Translabyrinthine surgical approach to the internal acoustic meatus[1]

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A good surgical approach should offer adequate access to manage the pathology and possible complications; it should be capable of modification to suit the circumstances; and it should be relatively devoid of risk. This versatility is to be found in the translabyrinthine approach to the internal acoustic meatus and cerebellopontine angle if combined, when necessary, with a modified transtentorial dissection.

Acoustic neuroma surgery

The translabyrinthine approach was first suggested by Panse (1904) and it was performed in 1912 by Quix and later by others. Though Cushing (1917) foresaw combined surgical attacks on this area, he condemned the translabyrinthine operation (Cushing 1921) and it fell into disrepute. For the next forty years the suboccipital operation described by Dandy (1925) was predominantly used, and even today it is preferred by many neurosurgeons. Ironically it is returning to favour with neurosurgeons and otologists since, in the management of smaller vestibular schwannomas, it offers the prospect of preservation of hearing as well as of facial nerve function following total tumour removal (Smith 1977). Regrettably, however, many patients when first seen have large tumours which are not amenable to such preservation, and even among the group with smaller tumours the hearing loss is frequently so severe that there would be little point in attempting to maintain it. Furthermore, Morrison *et al.* (1976) have drawn attention to the fact that some schwannomas, whatever their nerve or origin, are surgically inseparable from the cochlear division of the VIII cranial nerve; this applied to nearly one in four.

House (1964) and Hitselberger & House (1966) pioneered the modern revival of the translabyrinthine operation which, assisted by microsurgical dissection, antibiotics, steroids and by good anaesthesia, is now practised by teams of otologists and neurosurgeons in many centres throughout the world. With increasing experience, surprisingly large tumours can be removed totally by the translabyrinthine approach. The principal advantage is in the surgical management of small and medium-sized tumours when there is very little risk of mortality or morbidity even to the facial nerve (Table 1). When the otologist becomes involved in the surgical treatment of these lesions, his searching for smaller tumours is likely to be more enthusiastic and persevering. The advent of computerized axial tomography, while revolutionizing the comfort and safety of diagnosis, has not yet solved this problem. There is still a need for tomographic contrast radiology of the type described by Morris & Wylie (1974) for the demonstration of intracanalicular and smaller angle filling defects.

When we come to consider large tumours which have distorted or displaced the brain-stem and which are frequently associated with raised intracranial pressure, the translabyrinthine

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Table 1. Surgical management of 137 acoustic neuromas by the translabyrinthine approach

Tumour size	No.	Facial nerve preservation	No. of deaths
Small	16	100%	–
Medium	59	81.4%	1
Large	62	14.5%	2
	137		3 (2.2%)

operation does not afford sufficient access for safe total removal. A number of combined approaches have been devised to overcome this: the suboccipital-petrosal approach (Hitselberger & House 1966); the subtemporal transtentorial method (Rosomoff 1971); and the translabyrinthine-transtentorial technique (King 1970, Morrison & King 1973). Other workers, including Dawes & Hankinson (1971) and Ojemann *et al.* (1972), prefer a two-stage operation in which the suboccipital and translabyrinthine approaches are used separately. House and his colleagues (Pulec *et al.* 1971) now appear to favour suboccipital decompression followed a week later by translabyrinthine surgery.

Thomsen (1976) reported a series of 125 suboccipital operations in which 105 of the tumours were large and only 20 were medium-sized: the mortality was 22%. In a separate series of 39 cases, the introduction of the operating microscope reduced the mortality to 13%. In 1974, Yasargil & Fox reported a series of 120 suboccipital microsurgical operations in which approximately half of the tumours were large: the mortality was only 3.3%, the morbidity was relatively low and facial nerve preservation was as good as, if not better than, that presented in Table 1. The difference between the series of Thomsen and Yasargil & Fox, and the similarity between the series of Yasargil & Fox and the one reported here, is a consequence of tumour size and microsurgical method. It might appear that the surgical approach is of lesser significance. However, it is felt that, in the removal of very large tumours, the translabyrinthine-transtentorial operation has the advantages of avoidance of cerebellar retraction or excision and of excellent exposure of the all-important brain-stem and its vessels, especially in the region of the tentorial hiatus.

The translabyrinthine approach was employed in 201 operations (Tables 2 & 3). During this time there were only 10 suboccipital operations for acoustic neuromas. The surgical technique of the purely translabyrinthine operation has been described in detail (Morrison 1976), while the original translabyrinthine-transtentorial method has been reported by Morrison & King (1973). Certain modifications of the approach were employed and are shown in Table 4.

