

British Skull Base Society

Abstracts from meeting 18–19 May 1995

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The fourth meeting of the British Skull Base Society was held at the Medical School, Queen's Medical Centre, Nottingham.

Retrocochlear Surgery for Tinnitus

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Surgery for tinnitus is controversial. During the last 10 years retrocochlear procedures have been undertaken in 41 patients with tinnitus. The severity of this symptom was assessed pre and post-operatively by a quantitative rating system, in which the relative level of subjective tinnitus loudness above threshold is matched to the contralateral ear. Thirty-two patients with total or severe sensorineural hearing loss were managed by translabyrinthine cochlear nerve section. Investigation by air CT cisternography initially, and fast-spin echo MRI latterly has resulted in the diagnosis of cochlear nerve vascular compression in nine patients presenting with severe primary tinnitus. These cases have been managed by microvascular decompression.

Just under 90 per cent of the VIIIth nerve section cases were secondary or tertiary referrals, with a mean age of 40 years (range 10–62 years). In many of these patients their primary complaint was intractable vestibular symptoms due to peripheral labyrinthine disease. Diagnoses included delayed hydrops 12; failed stapedectomy six; post-CSOM labyrinthitis five; post-otological surgery four; Meniere's disease three; miscellaneous two. Tinnitus was abolished or reduced to a level of 10 dB or less in 53 per cent of 25 patients with complete follow-up data. Twenty-four per cent achieved a tinnitus intensity reduction of 50 per cent; 24 per cent were unchanged.

Just under 90 per cent of the patients undergoing microvascular decompression were also secondary or tertiary referrals, with a mean age of 48 years (range 31–76 years). The duration of symptoms varied between one and 10 years. Three had associated vestibular features. Their subjective tinnitus perception varied between 30 to 60 dB above threshold, and persisted despite comprehensive medical and psychotherapeutic treatment. Delay in the ipsilateral ABR III-V waveforms was seen in six of eight

patients tested, reflecting retrocochlear pathology. Microvascular decompression was carried out by a retrolabyrinthine or a retrosigmoid approach with a minimum post-operative follow-up 1.3 years. Tinnitus was completely abolished in three (33 per cent), very significantly improved to a sensation level of 10 dB or less in three (33 per cent), significantly improved to a level of 15 dB in one (11 per cent), and unchanged in two (22 per cent).

Retrocochlear surgery can therefore be considered a useful management option in patients with troublesome tinnitus which is unresponsive to conservative treatment.

Hydrocephalus Complicating Acoustic Neuroma Tumour and Host Factors

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The association between hydrocephalus and acoustic neuroma is unpredictable. Whilst hydrocephalus is unusual with intra-canalicular tumours, the extent of tumour spread into the cerebello-pontine angle does not necessarily parallel its development. However, hydrocephalus may add significantly to the morbidity associated with acoustic neuroma resection and its pre-operative identification is important in order that such complications may be minimized. We have attempted to identify tumour and host factors which are associated with an increased incidence of hydrocephalus and discuss its management.

One hundred and thirty-one consecutive cases of acoustic neuroma operated upon by one of the authors (PAF) and three co-surgeons (MDA, JT and JAC) were reviewed. Radiological evidence of hydrocephalus was noted, together with a variety of tumour (size, cystic change) and host (age, sex, duration of hearing loss, tinnitus and ataxia) factors. The development of a post-operative csf leak was also noted. Results were analysed by non-parametric and multi-variate statistical methods.

The presence of hydrocephalus was found to be significantly correlated with the size of the tumour ($p < 0.001$). Hydrocephalus was not found to be associated with the development of a csf leak, perhaps due to early recognition and treatment of the former.

Malignant Tumours of the Middle Ear

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Questions persist in the surgical management of malignant tumours of the middle ear. These issues include: the method and extent of temporal bone resection, the inclusion of dural and internal carotid artery resection, the efficacy of pain relief, the prognostic indication of differentiation in squamous cell carcinomas and the timing of facial nerve repair.

