations and numbers of PCA pump denials, which suggests that other biological factors must play a role.

Reference:

- 1 Hein HAT et al. *Anesthesiology* 2003; 99: A1006.

A-809

Preemptive selective cyclooxygenase-II inhibitors for pain management in laparoscopic nissen fundoplication

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Background and Goal of Study: Laparoscopic Nissen Fundoplication surgery differs from other laparoscopic procedures due to its longer duration,

surgical technique, excessive irritation of the diaphragm and patient position (1). The aim of this randomised, double-blind, prospective, placebo controlled study was to determine the effectiveness of preemptively used selective COX-II inhibitors on Nissen fundoplication surgery.

Materials and Methods: 60 ASA I–II patients undergoing laparoscopic Nissen fundoplication surgery were randomised to 4 groups. Group C (n = 15), R (n = 15) and P (n = 15) received 200 mg celecoxib, 50 mg of rofecoxib and placebo pill (vitamin C 500 mg) orally one hour prior to surgery, respectively. Group D (n = 15) received 75 mg diclofenac potassium intramuscularly before anaesthesia induction. Standard anaesthesia induction was done with propofol and rocuronium and anaesthesia was maintained with desflurane in O₂–N₂O mixture. Abdominal and shoulder pain while at rest, motion, and coughing were assessed by VAS (0–10 cm) at 10, 15, 30, and 60th minutes and 2, 4, 8, 12, 16, 20, and 24th hours after surgery. Tramadol 100 mg im was administered when VAS > 4 cm. Kruskal-Wallis One-Way ANOVA, Mann-Whitney-U and Chi-square tests were used and p < 0.05 was considered significant. Values are expressed as median and interquartile range.

Results and Discussions: Patients characteristics and demographic data were similar among groups. Tramadol requirement at the first hour was higher in Group P 100 mg (100–100) compared with Group C 0 mg (0–100) (p = 0.001), Group R 100 mg (0–100) (p = 0.008) and Group D 0 mg (0–100) (p = 0.001). Total tramadol requirement at the 24th hour was also higher in Group P 200 mg (100–275) compared to Group C 100 mg (0–100) (p = 0.002), Group R 100 mg (75–100) (p = 0.007) and Group D 50 mg (0–100) (p = 0.001). Pain scores were higher at the 10, 15, 30, and 60th minutes in Group P (p < 0.05).

Conclusion: Preemptive use of celecoxib 200 mg, rofecoxib 50 mg, or diclofenac 75 mg in laparoscopic Nissen fundoplication surgery has a tramadol sparing effect both in the first and 24th hour with a decrease in pain intensity in the first hour.

Reference:

- 1 Pierre AF, Luketich JD, Fernando HC et al. *Ann Thorac Surg* 2002; 74: 1909–15.

A-810

Comparison efficacy and tolerability of preemptively used lornoxicam and tramadol for postoperative pain

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Introduction: Postoperative pain is the most common form of acute pain. The management of postoperative pain has traditionally focused on parenteral administration of opioid analgesics. This randomized double-blind study compared the analgesic efficacy and tolerability of preemptively used lornoxicam and tramadol in 74 patients with pain following arthroscopic reconstruction, laparoscopic cholecystectomy and inguinal herniography.

Method: After approving the ethics committee and having written, informed consent all the patients randomized in four groups. All groups received pills 4 hours before the operation and at the end of the operation they received drugs IV via a PCA. Preemptively Group PL received 4 mg lornoxicam, Group PT 50 mg tramadol and Group L and T placebo pills. After the operation Group PL received 0.8 mg/h infusion and 1 mg bolus lornoxicam; Group L 1.6 mg loading, 0.8 mg/h infusion and 1 mg bolus lornoxicam; Group PT 5 mg/h infusion and 10 mg bolus tramadol; Group T 20 mg loading, 5 mg/h infusion and 10 mg bolus tramadol for 24 hours. Efficacy was assessed by comparing mean hourly pain intensity difference, mean hourly pain relief from a 5-point verbal rating scores at 0, 1st, 2nd, 3rd, 6th, 10th and 24th hours and overall assessment of pain relief at 24th hour.

Results: According dermographic evaluation, operating time, heart rate and mean arterial blood pressure values there were no significant differences between the groups. Both Group PL and PT had lower pain intensity and higher pain relief values than Group L and T. Group PL and PT had lower total drug demand and also overall assessment of pain relief were higher in those groups. When all the groups compared with each other we found out that overall assessment of pain relief was highest in Group PL among the others. Pain intensity was highest in Group T and lowest in Group PL at all times.

Conclusion: Trends toward slightly faster onset of analgesia with lornoxicam and slightly greater PCA demand with tramadol were observed initially, which may partly have been due to a higher baseline pain intensity in group tramadol. After surgical procedures equivalent pain relief with lornoxicam and tramadol when administered by PCA. This study suggests that preemptive administration of drugs had higher pain relief for the treatment of postoperative pain.

A-811**A comparison of two continuous subcutaneous infusion doses of morphine for postoperative analgesia**

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*Department of Anaesthesiology, General Hospital of Larisa, Larisa, Greece***Background and Goal of Study:** Titration of subcutaneous morphine infusion dose in order to provide effective postoperative analgesia without adverse effects.**Materials and Methods:** Sixty healthy, young patients undergoing internal fixation surgery for fractured long bones under standard general anaesthesia were randomly divided into two equal groups. Group A received a subcutaneous infusion of morphine at 30 µg/kg/hr and group B received morphine at 40 µg/kg/hr for 24 hours commencing in the PACU. Postoperative pain was evaluated with a VAS 1–10 scale at 2, 4, 8, 12 and 24 hours, and sedation using a five point scale (0: alert, 4: deep sleep) by a blinded observer. Other adverse effects were also recorded. Rescue analgesia of 20 µg/kg IV morphine was given if VAS > 3.**Results and Discussions:**

Patient characteristics in the 2 groups did not significantly differ.

	A	B	p
VAS			
2	5 (4–7)	4 (3–5)	<0.05
4	5 (4–6)	3 (2–4)	<0.05
8	4 (3–5)	3 (2–4)	<0.05
12	3 (2–4)	2 (1–3)	<0.05
24	3 (2–4)	1 (1–2)	<0.05
Sedation			
2	1 (0–2)	1 (1–2)	
4	1 (1–2)	1 (1–2)	
8	1 (1–2)	0 (0–2)	>0.8
12	0 (0–2)	1 (0–2)	
24	1 (0–2)	1 (0–2)	

Six patients in group A (20%) and 7 in group B (23%) complained of nausea. No patients in both groups complained of vomiting, urinary retention, or itchiness.

Conclusion(s): A continuous subcutaneous infusion of morphine of 40 µg/kg/hr provides superior postoperative analgesia than an infusion of 30 µg/kg/hour, without an accompanying increase in adverse effects.**A-812****Does the addition of sufentanil to intrathecal morphine improve intraoperative and postoperative analgesia after major abdominal surgery**

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*Department of APSIC, Division of Anesthesiology, Geneva, Switzerland***Background and Goal of Study:** Intrathecal sufentanil improve analgesia during labour and intraoperative C-section (1). Intrathecal morphine improve postoperative analgesia (2). The aim of the study was to determine if sufentanil added to intrathecal morphine improve intraoperative and postoperative analgesia compared with intrathecal morphine alone in patients undergoing major abdominal surgery.**Materials and Methods:** 80 adults undergoing major abdominal surgery were randomly allocated to receive either 0.4 mg of intrathecal morphine or 0.4 mg of intrathecal morphine plus 10 micrograms of sufentanil before general anaesthesia. Intraoperative sufentanil consumption, postoperative morphine consumption delivered with a morphine-PCA, pain score evaluated with a visual analogue scale (VAS), adverse effects, and patient satisfaction were recorded during 48 hours. Data were analysed using Student's test, Anova or Chi-square as required. A P value <0.05 was considered statistically significant.**Results and Discussions:** No difference was observed among the two groups in intraoperative sufentanil consumption. Nausea, vomiting and pruritus were comparable among the two groups. No respiratory depression occurred. No difference was found in pain relief and in patients' satisfaction. Data: (Mean ± SEM) are shown in the table.

	Bolus of morphine in PACU	Consumption of morphine at 24 h	Consumption of morphine at 48 h
Intrathecal morphine group	7 ± 0.6	25 ± 2.7	20 ± 2.5
Intrathecal morphine plus sufentanil group	7 ± 0.8	23 ± 2.37	18 ± 2.53

P was NS for each group. PACU: Postanesthetic Care Unit

Conclusion(s): 10 micrograms of sufentanil added to intrathecal morphine do not improve intraoperative and postoperative analgesia for major abdominal surgery.**References:**

- 1 Benhamou D. *Anesth Analg* 1998; 87: 609–13.
- 2 Devys JM. *Can J Anaesth* 2003; 50: 355–61.

A-814**Efficacy of oral preoperative gabapentin to control postoperative pain**

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*Department of Anesthesia-Reanimation, Hospital Ambroise Pare, Boulogne, France***Background and Goal of Study:** Gabapentin (G) is an anticonvulsive drug currently used in neuropathic pain (1). G has anti-hyperanalgesic property but its effects on acute postoperative pain are not well known (2). We realized a prospective double blind randomized study to evaluate analgesic effect of G on pain at rest and during mobilization in patients undergoing arthroscopic anterior cruciate ligamentoplasty.**Materials and Methods:** After institutional approval and informed consent, 40 ASA 1–2 patients were randomly allocated in two groups: the G group received 15 mg/kg per os of G one hour before surgery whereas the P group received placebo. A standardized anaesthetic regimen was used: no premedication, general anesthesia using TIVA with propofol and remifentanyl to obtain a bispectral index between 35 and 55. 15 min before the end of the surgery, all patients received 0.1 mg/kg of IV morphine (M) and 100 mg of ketoprofen. Preoperative stress (VAS, 0–10) and side effect of G, postoperative pain in recovery room (RR) and in bed (VAS, 0–10), M consumption during the first 24 hours and flexion angle were recorded. Statistical analysis used ANOVA, Student t-test and Mann-Whitney test. P < 0.05 was considered significant.**Results and Discussions:** preoperative stress was significantly lower in G group than P group (3.1 ± 1.7 vs 6.5 ± 1.5).

