ORIGINAL ARTICLE

The Translabyrinthine Approach for Acoustic Neuroma and its Common Complications

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Summary

A retrospective analysis of 15 cases intracanalicular acoustic neuroma that had undergone tumour excision by translabyrinthine approach spanning from August 1996 until December 2002 is presented. The main presenting complaints are unilateral hearing loss (100%) and tinnitus (86.7%). The mean age of presentation was 48.5 years old. Magnetic resonance imaging is the most important investigation tool to diagnose acoustic neuroma. At six months post operatively, the facial nerve was normal or near normal (grade I and II) in 46.6%, grade III to IV in 46.6% and grade V to VI in 6.7% of the cases respectively. There were also four cases of post operative cerebrospinal fluid leak, which was successfully managed with conservative measures. The translabyrinthine approach is the most familiar surgical technique employed by otologist. It is the most direct route to the cerebellopontine angle and internal auditory canal. It requires minimum cerebellar retraction. However, it sacrifices any residual hearing in the operated ear.

Key Words: Acoustic neuroma, Translabyrinthine approach

Introduction

The earliest report of a CSF rhinorrhoea following acoustic neuroma surgery is attributed to Panse who described the translabyrinthine approach (TLA) to the cerebellopontine angle in 1904. He abandoned this approach, at least in part, because of persistent CSF leak the associated meningitis. Dandy advocated the complete, extracapsular removal of the acoustic neuroma in 1925 and the unilateral suboccipital approach to the cerebellopontine angle in 1934. One of 5 mortalities in his series of 46 patients was the result of recurrent meningitis secondary to CSF leak.

The modern era of acoustic neuroma tumour surgery began with the publication of William House's first monograph in 1964. He reintroduced and refined the translabyrinthine operation of Panse. The revival of the TLA and the universal application of microsurgical techniques has lowered the operative mortality rate, decreased central nervous system morbidity and improved postoperative facial nerve function. Cerebrospinal fluid leak however persisted as a significant postoperative complication. The purpose of this report is to analyze retrospectively and prepare basic data of acoustic neuroma in the patient managed by ENT surgeon through TLA and to asses the incidence of complications, mainly facial nerve injury and CSF leak.

Materials and Methods

The records of all patients with acoustic neuroma who underwent translabyrinthine resection of the tumour between August 1996 and January 2003 were traced. At the Department of Otorhinolaryngology, Hospital Universiti Kebangsaan Malaysia, the translabyrinthine

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approach is the preferred approach for those with intracanalicular or small tumour that are less than 2cm in the cerebellopontine angle with either severe or profound hearing loss. Patients' demographic data, symptoms, signs and postoperative complications were analysed.

Results

There were 9 female and 6 male with age ranges from 37 to 65 years old and mean age was 48.5 years old. Chinese and Malay constitute 7 each while only one patient was Indian. Severe to profound unilateral hearing loss (100%) and tinnitus(86.7%) were the most common presenting symptoms. Other associated symptoms are non specific giddiness or imbalance (40%) and headache (6.7%). All patients were confirmed to have severe to profound sensorineural hearing loss by standard pure tone audiometry (PTA) which was performed by trained audiologist. Magnetic resonance imagings (MRI) with gadolinium were performed in all cases. Almost all the tumours were intracanalicular with or without small extension into cerebellopontine region. As mentioned, all cases underwent tumour excision through TLA surgeries. The most common post operative complication is vertigo or giddiness, which may or may not associate with vomiting and paralytic nystagmus to contralateral site of operation. It occurs in almost all of the patients which lasted for few days to weeks. The facial nerve paresis is the second most common complication. At six months post operatively 7 patients (46.6%) have normal or near normal facial nerve function or grade I to II, the same number of patient have grade III to IV paresis and the other 1 (6.7%) has grade V to VI House-Brackmann classification. Cerebrospinal fluid (CSF) leak were found in four of the cases (26.7%). Three presented as fluctuant swelling at the operated site while one presented as rhinorrhoea. Only one of the patients required lumbar drainage, others were successfully managed by conservative measures such as compression bandage, rest in bed and avoidance of exertion. There was no reported mortality or postoperative meningitis in this series.

Discussion

There are three common approaches to the cerebellopontine angle and internal auditory meatus, from above, from behind and from side. The superior approach or middle cranial fossa approach has the advantage of allowing the possibility of preserving hearing, but the disadvantages of a slightly increased risk of injury to the facial nerve, and limited access, although the greatest proponents of the technique can remove tumour of up to 4cm intracranial diameter through it (Haid and Wigang, 1992). It also carries a slight risk of epilepsy from retraction of the temporal lobe. The posterior approach or retrosigmoid technique has the advantage of being applicable in hearing preservation operation, but carries the risk of cerebellar retraction. Early facial nerve identification is less secure than with the translabyrinthine procedure. The main indication for translabyrinthine approach is for removal of small to medium sized cerebellopontine angle tumour in non- serviceable hearing ear with good hearing in the contralateral side.