A retrospective study of 25 patients treated at the Department of Otolaryngology/Head and Neck Surgery of Beaujon and Bichat-Claude Bernard Hospitals was performed with special reference to the afore-mentioned dilemmas.

This research reveals that the peri-petrous extension of the tumour is often underestimated despite the progress of modern imaging technology. Histology and staging dictate the extent of resection. Total excision requires at least a sub-total petrosectomy with meningeal and internal carotid resection as indicated. Actuarial two-year survival for squamous cell carcinoma was 38 per cent. Facial nerve grafting should be undertaken at the time of primary surgery.

It is concluded that a prospective, multicentre, controlled trial is required to rationalize a uniform protocol in the management of middle ear malignancies.

Intra-operative Image Guidance: The Use of the ISG Viewing Wand in Skull Base Surgery

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The ISG Viewing Wand is a new intra-operative image guidance system using a proprioceptive robotic-like jointed arm. Linked to an ISG Allegro image processor, the system utilizes pre-operative scan data and provides surgeons with almost instantaneously reconstructed computer generated CT or MRI images in two or three dimensions, correlating the position of the tip of any instrument held by the Wand to its corresponding locus on the reformed scan images. The system has been shown to be accurate to within 2 mm when images are recreated from scans with a 4 mm slice thickness. In addition to its application in over 300 neurosurgical cases in Bristol, more than a dozen patients with skull-base, cerebello-pontine angle or temporal bone lesions have also undergone Wand-guided resections. Primary cholesteatomas, glomus jugulare tumours, squamous carcinomas of the temporal bone, cordomas, chondrosarcomas and acoustic neuromas are amongst the lesions that have been safely excised with the aid of the Wand.

By discussing cases and with the aid of computer

generated intra-operative images, we illustrate the advantages that this form of image guidance can offer the skull base surgeon. In our experience, the system has proved to be particularly useful in pre-operative planning, allowing minimally-invasive approaches, providing per-operative navigation, identifying the relationship and proximity of important anatomical structures and in assessing the extent of lesion resection.

The Wand has been used extensively for other neurosurgical procedures and recently has been used to aid functional endoscopic sinus surgery. The potential applications of this form of 'virtual-reality' imaging technology to other surgical procedures are considerable and we discuss possible future developments.

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The Treatment of Hyperactive Cranial Nerve Syndromes By Vascular Decompression

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In current literature, confusion still surrounds the aetiology of trigeminal neuralgia (TN) and hemifacial spasm (HFS). The options for treatment are also continually debated. Over 14 years, 190 patients have been treated for TN (140) or HFS (50). Seven cases had multiple syndromes e.g. bilateral or TN/HFS. All received CP angle explorations by a key-hole microsurgical approach. Findings were neurovascular compression (83 per cent), tumour (two per cent), AVM (two per cent). No abnormality (14 per cent).

Vascular compression was treated by microvascular decompression (MVD) using teflon sling retraction in most cases. Six cases of 'giant vessel' ectasia required vessel retraction with silastic slings. Mean hospitalization: four days.

MVD Results: (156 cases at 14 years, mean FU six years) cure 90 per cent, partial relief three per cent, failure six per cent. All TN relapsed failures were within eight months and have been successfully treated by other means. TN cases with no observed abnormality (24) received partial sensory rhizotomy (PSR). This resulted in 83 per cent cure, 12.5 per cent partial relief and four per cent failure. All tumour/AVM cases cured.

Temporary morbidity: facial weakness 1.5 per cent, bulbar disturbance one per cent, imbalance one per cent, diplopia 0.5 per cent, herpes simplex one per cent, headache 1.5 per cent, CSF leak one per cent.

Permanent morbidity: deafness three per cent, ataxia 0.5 per cent, dysesthesia one per cent, facial numbness 0.5 per cent. No mortality. Deafness followed MVD for HFS has so far been abolished

by BSAEP and ECoG monitoring intraoperatively. In fit patients under 75 years, MVD offers a 90 per cent chance of permanent cure with minimal complications and virtually no facial numbness or weakness. Although meticulous technique is essential, this approach is preferable to percutaneous thermocoagulation for TN or Botulinum toxin injection for HFS, both of which cause deficits and generally require repeating throughout life. The surgical option may ultimately be cheaper.

