Total removal of acoustic neurinomas

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The authors analyze the results of total removal of acoustic neurinomas in 120 patients operated on between January, 1967, and January, 1976. The facial nerve was preserved after surgery in 65 patients (54.2%). The use of microsurgical techniques in the last 3 years of study permitted preservation of the seventh nerve in 26 of 35 operated patients (74.3%). Of 103 patients examined postoperatively, 96 retained their full or partial capacity for work (93.2%). Ten patients (8.3%) died after surgery. In the last 3 years, 35 patients were operated on without a single death.

KEY WORDS • acoustic tumor • total excision • surgical results

In recent years considerable progress has been achieved in the total removal of acoustic neurinomas. This progress has resulted from better diagnosis of the disease, and improvement of the operative procedure, especially with the use of microsurgical technique.

We are reporting our experience with the surgical treatment of acoustic neurinomas, and analyze our data obtained during 9 years in the following three periods: 1967 to 1970, 1970 to 1973, and 1973 to 1976. The operative results are estimated according to anatomical preservation of the facial nerve, postoperative working capacity of the patient, and the mortality rate.

Clinical Material and Methods

During the period from January, 1967, to January, 1976, 122 patients with acoustic neurinomas were admitted to our department. Of these, 120 patients were subjected to total removal of acoustic neurinomas. There were 29 males and 91 females, aged between 16 and 67 years. All operations were performed by the same surgeon (E.I.Z.). The patients were divided into three groups according to their preoperative condition as follows:

Good = patients with signs of vestibular and acoustic nerve lesion, but with no general cerebral signs

Fair = patients with severe signs of vestibular and acoustic nerve lesions, cerebellar signs, and marked general cerebral signs

Poor = patients with severe signs associated with the brain stem, cerebellum, and cerebellopontine angle, and severe general cerebral signs.

The patients were further divided into three groups according to the size of the excised tumor, as follows:

Group I = patients with small tumors up to 2 cm in diameter, protruding out of the internal auditory canal but not as far as the brain stem and not stretching the facial nerve

Group II = patients with medium-sized tumors, 2 to 4 cm in diameter, that reached the brain stem did not deform it; however, the facial nerve was stretched by the tumor

Group III = patients with large tumors, over 4 cm in diameter, closely connected with and deforming the pons varoli and medulla oblongata, and sometimes spreading under the brain stem.

The distribution of patients according to their preoperative condition and tumor size is shown in Table 1.

<table>
<thead>
<tr>
<th>Tumor Size</th>
<th>Preoperative Condition of Patients</th>
<th>Total Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td>small</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>medium-sized</td>
<td>28</td>
<td>9</td>
</tr>
<tr>
<td>large</td>
<td>18</td>
<td>38</td>
</tr>
<tr>
<td>total</td>
<td>55</td>
<td>47</td>
</tr>
</tbody>
</table>
Acoustic tumors

### TABLE 2
**Preservation of the facial nerve after total removal of acoustic neurinoma**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Cases</td>
<td>Preservation of VIIth Nerve</td>
<td>No. of Cases</td>
<td>Preservation of VIIth Nerve</td>
</tr>
<tr>
<td>small</td>
<td>5</td>
<td>5</td>
<td>9</td>
<td>9 (100%)</td>
</tr>
<tr>
<td>medium-sized</td>
<td>19</td>
<td>16</td>
<td>38</td>
<td>30 (78.9%)</td>
</tr>
<tr>
<td>large</td>
<td>30</td>
<td>8</td>
<td>73</td>
<td>26 (35.6%)</td>
</tr>
<tr>
<td>total</td>
<td>54</td>
<td>29</td>
<td>120</td>
<td>120 (54.2%)</td>
</tr>
</tbody>
</table>

The anesthesia and the operative procedures are outlined in detail in our earlier reports and do not differ much from those described by Drake and Yaşargil and Fox. Since 1972, we have used microsurgical techniques for total removal of acoustic neurinomas.

### Results

#### Preservation of the Facial Nerve

Anatomical preservation of the facial nerve following total removal of acoustic neurinoma was achieved in 65 patients (54.2%). Of these patients, 54 (45% of total cases and 83% of the patients with a preserved facial nerve) showed complete or partial return of facial function (Table 2).

Throughout the total study period, the facial nerve was preserved in all nine patients with small tumors, in 30 of 38 patients (78.9%) with medium-sized tumors, and in 26 of 73 patients (35.6%) with large tumors. The improvement of the operative procedure, especially the use of microsurgical technique for the last 3 years, has considerably increased the chances of facial nerve preservation. During the period from 1967 to 1970, the facial nerve was preserved in 32.1% of cases, from 1970 to 1973, in 53.7%, and from 1973 to 1976, in 74.3%.