	PAIN AT REST			
	First pain score in RR	Titrated patients in RR	M titration in RR (mg)	M consumption at 24 h (mg)
G	5.2 ± 2.6*	9/20*	6.8 ± 5.8*	22 ± 13*
P	7.4 ± 1.1	19/20	12.8 ± 3.6	47 ± 21

	MOBILIZATION AT DAY 1	
	Passive flexion	Active flexion
G	69.7° ± 15.2*	64.7° ± 14.2*
P	48.9° ± 19.3	44.2° ± 20.4

*: p < 0.05; °: degree

Conclusion: At this dosage G had no side effect in preoperative room and presented anxiolytic effect. Analgesic effects were found on pain at rest and during mobilization.**References:**

- 1 Mao J *Anesth Analg* 2000; 91: 680–7.
- 2 Dirks *Anesthesiology* 2002; 97: 560–4.

A-816**Remifentanyl induced hyperalgesia in a mouse model of incisional pain**

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*Dept of Neuropharmacology, UPF and *Dept Anaesthesiology, Hospital de Mor UAB, Barcelona, Spain***Background and Goal of Study:** Opioid-induced hyperalgesia and allodynia (OIH) have been reported in man and in animal models after the acute analgesic effects (1). These studies raise the question of the implication of the different opioids used during surgery in the development of OIH in the postoperative period. The aim of our study was to compare the efficacy of fentanyl and remifentanyl inducing hyperalgesia in mice with incisional pain.**Materials and Methods:** The incisional pain model was adapted from (2). We used male albino mice in which hyperalgesia was assessed as follows: Randall-Selitto and plantar tests for mechanical and thermal hyperalgesia, and Von-Frey and cold-plate tests for mechanical and thermal allodynia. In operated mice we compared the effects of opioids Vs saline. Fentanyl (400 µg/kg, SC) and remifentanyl (40 µg/kg, SC) were infused for 30 min during surgery. Nociceptive threshold was evaluated daily for 7 days.**Results and Discussion:** Apparent hyperalgesia was not present after fentanyl infusion, but an equivalent dose of remifentanyl induced significant

thermal hyperalgesia and mechanical allodynia for 7 days. Moreover, remifentanyl clearly enhanced postoperative pain for 7 days Vs 3 days, in saline operated mice.

Conclusion(s): Remifentanyl enhanced postoperative pain in mice. Our results corroborate clinical observations showing that relatively large-dose of intraoperative remifentanyl increased postoperative pain and morphine consumption in humans (3). Our results provide the first evidence of opioid-induced hyperalgesia in an incisional pain model in mice, presenting a new animal model to study the mechanisms implicated in OIH.

References:

- 1 Simonnet G, Rivat C. *NeuroReport* 2003; 14: 1–7.
- 2 Brennan T.J., Vandermeulen EP, Gebhart GF. *Pain* 1996; 64: 493–501.
- 3 Guignard B, Bossard AE, Coste C, et al. *Anesthesiol.* 2000; 93: 409–417.

Acknowledgements: Partially supported by Instituto de Salud Carlos III, Madrid, Spain # C03/06 and *Generalitat de Catalunya* # 2001SGR00409.

A-817

Can soft tip epidural catheter prevent minor complications?

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Background and Aim of Study: The greatest fear in the positioning epidural catheter is the neurological damage; other, more frequent, complications are paresthesias and minor bleeding. With this study we want to analyse if a soft tip epidural catheter has less minor complications than normal catheter.

Materials and Methods: With this retrospective study, we analysed the prevalence of complications (minor bleeding and paresthesia) in the insertion of a normal epidural catheter (Perifix BBraun®) and a soft tip epidural catheter (Perifix soft tip BBraun®). We also investigated, when a minor complication happened, if the physician had decided to position the catheter in the same space, to try another space or to stop the technique. We analysed 61 cases of epidural insertion (38 normal and 23 soft tip catheter) positioned in abdominal, thoracic or urological surgery.

Results: In none case we registered neurological damage. We had minor complication in 41% of insertion of normal epidural catheter (23% minor bleeding and 18% paresthesia) and in 17% of soft tip epidural catheter (0% minor bleeding and 17% paresthesia). In the cases of presence of paresthesia the physicians always decided to leave the catheter; instead in the cases of minor bleeding, twice (25%) the physician decided to remove the catheter, without positioning it in other space, and in other two cases the physician decided to try in another intervertebral space (upper).

Conclusions: This study underline the importance of the presence of soft tip to prevent minor bleeding. Even if this bleeding is not associated with neurological damage, it is important to prevent this event since it can avoid the definitive insertion of the catheter or other attempts in another intervertebral space.

A-818

Strategy for chronic low back pain: role of epiduroscopy as a treatment tool

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Background and Goal of Study: Treatment of the chronic low back pain is one of the major subjects in the pain clinic fields. In 1990s, spinal cord stimulation (SCS) and epiduroscopy (ES) were clinically and successfully introduced in this field. We focused the low invasive property of these techniques. In this study we evaluated the treatment effect of ES and planned the practical strategy for chronic low back pain.

Materials and Methods: 50 low back pain patients who were treated with epidural nerve block for more than 5 times were randomly selected and treated with ES. Their age, sex and precise diagnosis were not also conditioned. Patients' active daily life (ADL) and pain score (PS) were evaluated 6 months later by the mailed questionnaire. Subjective satisfaction degrees were also evaluated. Statistical analyses were evaluated by Wilcoxon's t-test.

Results and Discussions: Patients who were 34 male and 16 female had ES treatment. Their ages were between 38 to 84 years old (mean 58.2). 3 male patients were not successfully treated for the closure of the sacral hiatus. 4 patients had orthopedic operations to remove big hernia and 5 patients had SCS treatment after ES. 29 patients (18 male, 9 female) answered the mailed questionnaire. Just after the ES, 90% patients were satisfied and their PS and ADL were also improved significantly, 75% and 60% respectively ($p < 0.01$) but their degrees were gradually decreased. Every patient had inflammatory changes such as adhesion or reddish appearance in the

epidural space. After the ES, some patients whose adhesion in the epidural space was removed showed dramatic pain relief. It means nerve root restriction and epidural inflammation may be responsible for the pain sensation.

Conclusion(s): ES is useful not only for the diagnostic but also for the pain treatment tools. As a low invasive treatment tool, ES has a promising position before SCS.

Reference:

- 1 Saberski I.R., Kitahara L.M., (1995) Direct visualization of the lumbosacral epidural space through the sacral hiatus. *Anesth Analg* 80: 839–840.

A-819

Effects of paracetamol and parecoxib on kidney function in elderly patients undergoing orthopedic surgery

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Background and Goal of Study: Common renal adverse effects of non-steroidal anti-inflammatory drugs (NSAIDs) are reductions in renal blood flow, glomerular filtration rate, and sodium and potassium excretion, mainly via inhibition of renal COX isozymes. The present study was designed to determine the effects of i.v. paracetamol and parecoxib sodium on renal function in elderly patients undergoing orthopedic surgery.

Materials and Methods: The protocol was approved by the institutional review board, each patient provided written informed consent. Seventy-five patients (range 65–95 years, mean (\pm SD) 76 ± 8 years) undergoing hip replacement or surgery of the femoral shaft participated in this randomized and placebo-controlled study. After their arrival on the PACU the patients received an initial dose of the study medication – paracetamol 1000 mg i.v. ($n = 25$), parecoxib 40 mg i.v. ($n = 25$) or saline ($n = 25$); subsequent doses were administered for 3 following days (paracetamol 4×1000 mg i.v., parecoxib 2×40 mg i.v., daily). Opioids were provided as a rescue medication. Blood and urine samples were collected before and after surgery, and glomerular filtration rate, sodium and potassium excretion as well as marker of renal tubular dysfunction were determined. ANOVA, followed by posthoc tests, was used for statistical analysis.

Results and Discussions: The treatment groups were comparable in respect to demographic data and type and duration of surgery (78 ± 36 min). Treatment with paracetamol led to significant opioid-sparing effects (paracetamol 41%, $p < 0.05$; parecoxib 22%: n.s.). During the first 2 hours after the initial dose of parecoxib, creatinine clearance was diminished (132 ± 80 to 85 ± 45 ml/min, $p < 0.05$). Sodium and potassium excretion as well as urine albumine and alpha-1-microglobulin were transiently elevated (group differences: n.s.).

Conclusions: We demonstrated an acute significant reduction in creatinine clearance with i.v. parecoxib in elderly patients. This seems to be of no clinical relevance in our population, since creatinine clearance recovered after only 4 hours. However, further data in renal mild to moderate compromised patients with repetitive dosing are warranted.

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A-820

Postoperative analgesia in children: a postoperative pain service recording

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Background and Goal of Study: Recording for one year of the methods and the results of postoperative analgesia in paediatric patients, as it is applied in accordance with the protocols of the department.

Materials and Methods: 404 paediatric patients, aged 80.3 ± 51.4 months that underwent various operations under general anaesthesia, were included. The operations were divided depending on the postoperative pain intensity as, less ($n = 229$) and more painful ($n = 179$). Five different methods of postoperative analgesia were applied to the patients: 1) iv opioid administration with pump 2) epidural (epd) (lumbar or caudal access) local anaesthetics administration with pump 3) iv opioid bolus injection 4) epidural local anaesthetics bolus injection 5) infiltration with local anaesthetics 6) control group: paracetamol administration according to surgical department protocols. The patients were evaluated for pain intensity (VAS score), additional analgesia, bowel motility, sedation, motor blockade and pruritus.

Results: First evaluation mean time was 7 h 19 m. The results are shown on the following table.

Patients N = 404	iv bolus (5%)	iv pump (41%)	epd bolus (18%)	epd pump (6%)	infiltration (20%)	control (4%)
Supplem. analg.	14,3%	7,3%	15,3%	7,69%	16,5%	94,5%
VAS < 3	100%	92,9%	90,1%	79%	93%	58,3%
Bowel movem.	33,3%	52%	47,2%	76,9%	47,2%	72,2%
Sedation	0%	1,2%	6,9%	3,8%	6,9%	16,6%
Bromage	0%	0,6%	1,4%	7,7%	1,4%	0%
Vomiting	4,7%	9,2%	5,5%	30,7%	5,5%	5,5%
Pruritus	0%	1,8%	0%	3,8%	0%	0%

In the epidural pump group the analgesic regimen seems to be less successive and that may be due to more painful operations. The side effects among patients who received postoperative analgesia did not differ from those of the control group.

Conclusions: From the results, it seems that all methods of postoperative analgesia were satisfactory as it concerns on pain control. The choice of analgesic regimen must depend on the abilities and the knowledge of the anesthetist and the kind of operation.