The Transzygomatic Approach: A Long Term Clinical Review

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The transzygomatic approach has been utilized to improve access to the skull base, infratemporal fossa and orbit for a number of years. It provides a low anterolateral approach to the skull base, along the floor of the middle fossa. It allows both a transsylvian and subtemporal approach with a reduction in brain retraction and better exposure of adjacent neurovascular structures. A long term review of 53 patients is presented highlighting the anatomical location, the nature of the pathology and the post-operative morbidity. Outcome was assessed at two years post surgery and patients were examined to establish the morbidity of the approach, specifically any functional or aesthetic impairment.

It is concluded that the technique is versatile and can be used to improve exposure of a variety of anatomical locations. There is minimal long term morbidity attributable to the surgery of access and the majority of patients have had good outcomes.

Skull Base Surgery in Rhinocerebral Aspergillosis

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Aspergillosis of the paranasal sinuses with extensive intracranial involvement is seen in parts of India and the Middle East. Extensive involvement of the anterior skull base is characteristic of this disease. Unlike invasive aspergillosis reported from other parts of the world, this type of aspergillosis is typically seen in young healthy immunocompetent adults. The term Rhinocerebral Aspergillosis has been used to describe this type of the disease. We present here our experience with anterior skull base surgery in 22 patients with Rhinocerebral aspergillosis. Extension across the dural barrier is the single most important factor influencing the prognosis in these patients. The clinical presentation, management and factors determining the prognosis are discussed.

Nervus Intermedius Function After Vestibular Schwannoma Removal: Clinical Features and Pathophysiological Mechanisms

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Abstract

The results of facial nerve outcome following vestibular schwannoma removal have generally ignored the sensory component of the nerve. This lack of reporting occurs partly because the distress relating to these functions is less obvious to the surgeon, and partly because the facial nerve grading systems currently used do not include the functions of the nervus intermedius.

We have estimated the frequency and nature of abnormalities of nervus intermedius function following vestibular schwannoma removal using a retrospective questionnaire. Questionnaires were mailed to 257 patients and correctly completed and returned by 224 patients (87 per cent).

Prior to surgery five (two per cent) complained of crocodile tears, nine patients (four per cent) noted dryness of the eye and 15 (six per cent) complained of an abnormality of taste. Post operative crocodile tears occurred in 98 (44 per cent), an absence or significant reduction in the production of tears was noted in 162 (72 per cent) and a taste abnormality, either a significant reduction or an alteration in character, was noted in 107 (48 per cent). The onset of crocodile tears approximated to a bimodal distribution and the recovery of nervus intermedius functions was variable.

This study has demonstrated that nervus intermedius abnormalities are common following vestibular schwannoma removal. It also documents their natural history and discusses the underlying pathophysiological mechanisms. We suggest that appropriate pre-operative counselling be given to all patients undergoing surgery, and that the functions of the nervus intermedius be included in the surgical reporting of results of cerebello-pontine angle surgery.

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The Use of Endoscopy in the Management of Nasal Neoplasms

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The aim of this paper is to define the role of endoscopy in the management of nasal neoplasms.

We have reviewed our own experience in this

area, and illustrate this technique with five case reports.

We believe that the use of the endoscope is integral in the rhinological examination, which may result in the earlier detection of nasal neoplasms. We advocate the use of the endoscope in the accurate staging of such neoplasms.

Nasal tumours are preferentially biopsied with the use of the endoscope.

In the resection of benign neoplasms endoscopic resection can be used in case of inverted papilloma that are localized and in cases of inverted papilloma where the morbidity of radical resection is unacceptable. In cases of recurrence of inverted papilloma, further endoscopic resections can be done and does not preclude later radical resection if required. The same principles apply to other benign neoplasia.

The endoscope has no established role in the resection of malignant nasal tumours, but can be used in their palliation.

