 preservation of vestibular, cochlear, and facial nerves during microsurgical removal of acoustic tumors

report of two cases

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Acoustic tumors limited to the confines of the internal auditory canal have been found at autopsy, and histological studies demonstrated that these small tumors arose in most instances from the sheath of the superior or inferior vestibular nerve. Thus, the possibility exists of preserving the non-involved facial, cochlear, and vestibular nerves during removal of small acoustic tumors confined to the canal or even protruding a short distance into the cerebellopontine angle.

Since April, 1964, we have used the posterior transmeatal approach in 12 cases of acoustic tumor. It became apparent, particularly in small tumors (less than 2 cm) arising from one of the vestibular nerves, that under the binocular surgical microscope the other cranial nerves within the internal auditory canal can be separated from the capsule of the intrameatal portion of the neoplasm if they are not directly involved in the tumor growth. Consequently, when operating upon a small acoustic tumor in which partial function of the noninvolved cochlear and vestibular nerves is present preoperatively, the neurosurgeon should make every effort to preserve their residual function. The same applies to the facial nerve, which is rarely involved directly by the small acoustic tumor.

Case Reports

The first patient, a 45-year-old woman, had developed tinnitus (a buzzing "seashell" sound) in the left ear 3 years before admission to UCLA Hospital on December 18, 1965. At about the same time she had noticed decreasing hearing in the left ear, especially when using the telephone. Eighteen months later the patient had several episodes of severe vertigo of sudden onset causing her to veer to the left. They were partially relieved by rest and further controlled with appropriate drugs. Recently, the patient had had slight pain in the left ear without headache. She was examined by Dr. Richard Barton, an otolaryngologist, who performed otologic and vestibular tests and diagnosed a left acoustic neurinoma.

Examination. The patient had transient nystagmus on horizontal gaze, especially to the left, and slight fine intention tremor of both outstretched hands, which was apparently due to nervousness.

Hearing and vestibular functions on the right were normal. There was left sensorineural hypoacusis with loss of perception of whispered voice, and a mild-to-severe sloping loss of high frequency hearing, tested with pure tone air conduction lateralized to the right at 500 and 250 cps. Speech discrimination was 78% on the left, 100% on the right. The Bekesy test showed separation of "C" from "P" at fixed frequency tracings at 4,000, 2,000, and 1,000 cps, but no separation at 500 and 250 cps. The Short Increment Sensitivity Index showed high scores at 4,000, 2,000, and 1,000 cps; low score at 250 cps. The Alternate Binaural Loudness Balance Test demonstrated complete recruitment at 4,000, 2,000, and 1,000 cps.

It was concluded that the special diagnostic tests were consistent with a hearing loss secondary to a cochlear lesion of the left ear. The findings were normal on the right.

The Hallpike caloric test was normal on the right, but nystagmus reaction to both warm and cool water was decreased on the left side. Skull series, including polytome laminograms of the petrous bones, demonstrated moderate erosion of the superior wall of the left internal auditory canal consistent with acoustic neurinoma. A subsequent posterior fossa myelogram demonstrated an 8 to 10 mm tumor pro-
truding from the left internal auditory canal into the cerebellopontine angle (Fig. 1). All other laboratory tests were normal including cerebrospinal fluid protein.

Operation. A suboccipital craniectomy was performed on December 20, 1965, via the transmeatal approach previously described by the authors.\textsuperscript{10,11} The internal auditory canal on the left was widely opened lateral to the origin of the acoustic tumor by diamond drill microdissection. The tumor arose from the left inferior vestibular nerve. The superior vestibular nerve and cochlear nerves were compressed and stretched over the intrameatal portion of the tumor. These nerves, as well as the facial nerve which lay anteriorly and superiorly, were separated and carefully kept aside from the tumor as it was removed in two portions (Fig. 2). As far as could be seen, the internal auditory artery was not destroyed. The wound was then closed without drainage. At the completion, the retracted cerebellar hemisphere did not appear to have been traumatized. The pathological diagnosis on microscopic examination was acoustic neurilemma.