A-821

The addition of a tramadol infusion to morphine patient-controlled analgesia after abdominal hysterectomy

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Background and Goal of Study: Intraoperative administration of tramadol was reported to be as effective as morphine for postoperative analgesia after abdominal hysterectomy (1). The aim of this study was to determine whether the addition of a tramadol infusion to morphine patient-controlled analgesia (PCA) results in improved analgesic efficacy compared with morphine PCA alone after abdominal hysterectomy.

Materials and Methods: After ethics committee approval, 60 patients aged 18–65 years, ASA grades I–II, undergoing elective abdominal hysterectomy were included in this prospective study. Anaesthesia was induced with 1 µg/kg remifentanyl, 2.5 mg/kg propofol, 0.6 mg/kg rocuronium and maintained with 1–2% sevoflurane – 35% oxygen in N₂O and remifentanyl infusion. Patients were randomized into two groups, each receiving IV morphine PCA after surgery. The tramadol group (n = 30) received a loading dose of tramadol (1 mg/kg) at skin closure and a postoperative infusion of tramadol at 0.2 mg/kg/h. The control group (n = 30) received an equivalent volume of saline at skin closure and a postoperative saline infusion. Postoperative pain was assessed by visual analog scale (VAS), verbal rating scale (VRS) and morphine consumption. Mean arterial pressure, heart rate, respiratory rate, sedation and nausea scores were recorded. Patient satisfaction was assessed at 24 h after surgery. Chi-square, T-test, Mann-Whitney and Anova tests were used for statistical analysis. P < 0.05 was accepted as significant.

Results and Discussion: In the tramadol group, there was a significant reduction in PCA morphine requirements when compared with the control group (27 ± 4.6 mg vs. 40.5 ± 5.4 mg over 24 h). Pain scores were lower in the tramadol group than in the control group at all measurement times and tramadol was associated with improved patient satisfaction. No intergroup differences were found with regard to sedation, nausea and antiemetic use.

Conclusion: The addition of a tramadol infusion to morphine PCA resulted in improved analgesic efficacy and reduced morphine requirements compared with morphine PCA alone after abdominal hysterectomy.

Reference:

- Coetzee JF, van Loggerenberg H. Tramadol or morphine administered during operation: a study of immediate postoperative effects after abdominal hysterectomy. *Br J Anaesth* 1998; 81:737–41.

A-822

Thoracic epidural technique, a quality study

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Background and Goal of Study: Thoracic epidural catheters (ThE) have in many years been used for anaesthesia and pain treatment. The aim of the present study was to evaluate the quality and efficacy of the ThE technique.

Materials and Methods: At our department the thoracic epidural technique is used together with general anaesthesia for cardiac, pulmonary, oesophageal, vascular, and chest wall operations. Likewise, postoperative pain treatment is mainly epidural based. During an eighteen month period we registered insertion techniques, side effects and perioperative function of 269 ThE.

Results and Discussions: All thoracic levels from Th1 to Th12 were used, see table.

Th	1	2	3	4	5	6	7	8	9	10	11	12
No.	17	47	32	58	37	38	8	12	10	1	2	3

More than one insertion attempt was needed in 43% of the patients, and in 12% of the cases another level had to be used. It was in 4 patients impossible to locate the epidural space. One catheter was removed right after insertion due to severe paresthesias. In training anaesthesiologist performed 10% of insertions. The distance from the skin to the epidural space was 6.1 ± 1.4 cm (mean ± SD), range 2–10 cm, there was no difference between the different levels. The catheter was placed 5.9 ± 1.5 cm, range 3–10 cm into the epidural space, there was no difference between the different levels. In 7% of cases blood was detected in the catheter, and paresthesias were reported in 12% of patients. In one case dura was punctured. A paramedian technique was used in 77% of patients, and a hanging drop technique in 87%. During operation catheter function was good in 94% of patients. Postoperative pain treatment was unsatisfactory in 12% of patients. The epidural catheter fell out in 14 (5%) patients. A new catheter was inserted in 13% of patients, either because of loss of catheter or because of malfunction. Perioperative function and complications were not related to level of catheter insertion or length of catheter in epidural space.

No major complications (haematoma, infection, or permanent neurologic injuries) were reported.

Conclusion: ThE is a powerful technique especially in postoperative pain treatment. However we observed a high frequency of catheter malfunction, indicating the need for a more meticulous perioperative care of the ThE.

A-823

Effects of nociceptive stimuli on fetal pulmonary circulation

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Background and Goal of Study: The fetus is able to exhibit a stress response (increase in cortisol and catecholamines, tachycardia ...) to painful events as soon as 18 weeks of gestation. Stress hormones have been shown to modulate the pulmonary vascular tone and reactivity. At birth, the increase of stress hormones play a significant role in the adaptation to post-natal life. We therefore hypothesized that pain may alter pulmonary circulation in the perinatal period. The hemodynamic response to intradermal injection of formalin – used in experimental studies as nociceptive stimulus – was evaluated in chronically-prepared, late-gestation fetal lambs.

Materials and Methods: Eight ovine fetus were operated on between 128 and 130 days gestation (term = 147 d). Catheters were placed into the ascending aorta, superior vena cava, main pulmonary artery and left atrium. An ultrasonic flow transducer was placed around left pulmonary artery (LPA). Three other subcutaneous catheters were placed in the lambs' limb. Protocols started 5 days post-surgery. The hemodynamic responses to intradermal injection (ID) of formalin (formalin 1%, 1 ml) (PROT 1), to formalin ID after fetal analgesia by sufentanil infusion (loading dose = 6 µg, then 6 µg/hr) (PROT 2), and to sufentanil infusion alone (PROT 3) were recorded. Cortisol and catecholamines blood concentrations were also measured. Protocols were approved by the "Comité d'Ethique de la Fondation de France".

Results and Discussions: PROT 1: 25 minutes after formalin ID, pulmonary vascular resistances (PVR) increased by 35% (from 0.7 ± 0.04 to 1 ± 0.04 mmHg/ml·min, p < 0.001) for one hour. Cortisol increased by 50% (p < 0.05). PROT 2: during sufentanil infusion, PVR and cortisol did not change significantly after formalin ID. PROT 3: PVR did not change during sufentanil infusion. Catecholamines levels did not change during any of the protocols.

Conclusions: Our results indicate that nociceptive stimuli may increase the pulmonary vascular tone. This response is not mediated by an increase in circulating catecholamines levels. Analgesia prevents this effect. We speculate that this pulmonary vascular response to nociceptive stimulation may explain some hypoxemic events observed in neonates during painful intensive care procedures.

A-824**Effects of intrathecally administered cyclooxygenase-2 inhibitor, celecoxib on thermal and inflammatory induced pain in rats**

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Background and Goal: Cyclooxygenase-2 (COX-2) is reported to have an important role in pain mechanism in the spinal cord (1). We investigated the effects of intrathecally administered COX-2 inhibitor, celecoxib on thermal and inflammatory induced pain in rats.

Materials and Methods: Sprague-Dawley rats with lumbar intrathecal catheters were tested for their thermal tail withdrawal response using the tail flick test (TF) and for their paw flinches by formalin injection into the hindpaw (FOR) after intrathecal administration of celecoxib (0.5, 5, 50 or 200 $\mu\text{g}/20 \mu\text{L}$ in TF, 0.005, 0.05, 0.5, or 5 $\mu\text{g}/20 \mu\text{L}$ in FOR). Celecoxib was dissolved in polyethylene glycol and water and this solution was used as a control. Motor disturbance and other behavioral side effects were also examined. Eight rats were used in each dose group.

Results and Discussion: Even the maximum available dose of intrathecal celecoxib (200 $\mu\text{g}/20 \mu\text{L}$) did not have analgesic effects in TF. In FOR, intrathecally administered celecoxib induced dose dependent decrease of the flinch response in both phase 1 and 2. The 50% effective doses (ED_{50}) were 0.025 μg (95% confidence interval (CI): 0.007–0.082 μg) in phase 1 and 0.009 μg (95% CI: 0.003–0.023 μg) in phase 2. With the doses used in this study, no motor disturbance or behavioral side effects were observed. In the spinal cord, COX-2 might have some roles in inflammatory induced pain but not in thermal induced acute pain.

Conclusions: Intrathecal administration of celecoxib, a COX-2 inhibitor had analgesic effects on inflammatory induced acute and facilitated pain but not on thermal induced acute pain.

Reference:

- 1 Pitcher GM, et al. *Neurosci Lett* 2001; 305: 45–48.

A-825**Small dose clonidine plus ketamine supplementation of remifentanyl-based anesthesia: effect on perioperative opioid analgesic requirements**

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Background and Goal of Study: Opioid withdrawal induced antianalgesia and hyperalgesia were respectively alleviated by clonidine and ketamine in a human experimental pain model (1). Postulated mechanisms include synergism between α_2 -receptor agonists and opioids, and ketamine mediated blockade of the NMDA-receptor system activation by opioids. We considered the potential modulation of remifentanyl induced postinfusion enhancement of pain sensitivity, by intraoperative small dose clonidine plus ketamine administration.

Materials and Methods: Following institutional approval 40 patients, ASA I–III, undergoing open cholecystectomy were randomized to receive clonidine at 2 $\mu\text{g kg}^{-1}$, over a 5-min period, plus ketamine at 5 $\mu\text{g kg}^{-1} \text{ min}^{-1}$ (clon + ket group), or saline (control group), infusion intraoperatively. After a standardized induction, anesthesia was maintained with sevoflurane 0.5 MAC without N_2O , and remifentanyl infusion was titrated to autonomic responses. Thirty min before the end of surgery all patients received 0.15 mg kg^{-1} morphine. Pain scores, using visual analogue scale (VAS), at rest, and morphine requirements were recorded for 24 postoperative hours. Data (mean \pm SD) were analyzed with Student's t-test and χ^2 test as appropriate. Statistical significance was accepted for $p < 0.05$.

Results and Discussions: The study groups were comparable regarding demographics and duration of surgery. Administered doses of clonidine and ketamine were respectively 149.6 \pm 25.4 μg and 727.5 \pm 142.7 $\mu\text{g kg}^{-1}$. Patients in clon + ket group needed less intraoperative remifentanyl (0.30 \pm 0.10 $\mu\text{g kg}^{-1} \text{ min}^{-1}$ vs 0.39 \pm 0.15 $\mu\text{g kg}^{-1} \text{ min}^{-1}$, $p < 0.05$). They also had lower pain scores during the first 30 postoperative min ($p < 0.05$ to $p < 0.01$). Thereafter pain ratings were similar in the two groups. Cumulative postoperative morphine consumption was significantly reduced in the clon + ket group (29.3 \pm 13.5 mg vs 55.7 \pm 18.8 mg, $p < 0.001$). No significant side effects were observed in clonidine plus ketamine treated patients.