Finally, endoscopy is essential in the follow-up after resection of all nasal neoplasms, where recurrences are common and tend to occur at an early stage, enabling early detection and subsequent management.

Trans-labyrinthine Cochleo-vestibular Nerve Section for Ipsilateral Delayed Endolymphatic Hydrops

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The clinical entity of delayed endolymphatic hydrops was first defined by Schuknecht in 1978 (Schuknecht, 1978). It constitutes the development of symptoms consistent with endolymphatic hydrops either ipsilateral or contralateral to an ear with a profound hearing loss. We report our experience with the ipsilateral condition amongst 394 cases of Menière's syndrome followed prospectively.

Twenty-four patients were identified as suffering from this condition (6.1 per cent of the total series). A large proportion had had their hearing loss discovered in childhood. The mean delay of onset of vertiginous symptoms after the hearing loss was 18.2 years. All had trials of standard medical treatment but 13 patients continued to suffer from disabling vertigo and proceeded to surgical treatment. This made up 54.9 per cent of these patients which was substantially higher than patients with classical Menière's Disease during the same period (5.4 per cent) reflecting the increased severity of the symptoms.

One patient underwent a retro-labyrinthine vestibular nerve section as he had a contralateral severe hearing loss. Twelve patients underwent a translabyrinthine cochleo-vestibular neurectomy. Outcome was excellent as assessed using a disability grading system (Moffat *et al.*, 1991) and most patients were back at work six weeks after surgery. Vertigo and aural pressure was abolished in all patients and of three patients with intrusive tinnitus, two were relieved of this symptom. The only complication of

surgery was the development in one patient of a sinus at the abdominal fat graft site.

Trans-labyrinthine cochleo-vestibular neurectomy is an effective surgical treatment for ipsilateral delayed endolymphatic hydrops with low morbidity and excellent outcome.

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Transoral Median Rhinotomy ('De-gloving') in the Surgery of Tumour and Trauma of the Anterior Skull Base and Nasopharynx

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After evaluating the results of the transfacial approach to the sinuses and the skull base in 23 cases (Dieffenbach, Moore) for the above indications, the alternative transoral access was practised in extensive frontobasal fractures (six) secondary CSF fistulas (three) empty sella syndrome (two) juvenile angiofibroma (four) and craniofacial tumours (two). Longtime results confirm following advantages:

- (1) Comfortable access to the sphenothmoidal region and the nasopharynx, especially in laterally located pathology like subtemporal extension of juvenile angiofibroma.
- (2) Greater degree of safety in all interventions, resulting from wider exposure of the field.
- (3) Very good exposure of the midline from both sides, especially important in angiofibroma and transverse fracture lines.
- (4) Uneventful healing in all 17 cases.
- (5) Minimal sequelae: sensitivity loss in front teeth (two), mild infraorbital paresthesia (one).
- (6) Excellent cosmesis, superior to that in transfacial approach.

Theoretical risks of the operation lie in the undue treatment of the nose tip and the exaggerated traction on trigeminal branches.

The Use of Galeal-Pericranial Flap in the Management of Cerebrospinal Fluid Rhinorrhoea

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Persistent cerebrospinal fluid rhinorrhoea is a symptom of a dural fistula with leakage of CSF from its subarachnoid compartment into the nose and paranasal sinuses. A dural fistula may be a pathway for pathogenic organisms to enter the intracranial compartment and cause purulent meningitis, with its associated morbidity and mortality. Persistent CSF rhinorrhoea is an absolute indication for surgical repair. In this poster, we describe the use

of galeal-pericranial flap to repair the dural fistulae responsible for CSF rhinorrhoea. The flap is robust, easily harvested via a brow incision and can be used in association with either an external ethmoidectomy or frontal sinus osteoplastic flap approach to repair the defect. We describe the cases we have used it for and its success rate and illustrate its use with photographs and drawings.

The Management of Intrapetrous Aneurysms

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Intrapetrous aneurysms of the internal carotid artery are uncommon and dangerous. We describe a case of ENT presentation and review current management.