In translabyrinthine procedure, after a canal wall up mastoidectomy is performed, the vertical and horizontal segment of the facial nerve and the three semicircular canals are delineated. Bone is widely removed from the lateral venous sinus, from sinodural angle to the jugular bulb. An island of bone maybe retained on the central portion of the sinus to facilitate placement of the retractor. The dura of the posterior fossa is incised just anterior to the lateral venous sinus. The sinus and posterior fossa dura are then retracted. Intravenous infusion of 25 gram of mannitol as the dura is opened will provide additional decompression and exposure. Dissection is begun in the fundus of internal auditory canal identifying the facial nerve by following the proximal labyrinthine segment to the internal auditory meatus. The vertical crest (Bill's bar) of the internal auditory canal is a helpful landmark to separate the facial nerve from the vestibular nerve. Electrophysiology monitoring of the facial nerve is essential during the dissection. The vestibular and cochlear nerves are avulsed or sectioned in the fundus and the tumour is reflected posteriorly. The auditory-vestibular nerve complex is sectioned near the brainstem and the tumour is removed. The tumour bed and the posterior fossa are scrutinized for bleeding.

The translabyrinthine approach has many advantages. It is the most direct route to the cerebellopontine angle and requires minimum cerebellar retraction that is extradural, decreasing the incidence of postoperative ataxia. Facial nerve preservation is excellent with this technique as the nerve is traced sequentially from the mastoid segment until the internal auditory meatus and cerebellopontine angle portion. If the facial nerve is lost during acoustic tumour removal, the approach offers the best opportunity for immediate repair by end-to-end anastomosis or interposition of a nerve graft. It is also the most familiar surgical technique for the otologist. Finally, and most important, this approach is safe and effective, even with the largest of tumour removal and carries the lowest morbidity and mortality rates. Having said that, this technique has its disadvantages and the most obvious disadvantage is the sacrifice of any residual hearing in the operated ear. It also provide limited access for a large lesion (>4cm).

Although facial nerve dysfunction is an acceptable post operative complication, it would give significant impact on patient's social activities. Almost half of the cases in this series have normal facial nerve function at six months post operatively. Majority of facial nerve dysfunction are in grade III to IV House-Brackmann classification. Although facial nerve was preserved in all cases, paresis of the facial nerve is inevitably occurring. Part of it is attributed to the disruption of blood supply to the nerve during tumour dissection.

The incidence of CSF leak following translabyrinthine approach surgery ranged from 8.1 to 20% as stated by Ronald in 1994. Their series represent 364 CSF leaks in 3064 surgeries for an overall rate of 12%. Cerebrospinal fluid leak following acoustic tumour surgery results from a persisting communication or a series of communications between subarachnoid space and the temporal bone. An abnormal communications between the subarachnoid space and the temporal bone resulted either from erosion of the temporal bone by the tumour or from the surgical dissection necessary to remove the tumour. The leak can be at incisional wound, otorrhoea or otorhinorrhoea.

Following the translabyrinthine approach surgery, there are three possible routes by which CSF can gain access to the temporal bone air cell system. The dural opening into the posterior cranial fossa provides direct communication between the subarachnoid space and the mastoid. From the mastoid CSF can track to the middle ear via aditus ad antrum, facial recess cells, sinus tympani cells opened during facial nerve skeletonization or retrofacial air cells (Bryce *et al*, 1991). Secondly, CSF can gain access to the temporal bone via surgically exposed apical air cell tracts above or below the internal auditory canal. These tracts can connect directly with the middle ear via anterolateral extensions, hypotympanic extensions or directly to the Eustachian tube orifices via an anterosuperior extension. Finally, CSF can gain access to the vestibule through compromise in the fundus of the internal auditory canal. If the stapes has been accidentally subluxed, CSF can then leak directly into the middle ear (Hughes *et al*, 1982).

Saim et al in 1996 published a study of 120 histological sections of adult's temporal bones and found that the peritubal cells were present in 65% of the cases. Seventy three percent of the temporal bones with peritubal cells were found to open either into the osseous Eustachian tube or the middle ear. The epithelial lining of these cells was in continuity with that of the Eustachian tube and the middle ear. The peritubal cells open into the Eustachian tube anterior to its tympanic orrifice in 91% of he cases and only 9% of the cases they open into middle ear. The overall incidence of tubal opening was 59%. The majority of the peritubal cells open very close to the middle ear, but it should be noted that in 23% of the cases, the peritubal cells open into the Eustachian at a distance of more than 5mm anterior to its tympanic orifice. In these cases, the peritubal openings were actually very close to the cartilaginous segment of the Eustachian tube. The significant of these findings is that the CSF leak may not be controlled until the tubal opening of these air cells several millimetres anterior to the tympanic orifice are obliterated.