Conclusion(s): Small dose clonidine plus ketamine supplementation of remifentanyl-based anesthesia decreases intraoperative remifentanyl consumption and postoperative morphine requirements.

Reference:

- 1 Koppert et al. *Anesthesiology* 2003; 99: 152–9.

A-826**Preincisional low dose ketamine for postoperative analgesia in laparoscopic cholecystectomies**

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Background and Goal of Study: The aim of this study was to evaluate the effectiveness of preincisional low dose ketamine in postoperative pain relief and analgesic requirements, after laparoscopic cholecystectomy.

Materials and Methods: We studied 30 patients, aged 40–75 yrs old, ASA physical status I and II. Patients were divided randomly into two groups: Group 1 received ketamine 0.5 mg/kg iv with midazolam 0.03 mg/kg before induction of anesthesia, and Group 2, received only N/S 0.9% as control. Anesthesia was induced in both groups with propofol 2 mg/kg, remifentanyl 1 $\mu\text{g}/\text{kg}/\text{min}$ and rocuronium bromide 0.6 mg/kg iv, and then maintained with sevoflurane 0.8–1% in $\text{N}_2\text{O}/\text{O}_2$, remifentanyl and rocuronium. All patients, received paracetamol 600 mg im, as well as lornoxicam 4 mg iv, 15 min before discontinuation of remifentanyl. Postoperative pain was assessed using the Visual Analogue Scale (0–10), immediately after the operation, as well as after 4 h. Any additional analgesic requirements or side effects were recorded. Data were analyzed using ANOVA test.

Results and Discussions: Patients who received ketamine, had significantly lower VAS scores, compared with patients of the control group, immediately postoperatively and after 4 h. In addition, patients who received ketamine had less analgesic requirements during the early postoperative period, compared with the control group. Minimal side effects were recorded, regarding both groups.

Conclusion(s): Ketamine is an effective analgesic for the post-operative period, when used preincisionally in low doses in laparoscopic cholecystectomy.

References:

- 1 Miguel R, Fu E.: Preemptive analgesia with ketamine: *Anesth Analg.* 2000 Mar; 90(3):765.
- 2 Moiniche Steen: A qualitative and quantitative systematic review of preemptive analgesia for postoperative pain relief. The role of timing of analgesia. *Anesthesiology* 2002, 96: 725–41.

A-827**Ketamine for postoperative pain: a quantitative systematic review of randomised controlled trials**

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Background and Goal of Study: The aim of this study was to evaluate analgesic efficacy and harm of ketamine for the control of postoperative pain.

Materials and Methods: We systematically searched (Medline, Cochrane Library, Biosis, CINAHL, Embase, bibliographies, all languages, up to October 2003), for randomised, placebo-controlled trials testing ketamine for postoperative analgesia. Exclusion criteria were premedication, emergencies, no pain endpoints, and <10 patients/group. Authors were contacted for additional information. Meta-analyses were done using a fixed-effect model. Results were expressed as Weighted Mean Difference (WMD) or odds ratio (OR) with 95% confidence interval [CI].

Results and Discussions: 53 trials (1971–2003) were included. They reported on a large variety of routes of administration (PCA, PCEA, epidural, caudal, IV bolus, IV continuous, IM, SC, IA, TTS, PO), different doses, treatment or prevention, in adults and children. The largest subgroup (17 trials, 368 patients receiving ketamine, 285 controls) was on intraoperative IV administrations (bolus \pm continuous infusion). Weight-adjusted doses of ketamine were 0.15 to 1.6 mg/kg. Ketamine decreased the VAS (0–10 cm) for postoperative pain intensity at 24 h (WMD -0.7 cm [-1.0 ; -0.3]), cumulative morphine consumption (WMD -14.0 mg [-16.4 ; -11.6]), and increased the time to first analgesic request (WMD 18.2 min [14.9 ; 21.6]). The risk of pruritus was decreased (OR 0.23 [0.07; 0.83]), of vomiting was increased (OR 2.07 [1.02; 4.19]). There was no effect on nausea (OR 0.87 [0.49; 1.54]), hallucinations (OR 6.9 [0.67; 71.1]), and nightmares (OR 8.41 [0.5; 140.7]). There were no data on sedation.

Conclusion(s): In these trials, intraoperative IV ketamine had little effect on postoperative pain outcomes; the risk of hallucination and nightmares was not increased. The tested doses may have been too low.

A-828**Large dose remifentanyl-induced hyperalgesia and ketamine in abdominal surgery**

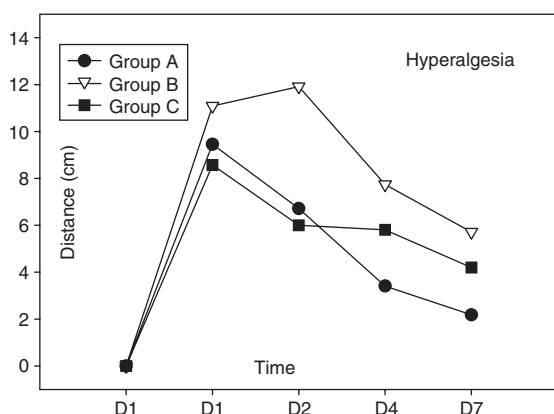
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Goal of Study: In the present study we hypothesize that large intra operative doses of remifentanyl induce acute opioid tolerance and secondary perincisional hyperalgesia. We also evaluated the influence of low-dose ketamine on these acute opioid effects.

Materials and Method: After approval from our institutional Ethics Committee, 75 patients scheduled for abdominal surgery were included. They were randomly assigned to receive intraoperatively: low-dose of remifentanyl (0.05 mcg/kg/min) (group A), high-dose of remifentanyl (0.4 mcg/kg/min) without or with ketamine (0.5 mg/kg and 5 mcg/kg/min) (group B and C). Ketamine was maintained during 48 h at 2 mcg/kg/min after surgery in the group C. Postoperatively all patients were connected to an i.v morphine patient-controlled analgesia (PCA). Wound mechanical hyperalgesia was evaluated by using von Frey hair at day 1, 2, 4 and 7. Postoperative analgesia was assessed by pain VAS at rest and after peak flow test as well as by PCA requirements. Cognitive tests were also realised during 48 h after surgery. Results were expressed as mean. Statistical analysis was performed using ANOVA (Statistical significance was considered at $P < 0.05$).

Results: Morphine PCA requirements were significantly reduced in group C than in the 2 others groups. Mechanical thresholds at 2 cm from wound were significantly lower in group B than in group A. Peri-incisional hyperalgesia measured with von Frey hairs was significantly larger in group B than in the 2 others groups.



Conclusion: Remifentanyl large doses increase the area of secondary hyperalgesia and the adjunction of low doses of ketamine to remifentanyl large doses prevents this effect.

A-829

Increased expression of PDZ-domain protein ProSAP2 but not ProSAP1 in the dorsal horn of the spinal cord after plantar incision in the rat

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Background and Goal of Study: Spinal glutamatergic transmission plays a major role for pain and hyperalgesia after tissue injuries including postoperative pain but the underlying molecular mechanisms are still unknown. Recently, we characterized the specific glutamate receptor subtypes involved in pain and hyperalgesia after a surgical incision in rats (1, 2). In the present experiments we studied the possible role of two postsynaptic density proteins (ProSAP1 and ProSAP2), that are known to modulate trafficking and clustering of glutamate receptors at the postsynapse (3), for spinal synaptic plasticity and hyperalgesia after plantar incision in rats.

Materials and Methods: Naïve rats were used for studying localisation of ProSap1/2 in the spinal cord without an incision. Furthermore, we analyzed spinal cord tissue of rats 2, 6, 12 and 24 hrs after an incision was made in the plantar aspect of the foot as described previously (1). Immunocytochemical staining was performed using 10 µm microtome sections from rat spinal cord. ProSAP1 and ProSAP2 was detected with the C-terminal rabbit anti-ProSAP1 polyclonal antibody (1:1000) and the N-terminal ProSAP2 polyclonal rabbit antibody (1:1000) using the peroxidase-antiperoxidase method.

Results and Discussions: In naïve rats, both proteins were expressed in the lumbar and thoracic spinal cord; however, ProSAP1 was primarily detected in ventral spinal cord tissue (motor neurons) whereas ProSAP2 was detected mainly in the dorsal horn. Furthermore, ProSAP2 but not ProSAP1

was upregulated in the ipsilateral superficial laminae of the spinal cord 6 and 12 hrs after incision.

Conclusion(s): From these data we conclude that ProSAP2, a postsynaptic density protein mainly located in the superficial laminae of the spinal cord, is upregulated 6 to 12 hrs after incision injury. Because ProSAP2 regulates glutamate expression at the postsynapse, we suggest that upregulation of ProSAP2 may contribute to increased glutamergic transmission and hyperalgesia after incision.

References:

- Pogatzki EM, Niemeier JS, Sorkin LS et al. Pain 2003; 105:97–107.
- Zahn PK, Umali E, Brennan TJ. Pain 1998; 74:213–223.
- Böckers TM, Bockmann J, Kreutz MR. J Neurochem 2002; 81:903–910.

A-830

Paradoxical effect of intrathecal lidocaine on spinal glutamate and prostaglandin E2 release following formalin inflammation

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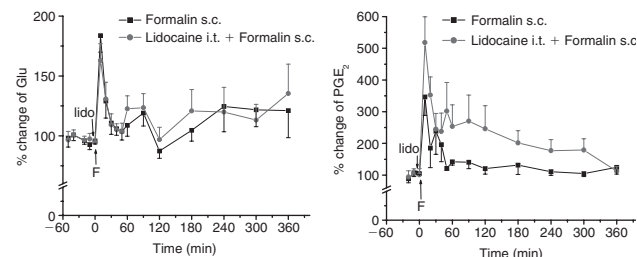
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Background and Goal of Study: Spinal anesthesia with local analgesic agents does not consistently reduce postoperative pain. We investigated the spinal releases of glutamate (Glu) and prostaglandin E₂ (PGE₂) in response to intrathecal (i.t.) injection of lidocaine following formalin inflammation.

