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Radical intracapsular removal of acoustic neurinomas

Long-term follow-up review of 11 patients

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✓ Historically, the neurosurgical treatment of large acoustic neurinomas has developed with two principal goals: complete tumor removal and preservation of facial nerve function. A recent goal for small tumors is the preservation of hearing. Out of a personal series of 124 acoustic neurinomas treated over the past 35 years, the senior author has undertaken a radical intracapsular approach in 12 patients with large tumors (> 3 cm in diameter). Surgical indications for intracapsular removal included advanced age (five cases), the patient's wish to avoid any risk of facial paralysis (six cases), contralateral facial palsy (one case), and contralateral deafness (one case).

Eleven of these 12 patients were available for follow-up review. Tumor recurrence developed in two patients (18%) at 2 and 3 years postoperatively; there were no late recurrences. Four patients died of unrelated causes, 10 to 19 years after surgery. The remaining five patients have survived a mean of 12 years since surgery without recurrence (range 3 to 22 years). Facial function was preserved in nine patients (82%). The results suggest that radical intracapsular removal may be the procedure of choice under certain circumstances and may offer an alternative to focused high-energy radiation.

KEY WORDS • **acoustic neurinoma** • **facial nerve** • **hearing**

In the patient who presents with an acoustic neurinoma, the function of the facial nerve is characteristically virtually normal. The objective of surgical treatment is complete removal of the tumor. The surgical challenge lies in the preservation of facial nerve function and, in some cases, the preservation of hearing. With large tumors (> 3 cm in diameter), complete surgical excision carries a significant risk of injuring the facial nerve, often permanently. The alternative radical intracapsular removal is less likely to cause facial palsy; however, with that procedure the risk of tumor recurrence is considered to be high. The objective of this study was to assess this risk in a series of patients with long-term follow-up review.

Summary of Cases

Indications for Procedure

The physicians' records and/or hospital charts of all 124 patients with acoustic neurinoma treated by the senior author (C.G.D.) were reviewed. These cases spanned the period from 1952 to 1986. In 12 patients, a preoperative decision had been made to perform radical intracapsular removal rather than a complete removal of the tumor. This decision was based on various criteria (Table 1). Six patients were reluctant to accept any risk of facial paralysis. Two were salespeople, for whom a potential facial palsy represented a significant business handicap; another was a teacher who felt she could not return to school with a facial paralysis. One woman, an archeologist's wife with heavy social commitments, had previously undergone bilateral mastectomies and was frightened of a facial palsy. One patient with neurofibromatosis had a contralateral facial palsy due to complete removal of an acoustic neurinoma on the other side, and bilateral facial paralysis would have been a dreadful disability. One patient had Ménière's disease with contralateral deafness but preserved hearing on the side of the tumor.

Outcome

In assessing outcome, the operative results, time to recurrence (if any), and function of the facial nerve were evaluated. A summary of the results is presented in Table 2.

There was one perioperative complication (Case 9),

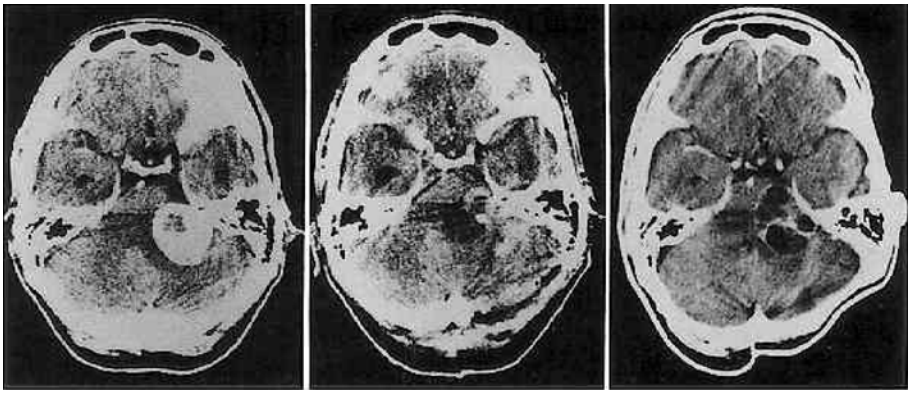

FIG. 1. Case 10. Contrast-enhanced computerized tomography (CT) scans in a 72-year-old mechanic with a large left-sided acoustic neurinoma. *Left:* Preoperative CT scan. *Center:* CT scan 1 week postoperatively showing intracapsular removal and collapse of residual capsule. *Right:* CT scan 22 months later showing striking cyst formation around a small residual fragment of tumor.