In order to prevent recurrence, the most efficient method to deal with CSF leak is to perfect the intraoperative technique. Limiting the CSF leak should be started with meticulous re-approximation and closure of the dura created between the posterior cranial fossa and the mastoidectomy cavity. The difficulty is because the dura contracts significantly after being incised, particularly when dehydrated. In addition, bony dissection around the internal auditory meatus leaves a large area devoid of dura mater.

Although complete and watertight closure of the dura is not possible, a partial closure may help to provide scaffolding in which the fat graft can lay. Bone wax can be used to occlude the retrofacial and petrous apex air cells. Then, strips of abdominal fat can be used to obliterate the remaining dura and bony defect. These adipose strips are packed into the defect in layers, working from posterior to the anterior aspect. Besides fat, temporalis fascia or fascia lata could be used to obliterate the cavity. Plugging the *aditus ad antrum* might prevent flow of the CSF into the middle ear, thence to Eustachian tube. Some surgeons have adopted routine obliteration of the middle ear and Eustachian tube with soft tissue, bone pate or proplast.

The skin is closed in layers and very important to apply mastoid pressure dressing. The duration of how long the mastoid pressure dressing is applied varies among surgeons but most of them agreed with the use of pressure dressing for at least 3 days postoperatively. Tos and Thomsen in 1995 recommended that a tight pressure dressing to be kept in place for at least 5 days postoperatively. Luxford and House left compression dressing for 72 hours. If any CSF leak noted at this time, the dressing is replaced for and additional 72 hours before another step such as exploration is taken.

Cerebrospinal fluid leaks are usually handled in a stepwise fashion and the management progresses from conservative measures, lumbar drainage and finally surgical exploration and repair. Conservative measure consist of applying pressure bandage, bed rest with end of bed elevated and restriction of patient's activity. Fluid restriction and acetazolamide can be instituted to reduce CSF production. As in our series, the vast majority of leak will respond to this conservative treatment.

If the leak persists despite conservative measure, a lumbar drain may be placed to further decrease CSF pressure and flow. It is usually placed for 3 to 5 days. The flow of CSF drainage should not be in excess of 20 to 25ml per hour, which is the rate of CSF production because of potential of pneumocranium. Graft *et al* in 1981 reported three cases of pneumocranium following insertion of continuous lumbar drainage for persistent CSF leak. However, all of them recovered well with conservative management. The rare persistent leak may require surgical exploration and repacking with abdominal fat or obliteration of the middle ear and closure of the ear canal.

Beside meningitis, and unusual complication of a CSF fistula is tension pneumocephalus. This complication may occur in the immediate postoperative period or may be delayed by weeks or months. One of the potential mechanism by which air may be accumulated intracranially is the use of nitrous oxide that well known to accumulate within existing air pockets. Therefore at the conclusion of a case, the CSF should be deliberately replenished with irrigation solution. Air may be forced intracranially through the Eustachian tube and the middle ear during Vasalva or nose blowing. Computed tomography scan can readily make the diagnosis of pneumocephalus. Small amounts of air or stable larger amount may be observed and will resolve eventually. Severe tension pneumocephalus requires prompt decompression through a burr hole or ventricular tap as necessary.

In conclusion translabyrinthine approach is the most familiar approach for acoustic neuroma surgery among the otologists. They must be aware of these common complications and precautions taken to avoid them.

References

1. Bryce GE, Nedzelski JM, Rowed DW. CSF leaks and meningitis in acoustic neuroma surgery. Otolaryngol Head and Neck Surg 1991; 104: 81-87.
2. Dandy WE. Removal of cerebellopontine angle tumours through a unilateral approach. Arch Surg. 1934; 29: 337-44.
3. Graft CJ, Gross CE, Beck DW. Complications of spinal drainage in the management of CSF fistula. J Neurosurg. 1981; 54: 392-95.
4. Hughes GB, Glasscock ME, Hays JW. CSF leaks and meningitis following acoustic tumor surgery. Otolaryngol Head and Neck Surg. 1982; 90: 117-25.
5. House WF. Monograph Transtemporal bone microsurgical removal of acoustic neuroma. Arch Otolaryngol. 1964; 80: 599-56.
6. Panse R. Ein Gliom des Akustikus. Arch Ohrenh. 1904; 61: 251-55.
7. Ronald AH. CSF leaks following acoustic neuroma removal. Laryngoscope 1994; 104: 40-58.
8. Saim L, McKenna MJ, Nadol JB. Tubal and tympanic openings of peritubal cells: Implications for CSF otorhinorrhoea. Am J Otol. 1996; 17: 335-39.
9. Tos M, Thompson J. CSF leaks after translabyrinthine surgery for acoustic neuroma. Laryngoscope. 1985; 95: 352-54.