Materials and Methods: Adult Wistar rats (8 rats/group) were anesthetized for implantation of a spinal loop microdialysis catheter⁽¹⁾. Following 5 days of recovery, the microdialysis experiment in freely moving animals started with 1 h baseline sampling (5 µl/min). A subsequent i.t. injection of 20 µl of 2% lidocaine or saline was given 5 min before a 50 µl of 5% formalin injection into the plantar of one hind paw of the rat. Dialysates were further collected for another 6 hours. Statistical differences in Glu and PGE₂ concentrations, measured by HPLC and ELISA, respectively, were assessed by two-way ANOVA for repeated measures.

Results and Discussions: Injection of formalin induced significant increases in Glu to 180.6 ± 15.3% and in PGE₂ to 346.7 ± 58.0% of their baseline values. However, intrathecal lidocaine did not attenuate the Glu increase and even accelerated PGE₂ release in CSF following formalin inflammation, although it totally blocked the sensory input. This may be due to a net increase in spinal cord excitability during recovery from lidocaine.

Conclusion(s): Pretreatment with i.t. lidocaine alone may not be beneficial to prevent the development of central hyperexcitability.



Reference:

- Marsala M, et al. J Neurosci Methods. 1995; 62: 43–53.

Acknowledgement: Research Grant Program of Belgium Society of Anesthesia and Resuscitation.

A-831

In patients undergoing lumbar laminectomy, PCA with morphine provides better analgesic effect but more side effects compared to PCA with fentanyl

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Background: In this study we compared Patient Controlled Intravenous analgesia (PCA) with Morphine versus PCA with Fentanyl concerning the postoperative analgesic effect, the incidence of side effects, and the total PCA consumption for 72 hours in patients undergoing lumbar laminectomy (LL).

Materials and Methods: 50 patients, 28 male and 22 female, ASA I–II, undergoing LL under standardized general anaesthesia, were randomized in a double blinded manner to receive postoperatively by PCA a solution of either Morphine 1 mg/ml (Group M) or Fentanyl 12.5 µg/ml (Group F). PCA settings and adjustments for the two solutions were standardized to deliver

equivalent drug doses. Pain scores at rest, at cough, and during mobilization were assessed by the visual analogue scale (VAS 1–10) every 6 hours. Side effects as nausea and vomiting, pruritus, sedation, respiratory depression, urinary retention and hemodynamic instability were evaluated every 6 hours for 72 h. Systolic, mean and diastolic blood pressure, heart rate and oxygen saturation (SpO₂) were recorded and documented every six hours for 72 h. All patients received Tropisetron 5 mg IV/24h, and Ketoprofen 100 mg IM/12 h. PCA consumption was measured for 72 h. Parametric data were analyzed statistically by unpaired Student's t- and repeated measures analysis of variance was used to analyze VAS scores for pain and side effects. Differences were considered statistically significant when $P < 0,05$.

Results: 24 patients were included in M Group and 26 patients in Group F. Patients' characteristics were comparable between groups. The average age was 32 yrs in Group M and 37 yrs in Group F. VAS pain scores at rest, at cough and during mobilization were significantly lower ($P < 0,05$) in Group M. The incidence of nausea, vomiting, pruritus, sedation and urinary retention was significantly higher in group M ($P < 0,05$). There was not any incidence of respiratory depression or hemodynamic instability in both groups. A higher number of demands and doses received were recorded in group F.

Conclusions: In patients undergoing LL, PCA with Morphine is associated with better analgesic effect but more side effects compared to PCA with Fentanyl.

A-832

Functional inhibition by methadone of N-methyl-D-aspartate receptors expressed in *Xenopus oocytes*

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Background and Goal of Study: Methadone is a strong opioid analgesic that is finding increasing use in chronic pain therapeutics. We explored its reported efficacy for inhibiting N-methyl-D-aspartate (NMDA) receptors in a functional electrophysiologic assay.

Materials and Methods: Rat NMDA receptors (NR1/2A, NR1/2B, NR1/2C, and NR1/2D) were heterologously expressed in *Xenopus laevis* oocytes by cytoplasmic injection of cRNAs encoding their subunits. Functional channels were activated with 10 mikroM NMDA, alone and in solutions containing various concentrations of methadone or morphine. The resulting currents were recorded using a whole cell two-electrode voltage clamp technique. Percentage inhibition of control-currents was plotted against drug concentrations. The concentration-response relations were fitted to a logistic function by means of an iterative, nonlinear least-squares program, which derived the 50% inhibitory concentrations (IC₅₀) and Hill coefficients.

Results and Discussions: Methadone inhibited all subtypes of rat NMDA receptor with derived 50% inhibitory concentrations for the NR1/2A, 2B, 2C, and 2D subunits of 3.6, 3.0, 12.1 and 8.9 mikroM, respectively with Hill coefficients of 0.73, 0.68, 0.77, and 0.73. These concentrations overlap with clinically achievable concentrations reported in pharmacokinetic studies. In contrast, morphine inhibited these functional ion channels only at 8–16 times higher concentration. In the presence of methadone, the maximum NMDA-stimulated currents were markedly decreased but the EC₅₀ value for NMDA was altered only slightly, indicating methadone blocks by a non-competitive mechanism.

Conclusion(s): These results provide further functional data describing the NMDA receptor inhibitory actions of methadone and support the hypothesis that methadone acts through both opioid and NMDA receptor mechanisms (1).

Reference:

1 Ebert B, *Biochem Pharmacol* 1998; 56: 553–9.

Acknowledgement: The authors thank Dr. Shigetada Nakamura for providing the rat NMDA receptor clones.

A-833

Intravenous patient controlled analgesia associated to background infusion: an effective and safe alternative to thoracic epidural analgesia for postoperative pain after colonic surgery

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Background and Goal of Study: Epidural analgesia has been recognized as a satisfactory method for pain relief after abdominal surgery (1). It remains an invasive procedure that may result in potential complications. We tested if intravenous patient controlled analgesia (PCA) plus a background infusion provided a valid alternative to epidural analgesia.

Materials and Methods: 32 patients undergoing elective colonic surgery, were assigned in a nonrandomized fashion, to epidural anaesthesia-analgesia group (EPI) or general anaesthesia-intravenous PCA (IV PCA). Allocation in IV PCA group was based on a patient's refusal to receive epidural anaesthesia-analgesia or a contraindication to receive an epidural catheter. In EPI group postoperative pain was controlled by continuous thoracic epidural infusion of ropivacaine 0.2% plus sufentanil 0.75 mcg/ml (5 ml/h). At the end of surgery in IV PCA group a continuous infusion of tramadol (6.25 mg/ml) plus ketorolac (1.875 mg/ml) at 2 ml/h was started and 60 min after extubation PCA was provided by a mechanical pump with morphine 0.6 mg/ml, bolus of 1 ml and lockout of 7 min. Patients were assessed for pain with a visual analogue scale (VAS) at rest (VASr) and after a deep breathe (VASi). Side effects, length of hospital stay, patient satisfaction were also registered. Unpaired t-test or Pearson's Chi-squared test were used as appropriate.

Results: A suitable pain relief was obtained in both group (VASr < 3; VASi < 4). At the first hour VASr was less in EPI group ($p < 0.05$). After 1 hour VASr in IV PCA group decreased until lesser values than in EPI group, $p < 0.05$ at 36 and 48 hours from awakening. VASi was significantly lower in EPI group from awakening to 4 hours later, then it became similar in both groups. Complications were found in EPI group: two patients had pruritus and three had urinary retention. Hospital stay in the two groups was comparable (EPI: 8 ± 3 ; IV PCA: 9 ± 2.7). Patient satisfaction was higher in IV PCA group ($p = 0.03$).

Conclusion(s): Intravenous PCA with low doses of morphine associated to a background infusion of ketorolac and tramadol is an effective and safe method for postoperative pain after colonic surgery. It represents a suitable alternative to epidural analgesia.

Reference:

1 P. Flisberg. *Acta Anaesthesiol Scand* 2003; 47: 457–465.

Education, Research and Presentation

A-834

Modelling and simulation for analysis of operative care chains

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Background and Goal of Study: In the management of operating rooms and hospitals there is little room for real-life experimentation with organisational forms. Modelling and simulation however, can help to analyse the effect of different capacity distributions on bottlenecks in the care chain. The goal of the study was to analyse the bottlenecks in a treatment chain of cardiothoracic surgery.

Materials and Methods: A structural model of the care chain was developed and constructed in the computer program. Lengths of stay (LOS) data were collected for the preoperative ward, operating room, the ICU and the postoperative ward periods of 1292 patients undergoing cardiothoracic

operations. Distribution functions of LOS were fitted to these data using the STAT:FIT module of a modelling and simulation computer program (Promodel®). The fitted distribution functions were incorporated into the model. The model was verified against realised annual production. Subsequently the model was used to simulate several scenarios to increase the annual number of operations (ANO) from 1250 to 1500.

Results and Discussions:

ICU beds	Ward beds	ANO	Cancelled operations (%)
9	18	1277	22.5
10	20	1320	18.2
11	22	1381	13.2
12	24	1442	9.0
13	26	1493	5.3

To increase the ANO to 1500 (+25%) the available operating rooms would have to increase from 3 to 4 (+33%). An increase of ICU to 13 beds (+44%)

is required to maintain the cancellation rate of operations due to ICU bed shortages at an acceptable level. Similarly, ward beds would have to increase to 26 (+44%) to keep the cancellation rate due to shortage of ward beds acceptable.

Conclusion(s): Modelling and simulation can be applied to the bottleneck analysis of care chains and provides the medical manager with the tools to test the realism of production pressures.

A-836

Perioperative electrolyte and fluid management. A survey about knowledge, teaching, routines and placing of responsibility among Danish anaesthetists and surgeons

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Background and Goal of Study: Perioperative electrolyte and fluid management attracts relatively little attention during the pre- as well as post-graduate training.

Aim: To evaluate the knowledge, daily routines and the placing of responsibility concerning perioperative electrolyte and fluid management among anaesthetists and surgeons in Denmark.

Materials and Methods: An anonymous questionnaire was sent to all physicians working in anaesthesia and surgery, focusing on 4 main topics: 1) Knowledge, teaching and attitudes, 2) Distribution of responsibility, 3) Guidelines and protocols and 4) Fingertip knowledge.