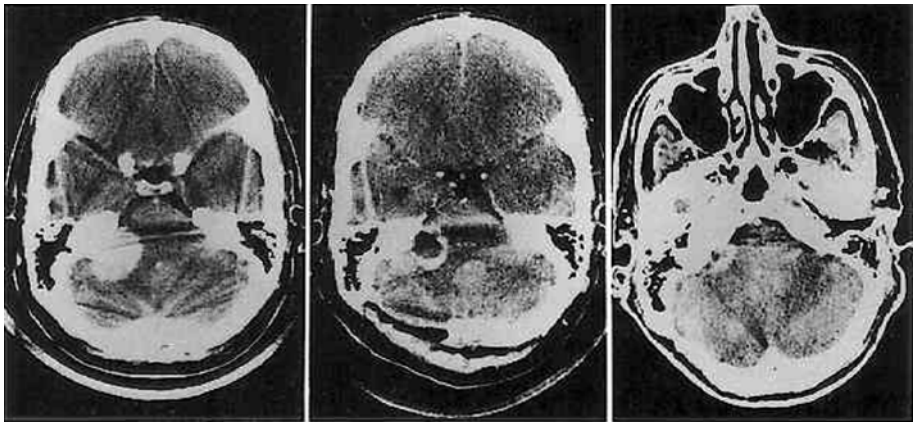

FIG. 2. Case 12. Computerized tomography (CT) scans in a 36-year-old man with a large right-sided tumor. *Left:* Preoperative contrast-enhanced CT scan. *Center:* Contrast-enhanced CT scan 6 weeks postoperatively showing that the outer rim of the tumor has partially collapsed. *Right:* On a CT scan obtained 3 years later, only the residual capsule remains.

a posterior fossa hemorrhage to which the patient succumbed despite evacuation. Of the remaining 11 patients, tumor recurrence developed in two cases (18%). In one, the patient with contralateral deafness, a significant portion of tumor wall (2 cm) was left *in situ*. Hearing was preserved for 3 years, when recurrent ataxia and cranial nerve symptoms necessitated total tumor removal. In the other, recurrence of headache and ataxia 2 years postoperatively led to reoperation, at which time a largely cystic mass with little actual tumor growth was found (Fig. 1).

There were no late recurrences, clinically or radiologically. Four patients died of unrelated causes 10 to 19 years postoperatively, and five have survived without recurrence for an average of 12 years (range 3 to 22 years) (Figs. 2 and 3).

Facial nerve function was preserved in nine (82%) of 11 patients. The anterior capsule of the tumor was penetrated inadvertently by the suction tip in the other two cases; neither facial palsy improved.

TABLE 1

Indications for intracapsular tumor removal in 12 patients with large tumors

Indication	No. of Cases*
avoid facial paralysis	6
advanced age (> 60 yrs)	5
contralateral facial paralysis	1
contralateral deafness	1

* Both age and facial function were considered in one patient.