The original combined approach involved elevating a temporal bone flap, opening the dura over the lateral surface of the temporal lobe, dividing the superior petrosal sinus and the tent into the tentorial notch. The retraction of the temporal lobe resulted in a frequency of epilepsy

Table 2. Experience of translabyrinthine surgery

	No. of operations
Acoustic neuroma	137
Other tumour pathology	20
Ménière's disease	29
Post-stapedectomy	8
Sudden idiopathic deafness	4
Politzer's abscess	3
	201

Table 3. Other tumour pathology managed by translabyrinthine surgery

	No. of operations
Meningioma of angle	4
Meningioma of internal acoustic meatus	1
Angioma of internal acoustic meatus	1
Facial neuroma	2
Pontine glioma	2
Neuroma of V nerve	2
Cholesteatoma of angle	2
Cholesteatoma of apex	2
Jugular neurinoma	1
Chordoma of clivus	1
Non-tumour filling defects	2
	20

Table 4. Translabyrinthine surgery and modifications

	No. of operations
Translabyrinthine only	117
Translabyrinthine + trans-sigmoid	1
Translabyrinthine + transtentorial	57
Translabyrinthine + modified transtentorial	19
Transtentorial + modified translabyrinthine	7
	201

of 22% (Cabral *et al.* 1976) and, when the dominant hemisphere was involved, a frequency of postoperative temporary dysphasia of the order of 13%. Although seizures were readily controlled by medication, the complication was an unacceptable one. The problem has been solved, at least in the most recent 19 operations for large tumours, by modifying the transtentorial dissection and confining it to a subtemporal dural incision with division of the superior petrosal sinus and part of the tentorium. This modification, combined with removal of the temporal bone above, behind and below the internal meatus, gives excellent access while avoiding the necessity for temporal lobe retraction. An intraventricular catheter drain aids the exposure by reducing pressure.

There is still one problem to be solved following this translabyrinthine operation, namely cerebrospinal leakage. This has occurred in 18 of the 201 operations (8.9%) and all have required secondary grafting to effect a seal.

Other tumour pathology

The versatility of this approach to the cerebellopontine angle is exemplified by Tables 3 and 4. Some of these lesions have been managed by translabyrinthine surgery alone: the lesions of the internal acoustic meatus, one of the facial neuromas, the cholesteatomas and the 2 non-tumour filling defects. These last 2 cases represent our only diagnostic errors from a series of 312 patients admitted for investigation. Both had severe unilateral hearing loss, tinnitus, variable

vestibular symptoms and non-filling of the canal on Myodil cisternography; one even had neurofibromatosis. One suspects that these are the cases sometimes described as 'arachnoiditis'.

Others in this group – 2 meningiomas, one facial neuroma, and the jugular neurinoma – were managed by the combined or the modified combined approach. The remainder were approached by the transtentorial operation with variable dissection of the temporal bone, sufficient for access yet limited to preserve the inner ear and its neural connections.

Cochlear and vestibular neurectomy

Endolymphatic sac surgery, which offers a good prospect of controlling vertigo and preserving or improving the hearing, is usually the first line in the surgical management of Ménière's disease. The disease is so frequently bilateral that one is reluctant to undertake destructive surgery. However, many patients are seen who have already had partial destructive operations and/or who have little or no useful hearing on the affected side; some of them have troublesome tinnitus and most of them have continuing vertigo and imbalance. Caloric stimulation, even with water at 0°C, frequently fails to induce vertigo or nystagmus. Yet these patients have residual vestibular function in the affected ear which manifests with postneurectomy nystagmus of several days duration. They can usually be rehabilitated.

When tinnitus is not a problem the translabyrinthine operation is employed to effect a complete osseous and membranous labyrinthectomy and the superior vestibular nerve is avulsed in the cribriform partition between the internal canal and vestibule. There is sometimes a minor leakage of cerebrospinal fluid. There is no risk to the facial nerve. This operation is simpler and safer than the middle fossa neurectomy; it has been employed to good effect in 12 patients.