An 18 year old lady presented in December 1993 to another institution with a six week history of intermittent brief epistaxis, left otalgia and deafness. The only positive finding on examination was of a left haemotympanum. A myringotomy under LA yielded blood but no improvement. A left tympanotomy under GA was then undertaken, which revealed blood in the mesotympanum and a disrupted incudo-stapedial joint.

CAT and MRI scans were performed but did not reveal the pathological entity. The haemotympanum persisted, the epistaxes worsened, and nothing abnormal was seen in the nose.

Arrangements were made for a cortical mastoidectomy, but the epistaxes became yet more severe and the haemoglobin dropped to eight. At this time blood was seen coming out of the left Eustachian tube orifice and she was transferred to our care.

She was transfused four units and arrangements made for urgent angiography. Repeat fiberoptic nasendoscopy revealed blood in the left Eustachian tube orifice and both maxillary sinus ostia. Angiography revealed the diagnosis of a left internal carotid artery aneurysm alongside the Eustachian tube, and this was duly embolized with no neurological sequelae at a second procedure, after counselling the family.

Such aneurysms can present during otological surgery, as described, or with neurological features. We review the literature and present guidelines for investigation and treatment.

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Skull Base Surgery in Ireland: The Beaumont Otolaryngological Experience

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With a population of just over three and a quarter million the prevalence of skull base lesions in The Republic of Ireland might be expected to be relatively small. However with the forging of closer links with the departments of Neurosurgery and Interventional Neuroradiology there has been a recent upsurge in the number of Skull Base cases passing through the Otolaryngology department of Beaumont Hospital and the instigation in 1994 of a formal Skull Base service.

This paper presents a review of the Skull Base cases dealt with by the Department of Otolaryngology in Beaumont Hospital since July 1991 and emphasizes the role played by technological advances in the improved management of these cases. These technological advances include improved imaging for better diagnosis and operative planning, the use of autologous blood transfusion, pre-operative embolization and the Nd-YAG laser for vascular lesions, the Cavitron ultrasonic aspirator for safer tumour removal, neurophysiological monitoring for cranial nerve protection.

Since mid 1991 over 64 Skull Base procedures involving the Department of Otolaryngology have been carried out. The range of pathology dealt with includes 45 acoustic neuromas, four glomus tumours, two angiofibromas, three spontaneous CSF leaks, two facial nerve decompressions, and other miscellaneous skull base tumours.

Bony Ossicular Fixation Following Neurotological Surgery

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Conductive hearing loss following a neurotological procedure involving a transmastoid approach without middle ear obliteration may be due to a middle ear effusion or iatrogenic compromise of the ossicular chain. Three cases are presented from a consecutive series of 77 patients undergoing retro-labyrinthine surgery, with a minimum follow up of 18 months, in whom a conductive hearing loss occurred secondary to ossicular fixation. This resulted from the deposition of bone dust in the attic and/or middle ear, and undergoing subsequent osteoneogenesis.

The conductive hearing loss developed about six to 18 months after surgery and was progressive. Attempts to remove the offending bony particles to restore normal ossicular mobility in two cases have been unsuccessful. An ossiculoplasty is recommended to correct this type of conduction defect. This uncommon complication can be prevented by temporary protective occlusion of the aditus during temporal bone exenteration.

The Impact of Intra-Operative Facial Nerve Monitoring in Acoustic Neuroma Surgery

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Continuous intra-operative facial nerve monitoring for cerebello-pontine angle surgery was first reported by Delgado in 1979. Since then several groups have reported improved long term facial nerve function following acoustic tumour surgery using intraoperative monitoring. Unfortunately many of these reports appear to have limitations in study design. Thus follow-up may have been too short, incomplete or unsatisfactorily conducted by postal questionnaire. In some studies, cases have been excluded inappropriately, whilst multiple surgical personnel at various stages of the 'operator learning curve' may introduce a further bias compromising valid group comparisons. The present study attempts to avoid these pitfalls.