#### Postoperative Working Capacity

Follow-up examination for recovery of working capacity was performed in 103 patients, with a follow-up period ranging from 12 months to 9 years (Table 3).

All patients were categorized in one of three groups, according to their postoperative working capacity as follows: Group I patients returned to normal work in their original profession (68 cases); Group II patients were moderately impaired, with neurological disturbances that forced them to change to an easier profession; however, they could fulfill all housework (28 cases); Group III patients were severely impaired, with marked neurological disturbances (blindness, brain-stem involvement, and cerebellar impairment), and needed outside assistance.

Thus, 93 of 103 patients (93.2%) showed normal or moderately impaired working capacity, and 6.8% became invalids. In the first 3-year period this ratio was 89.7% and 10.3%, respectively; in the second period, 93% and 7%; and in the third period, 96% and 4%.

#### Mortality Rate

Ten (8.3%) of 120 patients died in the postoperative period (Table 4). The mortality rate was 11% in patients with large acoustic neurinomas, and 5.7% in patients with medium-sized neurinomas. There was no mortality following total removal of small acoustic neurinomas.

In the first period (1967 to 1970), total removal of acoustic neurinomas resulted in a mortality of 9.7%, and in the next 3 years, 12.9%. There was no mortality among the patients operated upon between 1973 and 1976. The slight increase in mortality in the second period seems to be due to the late death of one patient from an unexpected suppurative complication 4 months after operation and of two patients from heart failure.

### Discussion

Total removal of acoustic neurinomas has recently become a problem of special interest for neurosurgeons. Damage to the facial nerve is a frequent operative complication. In earlier series, the facial nerve was injured in 70% to 90% of cases. Modern operative techniques have considerably im-

### TABLE 3
**Working capacity after total removal of acoustic neurinoma**

<table>
<thead>
<tr>
<th>Years</th>
<th>No. of Cases</th>
<th>Normal</th>
<th>Moderately Impaired</th>
<th>Severely Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970–1973</td>
<td>47</td>
<td>33</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>1973–1976</td>
<td>28</td>
<td>19</td>
<td>8</td>
<td>1</td>
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<tr>
<td>total</td>
<td>103</td>
<td>68</td>
<td>28</td>
<td>7</td>
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</table>
proved the chances of facial nerve preservation. Drake reported preservation of the facial nerve in 13 of 27 patients, Hullay, et al., reported 62% preservation, and Kesselring demonstrated preservation in 82 of 104 patients. Still better results have been obtained with the use of microsurgical techniques. Rand and Kurze demonstrated preservation of the facial nerve in nine of 12 cases operated on with this technique, and Yaşargil and Fox, in 85% of their similarly treated cases. During the last 3 years, we operated on 35 patients with acoustic neurinomas; of these, the facial nerve was preserved in 26 cases (74.3%). Therefore, it has become apparent that total removal of acoustic neurinomas can provide preservation of the facial nerve in the majority of cases.

Working capacity is of great significance for the assessment of the results of surgical intervention. Kesselring reported that complete or partial working capacity was preserved in 51.2% of his operated patients, Kunicki and Wicentowicz in 57.4%, and Olivecrona in 79.2%. According to the statistics published by Machmudov, 84% of the patients who underwent total removal of acoustic neurinomas showed normal or moderately impaired working capacity. In the series reported by Hullay and Tomits, this figure approached 94%. The follow-up review of 103 patients operated on in our department yielded normal or moderately impaired working capacity in 96 patients (93.2%); only seven patients became severely impaired. Thus, the above data suggest good results achieved by total removal of acoustic neurinomas in respect to preservation of working capacity.

In the early period of total removal of acoustic neurinomas, the mortality rate was rather high, and reached 11.9% to 24%; however, recently Konovalov, et al., reported a postoperative mortality of 5.3% (two of 38 operated patients), Hullay, et al., 3%, McCarty, 5%, and Yaşargil and Fox, 3.3%. There was no mortality in a series of 18 patients operated on by Scott. During the last 3 years we have operated on 35 patients without a single mortality.

On the basis of our findings, we suggest that the use of microsurgical technique, which provides visual control during manipulations on the brain stem, nerves, and vessels, is of great importance for the success of total surgical removal of acoustic neurinomas.

References

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**Table 4**

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Cases</td>
<td>Died</td>
<td>No. of Cases</td>
<td>Died</td>
</tr>
<tr>
<td>small</td>
<td>7</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>medium-sized</td>
<td>8</td>
<td>1</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>large</td>
<td>23</td>
<td>2</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>total</td>
<td>31</td>
<td>3</td>
<td>54</td>
<td>7</td>
</tr>
</tbody>
</table>

(9.77%) (12.97%) (0%)

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