Postoperative Course. The facial movements

Fig. 1. Posterior fossa myelogram demonstrating a small acoustic tumor protruding from the enlarged left internal auditory canal (arrow).

Fig. 2. Left: Small acoustic tumor (arrows) protruding from the left porus acusticus. Right: The left internal auditory canal widely opened after diamond drill dissection. The acoustic tumor originating from the inferior vestibular nerve has been removed from the canal (arrows). The superior vestibular nerve (SVN), cochlear nerve (CN), and facial nerve (FN) remain anatomically intact.
remained normal after the operation (Fig. 3). Ten days following surgery, audiological tests revealed no response on the left and the same normal preoperative findings on the right. These have remained unchanged for 17 months after operation. The Hallpike calorie test on the right for 30°C and 44°C was again normal. On the left there was no response to 44°C, but a 50% response to 30°C. Six weeks after surgery some response to 44°C was returning and that to 30°C was more pronounced. The patient’s most recent vestibular tests showed 50% response to both warm and cool water on the left and normal response on the right. The facial muscle function continued to be normal. The patient has returned to her usual occupation and social activities.

A second patient, a 32-year-old man, was operated upon on June 5, 1967, with total removal of a 2×3 cm left acoustic tumor and anatomic and functional preservation of the facial and inferior vestibular nerves. The facial nerve function is quite normal. The electroneystagmograph showed the left inferior vestibular nerve to be hypoactive but functioning on August 29, 1967. Although the cochlear nerve was preserved, the minimal function present before surgery was lost.

Discussion

Early diagnosis of acoustic tumors with sophisticated otological, vestibular, and x-ray techniques including, in particular, polytome x-rays of the internal auditory canal and posterior fossa myelography, has challenged surgeons to develop new and refined operations for acoustic tumor resection. Three microsurgical techniques are currently used to obtain exposure of the internal auditory canal:

1. The extradural transtemporal approach.
2. The translabyrinthine operation with or without suboccipital exposure.
3. The transmeatal posterior fossa approach. In addition, a transtentorial approach to the cerebellopontine angle can be employed, especially for surgery of the trigeminal nerve.

Total removal of a small acoustic tumor (less than 2 cm) with preservation of the facial nerve can be accomplished with the first three techniques. Cochlear and vestibular nerve function can be preserved only by the extradural transtemporal middle fossa operation or the transmeatal posterior fossa approach. The translabyrinthine approach in which the labyrinthine system is destroyed obviously precludes preserving function of the cochlear and noninvolved vestibular nerves.

House has reported three patients with small tumors limited to the internal auditory canal, among more than 150 with acoustic tumors, in whom it was possible to save or improve hearing as well as avoid facial nerve damage by means of the transtemporal operation. A most remarkable series in which microsurgical techniques were not used was recorded by McKissock in 1961. He reported that eight patients out of 270 with acoustic neuromas had had tumors less than 3 cm in diameter and that, in each case, total excision was successfully performed and the facial and cochlear nerves spared. Postoperatively, the hearing was preserved in five, although in two it was worse. The remaining three were deaf on the side of the tumor removal. The postoperative function of vestibular nerves was not mentioned.

Hullay and Tomits recently reported that the facial nerve had been preserved in 65% of
their total series of radical acoustic tumor removals; Pool\(^9\) reported 24% seventh nerve preservation in a comparable series. The function of the vestibular nerves after operation was lost in all cases reported by Hullay and Tomits and was not mentioned by Pool. In one patient of Hullay and Tomits, some hearing remained on the operated side.

**Summary**

We have reported the microneurosurgical excision of two small acoustic tumors of the left internal auditory canal to reemphasize that preservation of the facial, vestibular, and cochlear nerves can and should be a goal during total resection of small acoustic tumors. We believe that such preservation can be achieved using microsurgical techniques in a single suboccipital transmeatal operation.

**Bibliography**

3. **HOUSE**, W. F. Unpublished data.