Sixty-one consecutive patients undergoing acoustic tumour surgery carried out by one experienced neurotological surgeon over a period of just over five years have been studied prospectively. In the first period 26 patients underwent surgery without intra-operative monitoring, whilst 35 were monitored in the second phase. One hundred per cent follow up of minimum duration one year was achieved. Facial nerve function was assessed independently by two observers according to the House-Brackmann classification.

The distribution in tumour size was almost identical in the two groups. Eighty-five per cent of patients with tumours of less than 2.0 cm. extracanalicular extension attained a Grade I functional result irrespective of whether they were monitored or not. Grade I or II results were seen in 90 per cent of unmonitored patients and 96 per cent of the monitored group. None of these patients had a result inferior to Grade III. There was a trend towards improved functional results with monitored large tumours, which was not, however, statistically significant. These results are contrary to many earlier reports, and suggest that flaws in study design have probably exaggerated the efficacy of neuromonitoring in acoustic tumour surgery.

Dysphagia Management in Jugular Foramen Surgery

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Dysphagia remains a major contributor to post-operative morbidity in surgery of the jugular foramen. There have been a number of reports in the literature advocating the immediate use of ancillary procedures such as cricopharyngeal myotomy, vocal cord augmentation, thyroplasty and tracheostomy in the management of dysphagia in these cases.

In the ten years 1985-1994, the Skull Base Unit at St Vincent's Hospital, Sydney, has operated on 61 patients with tumours involving the jugular foramen. This retrospective analysis of these patients reveals that the post-operative morbidity can be substan-

tially reduced if intensive swallowing therapy is employed and if each patient is individually assessed postoperatively for any necessary adjunctive procedures. It is demonstrated that most cases of post-operative dysphagia will settle eventually with conservative management. The cortical and subcortical control of swallowing is an important factor that has been underemphasized in the past. Recent research on the pathophysiology of dysphagia and the findings of this study suggest that cricopharyngeal myotomy should no longer be considered a mainstay in the treatment of deglutition problems in these patients.

Translabrynthine Eighth Nerve Section for Tinnitus

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Abstract

Relief from intractable tinnitus can be obtained by surgical section of the cochlear nerve. Twenty-two patients with severe tinnitus, and severe or profound ipsilateral sensorineural hearing loss, had translabyrinthine VIIIth nerve sections. Aetiology was mixed. Twenty-one patients were available for long term follow-up, by questionnaire. Nine of the patients (43 per cent) had obtained cure or a significant decrease in their tinnitus, at a mean of four years, post surgery. One patient was unhappy at having undergone the procedure. Age, duration of tinnitus and aetiology offered no predictive value for success of the surgery. The operative technique is described. Although not successful in every tinnitus patient, VIIIth nerve section is a surgical option offering a reasonable chance of improvement in selected patients.

The Impact of Facial Nerve Monitoring on Post-Operative Facial Nerve Function Following Acoustic Neuroma Surgery

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Facial nerve monitoring has undoubted benefit during acoustic neuroma surgery and has led to an improvement in facial nerve function. Monitoring is an extremely useful aid to the early identification of the nerve, alerts the surgeon to inadvertent disturbance of the nerve during surgery, enables the surgeon to make a clear distinction between the nerve and tumour, facilitates tumour excision and allows the surgeon to make more accurate predictions of post-operative facial function for small tumours.

An ideal study to evaluate the benefits of facial nerve monitoring would be a prospective controlled trial of monitored versus non-monitored patients operated on by the same surgeon. In light of the

perceived benefits of monitoring, the ethics of such a study would be debatable. As a result the only viable controls are retrospective series.

We have reviewed the experience of a combined otological neurological service which began in 1986 and has used facial nerve monitoring almost from the outset. Both translabyrinthine and suboccipital

routes have been used and the unit policy has been to seek maximum possible excision of larger tumours in patients under the age of 65. Our results are compared with previous series and appear to show a significant improvement in facial nerve outcome for smaller tumours. The problems of using retrospective non-matched controls are discussed.