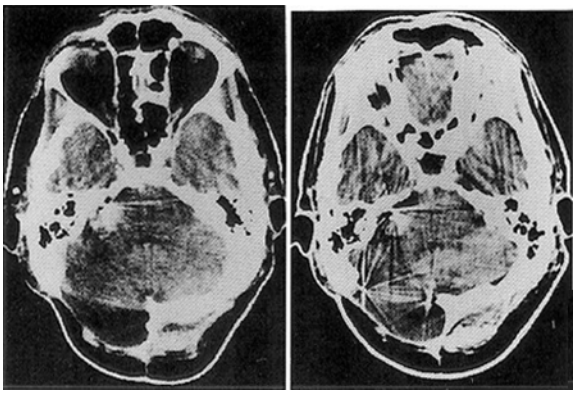

FIG. 3. Case 6. Computerized tomography (CT) scan in a 61-year-old man with a large right-sided tumor. *Left:* Contrast-enhanced CT scan 13 years after surgery showing a small fragment of residual tumor. *Right:* A CT scan 4 years later showing no significant change.

TABLE 2

Summary of 12 patients with large acoustic neurinomas treated by radical intracapsular removal

Case No.	Age (yrs), Sex	Year of Operation	Facial Function	Recurrence (yrs)	Follow-Up (yrs)	Comment*
1	74, M	1954	intact	no	18	unrelated death (stroke)
2	57, M	1958	intact	no	13	unrelated death (MI)
3	71, M	1962	palsy	no	19	unrelated death (MI)
4	68, M	1967	intact	no	22	well
5	56, F	1968	intact	no	10	unrelated death (MI)
6	61, M	1970	intact	no	19	well
7	55, F	1977	intact	no	12	well
8	54, M	1978	intact	yes (3)	—	reoperation: complete removal
9	42, F	1980	—	—	—	perioperative death
10	72, M	1985	palsy	yes (2)	—	reoperation: complete removal
11	36, F	1985	intact	no	4	well
12	36, M	1986	intact	no	3	well

* MI = myocardial infarction.

TABLE 3

Incidence of postoperative facial paralysis or paresis

Authors & Year	Tumor Size (cm)	Facial Paralysis or Paresis
Yaşargil, *et al.*, 1977	> 3.0	37%
King & Morrison, 1980	> 2.5	80%
Harner & Ebersold, 1985	4.1–6.5	63%
House & Hitselberger, 1985	> 4.0	40%
Samii, *et al.*, 1985	> 3.0	46%

Discussion

Harvey Cushing,[1] in his classic 1917 monograph on acoustic neurinomas, emphasized the significant morbidity encountered with attempted complete removal of such tumors. He advocated an intracapsular enucleation to avoid brain-stem and facial nerve injury. Dandy[2] disagreed, believing that the capsule should also be removed to prevent an eventual recurrence, and that facial nerve paralysis should be viewed as a "necessary sequel" to the operation. In patients with intracapsular or partial tumor removal, Olivecrona and Givré[4,10] found a 50% recurrence rate within 3 to 4 years and only 25% good long-term outcomes. Horrax,[6] reviewing Cushing's 176 cases of intracapsular enucleation, similarly estimated the useful survival rate at 25%. However, Pennybacker and Cairns[11] achieved 50% good outcomes with both intracapsular and complete removals, although 90% of the latter group had complete facial paralysis. McKenzie and Alexander[9] advocated intracapsular removal in the older age group, because of a lower morbidity rate from brain-stem injury, a lower incidence of ninth and 10th cranial nerve palsy, and also sparing of the facial nerve.

Since the advent of improved methods for sparing the facial nerve,[3,12] complete tumor removal has been achieved with significantly lower morbidity and mortality rates. Nevertheless, with large tumors, the incidence of postoperative facial palsy remains high: over 40% on the average (Table 3).[5,7,8,13,15]

In this series, the 18% recurrence rate compared quite favorably with that of other earlier series. This is likely related to a more radical, although still intracapsular, removal of tumor. After 3 years, there were no recurrences, suggesting a limited growth potential in many of these tumors.[14] The ability to preserve facial nerve function in more than 80% of patients indicates an overall lower morbidity compared with complete removal of large tumors. Modern methods of enucleation with ultrasonic suction should reduce the risk of facial nerve injury through inadvertent penetration of the capsule anteriorly.

The results suggest that, in the patient harboring a large acoustic neurinoma, radical intracapsular removal offers a low rate of recurrence and low incidence of facial palsy. In certain clinical situations, it may be the procedure of choice.

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