The Middle Fossa Approach to Vestibular Schwannomas: The First Ten Years at One Institution

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DISCUSSION

In 1996, our institution changed its protocol for the surgical management of patients with largely intracanalicular vestibular schwannomas and serviceable hearing from the retrosigmoid (RS) approach to the middle fossa (MF) approach. By switching to the MF approach, we were able to significantly improve these rates (defined as AAO Class A or B) from 20% to 56%. The MF offers a significant advantage over RS, particularly for tumors that extend to the lateral end of the internal auditory canal. Direct visualization of this area can not occur without drilling of the posterior semicircular canal, and as a result, “blind” tumor removal can result in damage to the cochlear nerve. Furthermore, better visualization, allows for more complete tumor removal, and decreased rates of recurrence. These data confirm our hypothesis that in the hands of an experienced vestibular schwannoma surgical team, the MF approach can result in improved hearing outcomes. Our rate of hearing preservation compares favorably to published results, which cite rates ranging from 20% to 85%.

Facial nerve outcomes were very good, as would be expected from an experienced surgical team. HB I or II function in the early group was not statistically different compared with later outcomes. When compared to the RS group, MF outcomes showed a trend toward worse outcomes, though the difference was not statistically significant.

Although not statistically significant, early results may suggest an improved rate of hearing preservation when compared to the late patients in this series. This result was not expected, especially given increased surgeon experience with time, advances in technique, and improvement in intraoperative neurophysiologic monitoring. Nonetheless these findings have prompted us to review changes in surgical technique, (e.g. use of papaverine, retraction devices, sacrifice of uninvolved vestibular nerve, etc.) Relationship between tumor size and hearing preservation, as described previously, was not statistically significant in this cohort, though there was a trend towards worse outcomes in patients with tumors greater than 16mm. This was true patients in both the early and late groups. As a result, we no longer offer the MF approach to patients with tumors with significant extension into the cerebellopontine angle.

RESULTS

In the early group, hearing preservation was 55.5% (18/33) and hearing improvement was found in 46.4% (15/32) of patients. In the late group, hearing preservation was 66.7% (6/9) and hearing improvement was found in 55.6% (5/9) of patients. These differences were not statistically significant. When comparing the RS group to the MF group, the percentage of patients with hearing preservation was 20% vs. 55.5% (p=0.0026), and the percentage of patients with hearing improvement was 22.2% vs. 55.6% (p=0.0010). These data confirm that, for the experienced vestibular schwannoma surgical team, the middle fossa approach to the internal auditory canal affords excellent visualization and subsequent modification can result in continued improvement in a variety of outcomes.

METHODS

All vestibular schwannoma surgeries performed at the New York University Medical Center from September 1996 to August 2006 were reviewed. Data were obtained from the NYU Acoustic Neuroma Database, chart review and audiology records. Of 637 surgeries, 73 were middle cranial fossa (MCF) Patients with pathology other than typical vestibular schwannoma and NF2 patients were excluded from this study – resulting in a cohort of 60 patients. All patients obtained a preoperative MRI with gadolinium and tumor size was measured from the axial images. The first 30 patients were classified as “early”. The subsequent 30 patients were classified as “late”. All surgeries were performed by a single surgical team consisting of one neurotologist (JTR) and one neurosurgeon (JGR). These patients were then compared to tumor size-matched patients (>2.0cm) who underwent a RST approach from 1993-1996 (35 of 98 patients) with attempted hearing preservation.

Full preoperative audiometric studies (pure tones, SRT, SDS, tympanograms) were performed on all patients and preoperative facial nerve function was recorded according to the House-Brackmann grading system. The intraoperative findings such as nerve of origin, cochlear nerve sacrifice, and total/subtotal tumor removal were recorded as well. Post-operative facial nerve function, as well as any other cranial nerve deficits, was recorded immediately post-operatively, at discharge from the hospital and at scheduled office visits. Note was also made of any complications such as wound breakdown, CSF leak, meningitis, pseudomeningocoele, or recurrence. Post-operative audiograms were obtained 2-6 weeks post-operatively and repeated usually at the three month post-operative visit. Many patients were followed for years, and thus the most-recent audiogram was used.

Fisher’s Exact Test was used to calculate differences, with a two-tailed p value set at 0.05 level of significance. Facial nerve preservation is defined as House-Brackmann Grade I or II. Hearing preservation is defined as AAO-HNS grade A or B.

CONCLUSIONS

These data confirm that, for the experienced vestibular schwannoma surgical team, the middle fossa approach to the internal auditory canal affords excellent visualization and results in good rates of hearing and facial function preservation. It also emphasizes the importance of surgical teams to periodically review their outcomes so that the variations in patient selection or technique over time can be properly evaluated. Such rigorous review and subsequent modification can result in continued improvement in a variety of outcomes.

REFERENCES

0-10 mm & 11-15 mm & 16-21 mm & 22-26 mm & 27-30 mm & TOTAL (n=30)

| A+B (%) | 11.1% (1/9) | 22.2 ( 4/18) | 52.4 (11/21) | 20.0 (7/35) | 66.7 (6/9) | 11-15 mm |

Table 1. Hearing outcomes – Early Group

Table 2. Hearing outcomes – Late Group

Table 3. Overall preservation (%A+B) of all pre-operative A+B patients.

Table 4. Percentage of patients with post-operative hearing (AAO A or B) comparing RS and MF approaches and tumor size.

Table 5. Facial nerve preservation (I or II) comparing RS and MF approaches and tumor size.