Results and Discussions: A majority of the respondents were consultants (48%) and senior residents (27%). More anaesthetists (57%) than surgeons (39%) answered. Four % were invalid or incomplete. Anaesthetists had considerably greater theoretical and practical knowledge about fluid and electrolyte management than surgeons. Both anaesthetists (82%) and surgeons (79%) indicated that they were responsible for fluid management in daily clinical practise. Anaesthetists (88%) indicated that they in general felt comfortable ordering fluid and electrolytes while it was only the case for 45% of the surgeons. 83% of the anaesthetists found that they were well-educated regarding fluid and electrolyte management in contrast to only 53% of the surgeons. Among the surgeons, 35% indicated that they did not know if there were sodium and potassium in isotonic glucose compared with 7% of the anaesthetists. Only 48% of the surgeons but 88% of the anaesthetists stated the correct sodium content in 1 litre of isotonic saline. The knowledge about the composition of other crystalloids and colloids were even less and showed the same difference between anaesthetists and surgeons.

Conclusion(s): The practice and knowledge about fluid and electrolyte management was poor and differed considerably between surgeons and anaesthetists. More attention should be paid on this topic during the pre- and postgraduate training.

A-837

Social representations of anaesthesia by surgeons, anaesthetists, nurses and patients

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Background and Goal of Study: We explore the social thinking of those involved in the practice of general anaesthesia, including anaesthetists, surgeons, nurses and patients. Patients entrust control of their consciousness to anaesthetists, for whom this is daily practice; yet the artificial suspension of the waking state may create deep anxiety. By focusing attention on what is evoked by the concept of general anaesthesia, we hope to gain insights into the way the service could be improved. This inter-disciplinary project involved social psychologists and anaesthetists.

Materials and Methods: In two public hospitals in Northern Italy, a questionnaire was administered to 87 staff and patients, who were then interviewed in depth. We used a qualitative-quantitative approach. A free association task was also performed and the data analysed by correspondence analysis. Computer-assisted procedures were used for narrative data.

Results and Discussions: The Asparm analysis showed an association between the What for patients and nurses whereas the How was of greater importance for surgeons and anaesthetists. Care and Powerlessness was contrasted with Competence and Anxiety, and Professionalism with Fear. The Aplum analysis showed Action contrasted with Inaction, Technology and Pain with Natural Recovery, Them and Me.

Conclusion(s): Our preliminary data would indicate that only staff have a social representation of general anaesthesia, whereas patients tend to identify it with sleep. Patients' contribution is limited to concern for the final outcome: *the what*; likewise for nurses, who display greater empathy toward

patients. Anaesthetists focus on their professional duties (*the How*), and consider the 'shadow zone' (pain, darkness, dependence). Surgeons are not exempt from fear, but count on their competence and professional role. Fear among staff is associated with low satisfaction within the team, whereas, professional pride and trust are found with a high index of satisfaction.

A-838

False loss of resistance is real and best predictor of epidural space

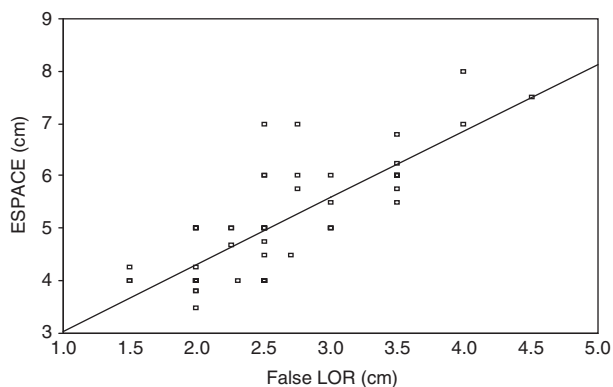
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Background and Goal of Study: Different attempts of anticipating depth of epidural space and difficulty or ease of doing an epidural have not been very successful so far. False loss of resistance poses a major problem. We investigated false loss of resistance and its significance.

Materials and Methods: 18 Gauge epidural set, 5 ml syringe, 22 gauge intravenous cannula and a tape measure were used. A perspective observational study done on 55 pregnant ladies. The data was analysed by regression analysis.

Results and Discussions: This new technique is based on identification of Supraspinous ligament which is responsible for Superficial Resistance and False loss of Resistance. This is explained on mechanical and anatomical bases. The ligament and new parameters were identifiable in all but one patient where difficulty was anticipated and resulted in a dural tap. New parameters, correlation coefficients and statistics are described. One of the graphs, which is shown below, depicts highest correlation coefficient of 0.8 described to date. Linear Regression Equation for graph will give the predicted value of Epidural Space.



Conclusion(s): This study gives a new, safer and reliable technique of doing an epidural, describing for the first time scientific bases of superficial (False) loss of resistance and superficial resistance. False loss of resistance is real and proved to be the best predictor of depth of epidural space in our study. This also forecasts instantaneously the ease or difficulty of doing an epidural. This has not been described before to the best of our knowledge.

A-839

Low doses of dopamine in preventing deterioration of renal function in patients undergoing elective major vascular surgery

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Background and Goal of Study: To determine whether dopamine prevents deterioration of renal function in aortoiliac surgery (1).

Materials and Methods: RCT. 39 consecutive patients with abdominal aortic aneurysm (n = 16) and occlusive disease (n = 23) who underwent elective infrarenal aortic reconstruction were studied. Epidural analgesia and general anaesthesia were used. Exclusion criteria were previous renal disease, diabetes mellitus, hemodynamic instability and reoperation during the study. Dopamine group – 20 patients were given 2 mcg/kg/min dopamine from the beginning of the surgery to the end of the 1st postoperation day. Control group – 19 patients without dopamine infusion. The creatinine (Cr) and dopamine in serum, the glomerular filtration rate (GFR), excretion of catecholamines and electrolytes were measured preoperatively, at the end of the operating (D0) and 1st postoperating (D1) days. Cr also was measured on 7th postoperation day (D7). All results were shown as a mean \pm standard deviation. $P < 0,05$ was significant.

Results and Discussions: Mean value of Cr, GFR, the total and fractional excretion of sodium did not differ between the groups. Diuresis on D0 were increased in the dopamine group as compared to the control group. In both groups there were no significant correlations between serum level of dopamine and the other measured parameters. In control group in D0 there were significant correlation between creatinine clearance and excretion of dopamine in urine ($r = 0.83, p < 0.001$).

Conclusion(s): These results indicate that dopamine (2 mcg/kg/min) has no beneficial effect on renal function in hemodynamic stable patients undergoing elective abdominal aortic surgery.

Reference:

1 Baldwin L., Henderson A., Hickman P. *Ann Intern Med* 1994; 1,120(9), 744–747.

Acknowledgements: The author was supported by grant by Academy of Medicine in Bydgoszcz.

A-840

A new approach to train intensive care specialists using a full-scale anaesthesia simulator in severe sepsis management

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Background and Goal of Study: The Surviving Sepsis six-point plan encourages the education of health care professionals who manage sepsis

patients about all aspects of sepsis management, including diagnosis, treatment and interventions, and standard of care, to decrease the unacceptable high mortality of severe sepsis [1]. Patient simulators are increasingly used for teaching in anaesthesia [2]. Beyond, we developed a training program for teaching intensive care specialists in sepsis management. We report our 1 year experience to share learnings of this new encouraging approach.

Material and Methods: We developed a new concept of teaching severe sepsis criteria and treatment using a full-scale anaesthesia simulator (METI[®] HPS) including the setting of a modern intensive care unit, e.g. ventilator, cardiovascular monitoring and blood gas analysis. Demonstration of different sources of infection, e.g. CT images, were added. Central is the debriefing with individual modules, according to the neglects and individual needs detected during simulation.

Results and Discussions: Up to now 69 physicians participated the training. 52% changed their treatment behaviours due to training content in the following 4 weeks after the training.

Physicians judgement was assessed by a semiquantitative scale from 1 (yes) to 7 (no): Sepsis Simulation Training (SST) helps to better identify (Mean \pm SD) (2,4 \pm 1,2) and better treat (2,5 \pm 1,2) patients with severe sepsis. SST including true-life scenarios is more appropriate than traditional lectures (1,5 \pm 0,7).

Conclusion: We suggest that the presented SST could be an innovative and effective way to train intensive care specialists in severe sepsis management.

References:

- 1 Surviving sepsis [http://www.survivingsepsis.org].
- 2 DE Burt; Br J Anaesth. 1995; 75: 472–80.

Patient Safety

A-841

Carbon monoxide production from five volatile anesthetics in dry sodalime in a patient model: halothane and sevoflurane do produce carbon monoxide

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Background and Goal of Study: Literature suggests that desflurane and enflurane may produce substantial amounts of carbon monoxide (CO) in desiccated sodalime (1). Isoflurane is said to produce less CO and sevoflurane and halothane should produce no CO at all (2). The purpose of this study is to measure the maximum amounts of CO production for all modern volatile anesthetics, with completely dry sodalime.

Materials and Methods: Completely desiccated sodalime was conducted through a patient model, using a circle anesthesia system connected to an artificial lung. A low flow anesthesia with a oxygen/air mixture was maintained using 1 MAC volume equivalent of desflurane, enflurane, isoflurane, halothane and sevoflurane. For quantification of CO production, a portable gas chromatograph was connected to this setup.

Results and Discussions: Highly toxic amounts of CO were measured with desflurane and enflurane. Smaller but still toxic amounts of CO were detected using isoflurane. Furthermore, sevoflurane and halothane did produce CO, albeit in small amounts. Complete peak, mean and standard error of the mean (SE) concentrations in parts per million of carbon monoxide are reported in the table underneath:

Anesthetic vapor	Peak [CO]	Mean [CO]	[SE]
Desflurane	14075	3986	677
Enflurane	10420	3077	501
Isoflurane	2443	890	121
Halothane	198	54	11
Sevoflurane	116	25	6

Conclusion(s): While using desflurane or enflurane in combination with sodalime, one should be aware of the possible production of high concentrations of carbon monoxide.

References:

- 1 Moon RE, Meyer AF, Scott DI, et al. Intraoperative carbon monoxide toxicity. *Anesthesiology* 1990; 73: A1089.
- 2 Fang ZX, Eger EI, Laster MJ, et al. Carbon monoxide production from degradation of desflurane, enflurane, isoflurane, halothane, and sevoflurane by soda lime and Baralyme. *Anesth Analg* 1995; 80: 1187–93.

A-842

Difficult intubation: analysis of predictive factors

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Background and Goal of Study: Prediction of difficult intubation is still a nightmare for anaesthesiologists. Many studies have been published trying to improve sensibility and specificity of predictive factors (1,2). The goal of our study was to assess bedside factors associated with difficult intubation (DI).