Tinnitus can be the predominant symptom in patients with Ménière's disease. When a broad-band masking noise (no more than 30 dB above threshold) delivered to the other ear abolishes the subjective tinnitus, it is considered to be arising peripherally and cochlear nerve section is advised. For this reason, 17 translabyrinthine VIII nerve sections were carried out in patients with Ménière's disease. A similar operation was performed in a number of unfortunate patients referred with 'dead' ears following stapedectomy and in a few patients with distracting tinnitus, subtotal deafness and vertiginous symptoms of sudden idiopathic onset (Table 5). Of this group of 29 patients, one (3.4%) had a partial postoperative facial paralysis which eventually showed almost complete recovery. The risk of this occurring has to be balanced against the significant rehabilitation following the VIII nerve section, and it is felt that the patient should make the choice. In the internal acoustic meatus it is not uncommon to find the neurovascular bundle packed together with little indication as to the plane of separation between the cochlear and facial nerves. Fisch (1974) reported 31 translabyrinthine VIII nerve sections for tinnitus with similar results, including one transient facial weakness.

The risk to the facial nerve from VIII nerve section might be diminished by using the lateral tympanotomy and transtympanic route to the internal meatus. The access is, of course, very limited, but peripherally the cochlear and facial nerves have separated and therefore, in theory, the facial nerve is less vulnerable. M Portmann (personal communication) has reported 50 such

Table 5. Relief of tinnitus by VIII nerve section in 29 cases

	Cured	Improved	Unchanged
Ménière's disease	6	10	1
Post-stapedectomy	2	5●	1
Sudden idiopathic and sensorineural deafness	2	2	–
	10	17	2

● includes 1 with partial postoperative facial paralysis

operations without facial nerve damage though with only a 30% betterment rate for tinnitus, the latter aspect presumably being related to patient selection.

Although 79% of the acoustic neuroma patients reported here have complained of tinnitus, it has been a troublesome symptom in only 4%. In these patients the cochlear nerve has always been separated from the tumour and divided to relieve the tinnitus.

References

Cabral R, King T T & Scott D F (1976) *Journal of Neurology, Neurosurgery and Psychiatry* **39**, 663
Cushing H (1917) Tumour of the Nervus Acousticus and the Syndrome of the Cerebellopontile Angle. Saunders, Philadelphia
Cushing H (1921) *Laryngoscope* **31**, 209
Dandy W E (1925) *Surgery, Gynecology and Obstetrics* **41**, 129
Dawes J D K & Hankinson J (1971) In: Diseases of the Ear, Nose and Throat. 3rd edn. Ed. J Ballantyne and J Groves. Butterworth, London; p 541
Fisch U (1974) *Transactions of the American Academy of Ophthalmology and Otolaryngology* **78**, 252
Hitselberger W E & House W F (1966) *Archives of Otolaryngology* **84**, 286
House W F (1964) *Archives of Otolaryngology* **80**, 599
King T T (1970) *Proceedings of the Royal Society of Medicine* **63**, 780
Morris L & Wylie I G (1974) *American Journal of Roentgenology, Radium Therapy and Nuclear Medicine* **122**, 560
Morrison A W (1976) In: Operative Surgery – Ear. Eds C Rob and R Smith. Butterworth, London; p 173
Morrison A W, Gibson W P R & Beagley H A (1976) *Clinical Otolaryngology* **1**, 153
Morrison A W & King T T (1973) *Journal of Neurosurgery* **38**, 382
Ojemann R G, Montgomery W M & Weiss A D (1972) *New England Journal of Medicine* **287**, 895
Panse R (1904) *Archiv für klinische und experimentelle Ohren-Nasen-und-Kehlkopfheilhunde* **61**, 251
Pulec J L, House W F, Britton B H jr & Hitselberger W E (1971) *Transactions of the American Academy of Ophthalmology and Otolaryngology* **75**, 48
Quix F (1912) *Verhandlungen der Deutschen Otologischen Gesellschaft* **21**, 245
Rosomoff H L (1971) *Laryngoscope* **81**, 1448
Smith M (1977) *Journal of the Royal Society of Medicine* **71**, 273–274
Thomsen J (1976) *Acta otolaryngologica* **81**, 406
Yasargil M G & Fox J L (1974) *Surgical Neurology* **2**, 393

Suboccipital surgical approach to the cerebellopontine angle and internal auditory canal[1]

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Base of the skull surgery requires a comprehensive, three-dimensional understanding of anatomy in order to design and implement a satisfactory surgical exposure. Adequate visualization of the pathologic lesion allows the best possible chance for total removal of the neoplasm and maximum preservation of adjacent, uninvolved, neurologic tissues; this is greatly facilitated by the use of the operating microscope. The surgical anatomy of the suboccipital craniectomy, one of many approaches to the skull base, is the subject of this discussion.

The suboccipital craniectomy is a lateral-posterior approach to the temporal bone. Various skin incisions can be used to expose postauricular cortical bone: the 'U' shaped incision of

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