

times with large discrepancies between in-vivo and in-vitro results. *Methods:* Polymerization time was measured for mixtures of lipiodol/NBCA of 50/50, 60/40, 70/30. The influence of pH, temperature and presence of biological catalysts on polymerization rate was investigated in-vivo using submerged droplet tests. PVA-C, silicone and endothelium surfaces were compared and contact angles were measured to assess physical interaction with NBCA. High-speed video of glue injection through a microcatheter was captured to characterize coaxial flow. *Results:* Polymerization rate increases with pH and temperature. A hydrophilic substrate such as PVA-C provides surface properties that are most similar to endothelium. Endothelium provides a catalytic surface that increases the rate of polymerization. Blood products further increase the polymerization rate with RBC's providing almost instantaneous polymerization of NBCA upon contact. Characterization of coaxial flow shows dripping to jetting transition with significant wall effect. *Conclusions:* We have successfully deconstructed and characterized the dynamic behavior of NBCA embolization. A refined understanding of NBCA behavior could help reduce embolization-related complications.

## F.06

### Our institution's experience with in-patient falls on the Neurosurgery ward

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*Background:* Neurosurgery patients are at higher risk of falls given the morbidity associated with their neurological disease. We present our department's experience with in-patient falls. *Methods:* We analyzed our hospital's database for Neurosurgery in-patient falls from January 1<sup>st</sup> till December 31<sup>st</sup>, 2015. *Results:* Of 1,317 patients admitted under Neurosurgery, 5% (n= 63) had in-patient falls. CT head was done in 24% (n= 15) of patients who had a fall and 93% (n= 14) of the CT head post-fall was reported as no significant interval change. The combined cost of repeat CT imaging reporting no interval changes was approximately \$ 7,000. One CT head post-fall showed worsening midline shift but did not impact management. One of the 78% (n= 48) post-fall patients who did not get a CT head progressed to coma requiring emergent surgery and another patient suffered an isolated hip fracture requiring operation. 41% (n= 26) of falls were from bed and 37% (n= 22) were while ambulating. Leading diagnosis of in-patient falls was subdural hematoma (33%, n = 21) and tumour (32%, n=20). *Conclusions:* Identification of risk factors for in-patient falls can reduce hospitalization costs. The highest number of in-patient falls occurs in patients with subdural hematoma and are likely to occur from a patient's bed.

## F.07

### Reducing ventricular shunt malfunction in the adult patient

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*Background:* Treatment of adult patients with hydrocephalus is often undertaken with a ventriculoperitoneal shunt (VPS). Failure rates have been reported as high as 50% in the first year. *Methods:* A Quality

Improvement (QI) model was used to evaluate and modify VPS-insertion techniques to improve outcome. Malfunction was defined as a change in neurological shunt-related function with correlated diagnostic imaging studies. Prospectively collected data from 2012-2015 was reviewed. *Results:* 146 patients underwent a new VPS insertion. Diagnoses were: normal pressure hydrocephalus 101 patients, acquired hydrocephalus 28 patients and chronic-congenital hydrocephalus 17 patients. 103 patients had traditional insertion of a ventricular catheter using surface landmarks with 2 catheter misplacements requiring surgery. Image guidance with electromagnetic tracking was instituted with 0 catheter misplacements in 43 consecutive patients. 121 patients had traditional minilaparotomy/trocar placement of the peritoneal catheter with 59/121 (49%) experiencing shunt malfunction and 35/59 (59%) experiencing a second malfunction requiring surgery. Laparoscopic insertion of the peritoneal catheter was instituted in 25 consecutive patients with 3 (12%) distal obstructions. Laparoscopy was also used in 13 patients undergoing VPS revision with 2 (15%) experiencing subsequent malfunction. *Conclusions:* Changes to standard VPS surgical treatment including the addition of image-guidance and laparoscopic surgical techniques were associated with a significant decrease in shunt malfunction requiring surgery.

## F.09

### Neurosurgical Outcomes in patients with Multiple Sclerosis related Trigeminal Neuralgia

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*Background:* The aim of this study was to assess the outcomes of surgery for multiple sclerosis-related trigeminal neuralgia (MS-TN). *Methods:* All Manitobans undergoing first surgery for medically refractory MS-TN between 2000 and 2014 were identified. The time interval until additional surgeries were required for recurrent pain, defined as the time to fail (TTF), was determined from a retrospective chart review. Kaplan-Meier analyses were performed and outcomes compared. *Results:* Twenty-one patients (26 sides) underwent first rhizotomy by GammaKnife (GK, 13), glycerol injection (PGR, 10) or balloon compression (BCR, 3). Second procedures were required in 88% at 15±13 months, including GK (24), PGR (19), BCR (25), microvascular decompression (2) and open surgical partial rhizotomy (Dandy, 4) for an overall total of 99 surgeries (1-12 per side). The additional GK, PGR, and BCR eventually failed and required further surgeries in 40%, 60% and 70% at 1, 2, and 3 years respectively with a trend to longer TTF compared to first surgeries (ns). Follow up of Dandy procedures, however, identified no pain recurrence at 4 to 110 months. *Conclusions:* The minimally invasive rhizotomies for MS-TN were associated with high rates of recurrence and reoperation. Long term pain relief was best achieved with a Dandy procedure, even after multiple prior rhizotomies.