Materials and Methods: A prospective study of unexpected difficult or impossible intubation was carried out in 800 patients scheduled for general surgery. We recorded Mallampati (MP) classification modified by Samssoon and Young (2), thyromental (TD) and sternalmental (SD) distances, interincisor gap (IG), head and neck movements (HNM) (3), neck's circumference (NC), and the presence of retrognathia or prognathia. Patients were classified in easy intubation (defined as one trial made by an expert anaesthetist), difficult and impossible intubation (two or more trials or fibroscopy-FBS-needed). Chi square test was used to assess relationship between predictive variables and DI.

Results and Discussions: Easy intubation was recorded in 760 patients (95%) and 40 patients (5%) were difficult or needed FBS. No differences were found on sex, age, weight, TD, SD, HNM, and NC between both groups. 280 (35%) of patients were classified as MP I, 342 (42%) as MP II, 136 (17%) as MP III and 41 (5%) as MP IV. We did not find any case of not intubate-not ventilate. Sensitivity (S) and specificity (SP) of MP classification, IG and both together are shown in the table.

	S%	SP%
MP	60	80,1
IG	40	91,9
MP and IG	25	96
MP or IG	75	75,9

Conclusions: Of all predictive factors studied, only MP classification and IG resulted in statistical differences between groups and assessing both factors may allow the anaesthesiologist to detect up to 96% of difficult intubation.

References:

- 1 Adler F et al. *Anesthesiology* 1997; 87: 1290–1297.
- 2 Samssoon GTL et al. *Anaesthesia* 1987; 42: 487–490.
- 3 Tse JC et al. *Anesth Analg* 1995; 81: 254–258.

A-844

Peripheral inserted central venous catheters (PICC): simple, successful and safe

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Background and Goal of Study: Central venous catheters (CVC) may be placed via peripheral or central veins. Each way of access has its specific advantages and disadvantages. Complications might be caused by local infections at the site of insertion, catheter related sepsis, thrombophlebitis, pneumothoraces or arterial puncture. Recent studies focus on the pros and cons of central insertion sites (1,2,3). Goal of our study was to analyse the technique of peripheral placement of central venous catheters.

Materials and Methods: All central venous catheters placed by our Department of Anaesthesiology in the year 2002 were included in this study. Placement of a CVC was documented on a separate record and data was completed during CVC-visits every second day. We strived for peripheral placement of the catheters if medical reasons required no specific insertion site. Correct placement was verified via atrial EKG.

Results and Discussions: A total of 1856 CVC placements could be included in our study. Table 1 shows the results. 1574 (84,9%) catheters could be placed via peripheral veins. In 78,8% (n = 1463) the first attempt of access was already successful. Correct placement of CVC could be verified by atrial EKG in 87,2% of cases. All catheters, nearly independent of site of insertion, were left in place for a mean of $6,9 \pm 4,6$ days. All in all inflammation was rare (<1%).

Table 1. Results (n%); Catheter days in (d/SD).

	V. basilica	V. cephalica	V. jugularis ext.	V. jugularis int.	V. subclavia	V. femoralis	Total
Insertion site	863/46,5	246/13,3	465/25,1	255/12,1	29/1,6	28/1,5	1856/100
1st attempt successful	760/88,1	201/81,7	294/63,2	162/72,0	22/75,9	24/85,7	1463/78,8
Verified by atrial EKG	841/97,5	244/99,2	418/89,9	102/45,3	11/37,9	2/7,1	1618/87,2
Catheter days	6,7/4,4	6,8/4,1	7,1/5,1	7,3/4,8	7,8/5,8	5,8/5,1	6,9/4,6
Redness	86/10,2	28/11,8	47/10,4	8/3,7	2/7,4	1/3,8	172/9,5
Inflammation	9/1,0	3/1,2	3/0,6	1/0,5	1/3,7	0/0	17/1,0

Conclusion(s): Peripheral placement of central venous catheters is a technically simple and low risk method. By adequate proceeding including electric verification successful placement is much more often as usually published (4). Comparable length of catheter days and rates of inflammation make peripheral insertion of CVC's a practical alternative.

References:

- 1 N Engl J Med 2003; 348: 1123–33.
- 2 JAMA 2001; 286: 700–7.
- 3 Crit Care Med 2002; 30: 454–60.
- 4 Chest 1986; 90: 806–9.

A-845

Decreasing the likelihood of teeth damage during laryngoscopy: comparison between a regular and a modified Macintosh blade

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Background and Goal of Study: The incidence of dental damage due to tracheal intubation ranges from 1:150 to 1:1000 intubations (1). Frequently these damages are caused by contact of the upper teeth with the laryngoscope blade. A laryngoscope with a partially low heeled blade (heel refers to the crescent shaped vertical portion of the laryngoscope) may provide a significantly greater heel-tooth distance than regular Macintosh blades and improve laryngeal visibility.

Materials and Methods: After IRB approval we studied 21 patients scheduled for elective surgery. After induction of anesthesia (Propofol: 2 mg/kg, Remifentanyl: 1 µg/kg over 30 s, Cisatracurium 0,15 mg/kg), the patients were put in "sniffing" position and an experienced anesthesiologist performed 2 laryngoscopies – with a regular and with a modified Macintosh laryngoscope (modified: heel removed at anesthesiologist's end, normal heel at patient's end). Cormack & Lehane Score, Mallampati Score, head height, head angle were recorded and two lateral X-rays were performed. The angular parameters (MIT, EIT) and tooth-blade distance were measured on the X-rays according to Yardeni et al (2) with MIT as a measure for forward space encroachment and EIT as a measure for eye line view displacement. The radiological angle measurement system used had an accuracy of 0.1°.

Results and Discussions: (Mean ± SD)

	Reg. Macintosh	Low heel Mac.
MIT*	1.7 ± 1.8°	-6.7 ± 3.5°
Tooth-blade-dist.*	0.2 ± 0.1 cm	2.5 ± 2.1 cm
Cormack/Lehane†	1.6 ± 0.8	1.2 ± 0.4

*p < 0.05; †p = 0.056; paired T-Test

Lower MIT indicates less forward space encroachment. Confounding factors (BMI, Mallampati, head position...) and EIT did not differ significantly (p > 0.05).

Conclusion(s): The modified Macintosh laryngoscope lowers MIT (less forward space encroachment of the laryngoscope) and increases tooth-blade distance significantly, thus improving visibility and reducing the risk of upper teeth damage.

References:

- 1 Lockhart PB. *J Am Dent Assoc*; 1986; 112: 480–3.
- 2 Yardeni IZ. *Acta Anaesthesiol Scand*; 2002; 46(8): 1003–9.

A-846

Complications associated with the use of haemodialysis catheters in patients with chronic renal failure

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Background and Goal of Study: The hemodialysis catheters are commonly used in patients with chronic renal failure (CRF). It's combined with the number of complications [1,2]. We analyzed the factors influence the kind and frequency of complications on hemodialysis.

Materials and Methods: We studied 129 cannulations in 95 patients. Vascular access was obtained using Seldingers technique without ultrasound guidance, by puncture of internal jugular (n = 99), subclavian (n = 24) or femoral veins (n = 6). 24 patients had more than 1 cannulation. The demographic data of patients, BMI (body mass index), anaesthesiologist's assessment of cannulation conditions (good or bad), presence of coagulation disorders, anticoagulation treatment and incidence of complications were analyzed. Data are shown as number of cases, percentage and mean ± SD (standard deviation).

Results and Discussions: The patients ages ranged from 19–85 years ($59,15 \pm 14,48$). Their mean weigh was $72,85 (\pm 16,98)$ and height $165,15 (\pm 9,08)$. The complications occurred in 45 (34,88%) cannulations: haematoma, bleeding – 22 (17,05%), cannula embolism – 13 (10,08%), infections – 8 (6,20%), laceration of vessel – 1 (1,55%), other complications – 1 (1,55%). The patients with BMI ≥ 25 had more difficult conditions to cannulation than the patients with BMI < 25 (p < 0,0005) but it wasn't associated with number of complications. We found higher INR [international normalized ratio] in patient with more number of haemorrhagical complications than in the rest (INR = $2,37 [\pm 1,53]$ versus INR = $1,19 [\pm 0,38]$, p < 0,05) There were no difference in coagulological parameters between patients with prophylaxis and without it.

Conclusion(s):

- 1 Coagulation disorders may predispose to local bleeding.
- 2 The obese patients seem to have worse conditions to cannulation of central veins.

References:

- 1 Hoch JR. *Semin Vasc Surg* 1997; 10: 135–143.
- 2 Farrell J, Walshe J, Gellens M, Martin KJ. *Am J Kidney Dis* 1997; 30: 690–692.

A-847

Methylprednisolone induces post-operative delirium in elderly patients

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Background and Goals: Anticholinergic agents and some anesthetic agents are known to cause post-operative delirium (1). In our hospital, post-operative delirium is frequently observed in orthopedic patients, especially in elderly patients who received methylprednisolone sodium succinate (MPSS) during the peri-operative period. In this study we retrospectively explored whether or not MPSS induced delirium in elderly patients.

Material and Methods: Seventy-one patients with cervical myelopathy who underwent anterior decompression or laminoplasty were divided into 4 groups by age (<71 or ≥ 71 years old) and total dose of MPSS administered for 3 days from the day of surgery (<1000, or ≥ 1000 mg).

Results: Post-operative delirium was observed in 21 of the 71 patients.

Age (years old)	Dose of MPSS (mg)	Incidence of Delirium
<71 (60 ± 7)	<1000 (351 ± 262)	2/20 (10%)
(61 ± 8)	≥1000 (1583 ± 383)	3/16 (19%)
≥71 (75 ± 3)	<1000 (294 ± 254)	4/19 (21%)
(78 ± 3)	≥1000 (1781 ± 514)	12/16* (75%)

(mean ± SD) *p < 0.01 vs other groups

Conclusion: Administration of 1000 mg or more of MPSS during the peri-operative period can induce post-operative delirium in elderly patients.

Reference:

1 Lipowski ZJ. *NEJM*. 1989; 320: 578-581.

A-848

A rat model of epidural patch for post dural puncture complications using intrathecal injection of Dextran 40 (rheomacrodex) or polygeline (haemaccel)

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Background and Goal of Study: Epidural autologous blood patch is currently considered the most effective measure in post dural puncture complications. However, some recently performed time vs success and time vs safety studies report a failure rate as high as 71%. We investigated the possibility of using Dextran 40 or Polygeline as alternative materials for epidural patches.

