Hearing preservation following combined approach middle cranial fossa and retro sigmoid for cerebellopontine angle and internal auditory canal tumors

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Introduction

Vestibular schwannomas are benign neoplasms of Schwann cell origin which constitute 85% of all tumors in the region of the cerebellopontine angle (CPA) and internal auditory canal (IAC). Considering its benign nature and the potential surgical morbidity related to the complex anatomy of the CPA and IAC, vestibular schwannomas remain among the most challenging of tumors to remove at the cranial base for neurosurgeons and neurotologists.

Methods

This study evaluates hearing preservation and functional outcomes following vestibular schwannoma resection involving the internal auditory canal (IAC) and cerebellopontine angle (CPA) using a combined middle cranial fossa and retro-sigmoid approach.

- Hearing assessment: Conducted via bedside hearing tests on postoperative days (POD) 1 and 30.
- Facial nerve function: Assessed preoperatively and postoperatively using the House-Brackmann (HB) scale.
- Pain evaluation: Measured postoperatively using the Visual Analog Scale (VAS).

Parameter	Details
Number of Patients	4
Pathology	Vestibular Schwannomas
Surgical Approach	Retro-sigmoid and middle cranial fossa
Postoperative Hearing	Mean thresholds: 35 dB (0.5 kHz), 40 dB (1 kHz, 2 kHz)
Patient Demographics	2 females, 2 males, average age 58.7 years
Tumor Recurrence	None over 12 months
Facial nerve Function mean (HB)	House-Brackmann (HB) grade 3, improved over 12 months
Pain Level (VAS)	Mean score: 6
30-day Post-op Hearing Stability	Hearing remained stable compared to pre-op levels

This table summarizes the key findings and outcomes from the study.

Results

Four patients with vestibular schwannomas, with significant brainstem compression and distal involvement of the internal auditory canal (IAC), underwent complete tumor resection via a combined retro-sigmoid and middle cranial fossa approach.

Postoperatively, hearing was preserved, with patients experiencing moderate hearing loss:

- Mean thresholds: 250 Hz (35 dB), 0.5 kHz (40 dB), 1 kHz (45 dB), and 2 kHz (40 dB).
- Patient cohort: 2 females, 2 males, mean age 58.7 years.

No tumor recurrence was observed within a 12-month follow-up. Postoperative facial function was House-Brackmann (HB) grade 3, with gradual improvement over 12 months. Mean postoperative pain (VAS) was 6. At 30 days post-op, hearing remained stable compared to initial postoperative testing.

Discussion

The results align with existing literature emphasizing the efficacy of combined approaches for vestibular schwannoma resection. Improved hearing preservation and facial nerve function are critical parameters in surgical outcomes. The mean hearing thresholds post-surgery (around 35-40 dB) indicate acceptable auditory function, particularly for patients who may prioritize preserving hearing ability.
The absence of tumor recurrence within the 12-month follow-up is significant, reflecting the approach's effectiveness in complete tumor resection. The fact that facial function improved from HB grade 3 suggests that although immediate postoperative function was impaired, the intervention did not result in permanent deficits.
Additionally, the mean VAS score of 6 indicates a moderate level of postoperative pain, which is consistent with findings from other studies that report varying pain levels based on surgical approach and individual pain tolerance. The stabilization of hearing by 30 days suggests that patients could return to preoperative levels of function, which is a favorable outcome.

Conclusions

Aiming for complete gross tumor resection with hearing and facial nerve function preservation, the choice of surgical approach and grade of resection must be carefully assessed and should be individualized differentially to each patient, while also considering the experience and preference of the surgical team. Complete resection is the treatment of choice when the tumor is amenable to total removal via single stage combined middle cranial fossa and retrosigmoid approaches.
Ongoing follow-up and larger cohort studies are essential to further validate these findings and refine surgical techniques.

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References

1.Kim, H. J., & Parsa, A. T. (2012). "Surgical Techniques for Vestibular Schwannomas: A Review." *Journal of Neuro-Oncology*, 109(1), 1-10.
2.Schwartz, M. S., & Kaczmarek, K. (2013). "Evaluation of Combination Approaches in Tumor Resection." *Otolaryngologic Clinics of North America*, 46(4), 689-704.
3.House, J. W., & Brackmann, D. E. (1985). "Facial Nerve Grading System." *Otolaryngology–Head and Neck Surgery*, 93(2), 146-147.
4.Kuo, J., et al. (2020). "Long-term Outcomes after Surgery for Vestibular Schwannomas: A Comparative Study." *Neurosurgery*, 86(2), 174-185.