Materials and Methods: Three equal groups (n = 10) of normal Sprague-Dawley rats were subjected to 15 repeated intrathecal injections of either 10% Dextran 40 in normal saline, a 3.5% colloidal solution of Polygeline, or 0.9% normal saline (control group) administered on alternate days over a 1 month period. Subsequently, the neurological effects, histopathologic consequences (immunohistochemical staining) and cytotoxic effects (0.1% eosin exclusion) were assessed. The results were evaluated by the Student's t-test.

Results: No behavioral or clinical derangements were observed in any of the three groups. No significant differences in histopathologic appearances of the spinal cords were detected. Similarly, viability of spinal neuron cells as well as renal, hepatic and peripheral blood mononuclear cells remained unaffected (mean values 96 ± 1 through 98 ± 1 in all samples, p = 0.7 through 0.9 for each comparison, with confidence limits of 95%).

Conclusion(s): Repeated intrathecal injections of Dextran 40 as well as of Polygeline exerted no deleterious (clinical or cellular) effects in the proposed rat model. Therefore, both substances might prove successful as alternative materials for epidural patches, especially in extreme situations, such as sepsis, HIV, or patients refusal to accept an autologous blood patch.

A-849

Patient safety may be affected by close-calls; will theatre teams self report?

A. Bleakley, A. Hobbs, J. Boyden, L. Walsh

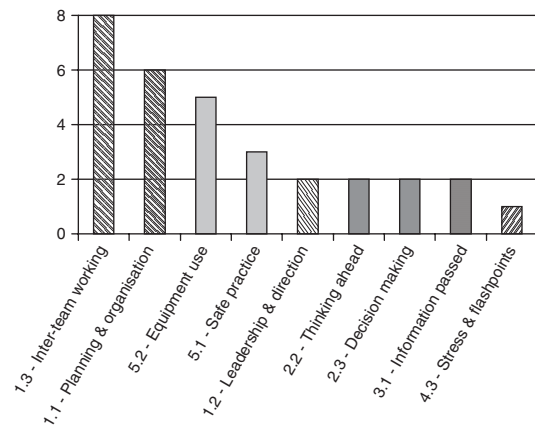
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Background and Goal of Study: Patient safety may be influenced by the accumulation of non-reported small errors in the theatre team¹. Will teams report such 'close-calls,' and can a teamwork matrix help analysis?

Materials and Methods: We analysed 14 confidential 'close-call' reports in 6 weeks raising 31 team issues.

1. Team management	Planning & organisation	Leadership & direction	Inter-team working
2. Team thinking	Situational understanding	Thinking ahead	Decision making
3. Team behaviour	Information passed	Communication style	Monitoring & support
4. Team climate	Recognition & respect	Managing disagreements	Stress & flashpoints
5. Team safety	Safe practice	Equipment use	Fatigue & low energy

Results and Discussions: Narrative scrutiny showed awareness of teamwork failings within and across teams. However, staff often feel powerless to effect change. Feedback to staff initiating practice changes, such as regular team self-review, and training in human factors are needed to prevent incidents and possible patient harm.



Conclusion: Theatre teams will report 'close-calls'. The teamwork matrix was useful in analysing team issues.

Reference:

1 Carthey J, de Laval L, Wright D, et al. *Safety Sci*. 2003; 41(5): 409-425.

Acknowledgement: QinetiQ for the teamwork matrix.

A-850

Can team self-review improve operating theatre teamwork and hence patient safety?

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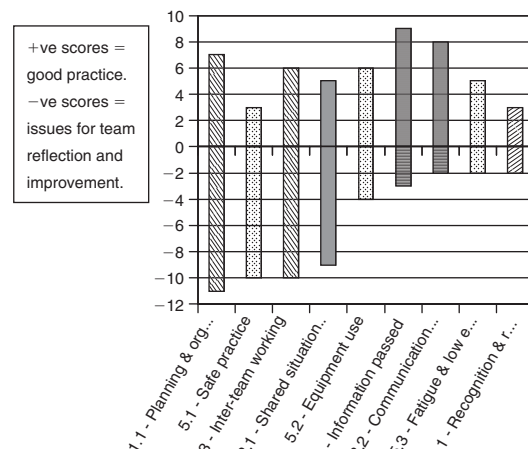
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Background and Goal of Study: Poor theatre teamwork may compromise patient safety¹. Can team-working improve through iterative cycles of reflective self-review (briefing and debriefing) and subsequent action?

Materials and Methods: Collating observation and team logs we analysed 24 reports involving 126 issues over 12 weeks from team self-reviews. We used a teamwork matrix and compared the data to 21 baseline reports.

1. Team management	Planning & organisation	Leadership & direction	Inter-team working
2. Team thinking	Situational understanding	Thinking ahead	Decision making
3. Team behaviour	Information passed	Communication style	Monitoring & support
4. Team climate	Recognition & respect	Managing disagreements	Stress & flashpoints
5. Team safety	Safe practice	Equipment use	Fatigue & low energy

Results and Discussions: Compared to baseline reports, 'information passed' and 'communication style' have improved significantly and teams increasingly highlight issues about 'safe practice'. 'Situational awareness' and 'team management' require further reflection to improve.



Current teamwork issues. Baseline data omitted for clarity

Conclusion: Key teamwork issues improve with team self-review. Briefing could improve team management.

Reference:

1 Schaefer H, Helmreich R, Scheidegger D. *Curr Anaesth Crit Care*. 1995; 6: 48–53.

Acknowledgement: QinetiQ for TSR process & matrix.

A-851

The impact of a preanesthesia equipment checklist on the incidence of equipment incidents

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Background and Goal of Study: Failure to check equipment and equipment failure have been identified as important contributors to anaesthesia-related morbidity and mortality. The aim of this study was to determine the impact of the introduction of an anaesthesia apparatus checklist on the incidence of equipment incidents during anaesthesia.

Materials and Methods: This prospective study was performed in a 175-surgical bed hospital, with a referral population of 250,000. A computerised critical incident reporting system was included in our continuous quality improvement program. Every anesthesiologist, on a voluntary and anonymous basis, could report those incidents that affected, or could have affected, the safety of the patient. One of the measures we adopted in response was the design of a preanaesthesia equipment checklist derived from international standards and manufacturer recommendations. The number of equipment incidents that occurred during the 31-month period before and 29-month period after the intervention was assessed. Each reported incident was evaluated to determine if the checklist could have prevented it. Data were analysed using a two-sided Z-test.

Results and Discussions: The rate of equipment incident decreased from 89 in 21809 cases (1 per 245 cases) to 33 in 22064 cases (1 per 668 cases) following the intervention ($p < 0.001$). Checklist could have prevented 29 equipment incidents in the pre-intervention period versus 7 in the post-intervention period. Breathing circuit leaks (19 versus 5), ventilator failure (15 vs 3) and laryngoscope failure (7 vs 2) were the most decreased incidents by the intervention. A reported limitation in this type of studies is the under-reporting of incidents.

Conclusion(s): A preanesthesia equipment checklist is an effective way to reduce the rate of equipment incidents.

A-852

Peri-operative complication of patient with end-stage renal disease: A retrospective study

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Background and Goals: Renal impairment (serum creatinine levels more than 2.0 mg per dl) has been identified as a risk factor of postoperative long-term morbidity (1), and independent risk factor for cardiac complications after noncardiac surgery (2). However, the peri-operative risk in patients with end-stage renal disease is not well established. The purpose of this retrospective study was to determine the incidence of moderate risk surgery in patient undergoing long-term hemodialysis.

Material and Methods: We undertook a retrospective medical record review to examine the peri-operative complication of parathyroidectomy in patients

who had been undergone hemodialysis more than one year and were 18 years or older. Pre-operative data including the NYHA functional class, medical history and current use of medications were obtained. Peri-operative major event during hospitalization, which were stroke, acute myocardial infarction, heart failure, angina, VT or VF and cardiac arrest or near cardiac arrest were searched for all patients from April 2002 to December 2002.

Results: Data from 60 patients (mean age 53 ± 11 years) were obtained. Duration of hemodialysis was an average (\pm SD) of 11 ± 6 years. Forty two patients were in NYHA class first degree, 4 patients were NYHA class second degree and 4 patients were NYHA class third degree. Eight patients had history of ischemic heart and 5 suffered from compensated chronic heart failure. Post-operatively, 6 patients (10%) had major event. Of one patient suffered from event of cardiac arrest due to asphyxia of sputum and became a persistent vegetable state, of one patient and four patients suffered from heart failure and angina, respectively.

Conclusion: There has been little discussion on the incidence of peri-operative risk in patients with end-stage renal disease. In our series, the incidence was 10% and that result demonstrated the higher incidence compared with cardiac risk of head and neck surgery of less than 5% described at ACC/AHA guideline of peri-operative cardiovascular evaluation for noncardiac surgery described.

References:

1 Samuels LE. *J Card Surg*. 1996; 11: 128–33.

2 Lee TH. *Circulation*. 1999; 100: 1043–49.

3 Eagle KA. *J Am Coll Cardiol*. 2002; 39: 542–53.

A-853

Role of education and point of care analysis with thromboelastography to reduce transfusions after adult cardiac surgery

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Background and Goal of Study: Transfusion practice is highly variable in adult cardiac surgical centres. The question addressed here is if this variability could be reduced or prevented by education programs and intervention with point of care testing.

Materials and Methods: We have conducted two audits of practice in centres in the UK specialising in adult cardiac surgery. The first was a benchmarking study and involved 24 centres. This showed a wide variability in transfusions for the index operation of primary myocardial revascularisation. Following the first audit centres were allocated to A receive their results only, B education as to how to reduce transfusions and C as with group B plus use of the TEG[®] point-of-care coagulation analyser.

Results and Discussions: For red cells, overall 52% of patients received transfusions but this varied between 19% and 82% of patients by centre. There was similar variability for haemostatic component transfusions. The second audit showed that overall red cell transfusions were given to 39% of patients ($p < 0.001$ c.f. audit one). There was no change in red cell transfusion practice in group A. For group B amount of red cells transfused fell significantly from 1.3 (0.3) (mean (s.d.) to 0.8 (0.15), ($p = 0.001$). The proportion and amount of red cell transfusions was also reduced significantly in group C Centres using TEG[®] administered significantly less haemostatic factors than non-TEG[®] centres. The rates of transfusion with FFP was 21% without and 12.2% with TEG[®] ($p = 0.016$) and for platelets 14.5% to 6% ($p = 0.0015$).

Conclusion(s): These data suggest a pivotal role for education and simple point-of-care testing to reduce inappropriate transfusion burden.

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