Role of Endoscopy in Resection of Intracanalicular Vestibular Schwannoma via Middle Fossa Approach: Technical Nuances

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BACKGROUND: **Surgical resection of vestibular schwannomas (VS) located within the internal auditory canal (IAC) is challenging, especially those located very laterally in the IAC. Various transcranial approaches have been described for resection of intracanalicular VS including retrosigmoid, translabyrinthine, and middle fossa approaches. Each approach has its indications, advantages, and limitations. The middle fossa approach (MFA) is considered by many authors as the gold standard approach for resection of small intracanalicular VS in young patients with serviceable hearing; however, there is often a limitation in complete visualization of the tumor.**

METHODS: **The authors present an illustrative case to highlight the technical nuances of complementary use of endoscopy in MFA for complete resection of intracanalicular VS located at the IAC fundus, preserving preoperative hearing status and mainting intact facial nerve function.**

RESULTS: **In our experience, the combined use of the endoscope and the microspe as described here and illustrated in our case, improves visualization of the IAC and its contents, improving ressection and outcomes.**

CONCLUSIONS: **MFA allows for a direct yet safe surgical corridor to small intracanalicular VS. The implementation of endoscopy with MFA, especially for VS located laterally in the IAC, allows for better opportunity for complete resection of the tumor with improved preservation of hearing and facial nerve function.**

INTRODUCTION

Vestibular schwannoma (VS) is a benign slowly growing tumor arising from the Schwann cell sheath of the vestibular branch of the cranial nerve VIII at the Oberstein-Redlich transition zone. A VS can be located solely within the internal auditory canal (intracanalicular), or it can extend through the internal auditory meatus to the cerebellopontine angle (intracanalicular and extracanalicular). The great advance in imaging modalities and its more frequent use, specifically high resolution magnetic resonance imaging (MRI), has led to increased detection of smaller intracanalicular VSs.[1-3]

Generally, there are 3 treatment options for small intracanalicular VS: observation, stereotactic radiosurgery, and microsurgical resection. The optimal treatment strategy varies depending on the tumor size, age, hearing status, and patient's preference. Microsurgical resection is typically the gold standard for symptomatic, relatively young patients. Various surgical approaches have been described for resection of intracanalicular VS including the retrosigmoid, middle fossa, and translabyrinthine approaches. Each approach has its indications, advantages, and limitations. Nonetheless, there is a common consensus about approaching small intracanalicular VS in young patients through the middle fossa approach (MFA) as it carries a better chance of hearing preservation with relatively low morbidity and

Key words
- Acoustic neuroma
- Endoscopic assisted
- Intracanalicular
- Middle fossa approach
- Surgical technique
- Vestibular schwannoma

Abbreviations and Acronyms
IAC: Internal auditory canal
MFA: Middle fossa approach
MRI: Magnetic resonance imaging
VS: Vestibular schwannomas

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mortality.[2,4,5] The endoscopic-assisted MFA for microsurgical resection of VS has been previously described, where the endoscope is used following removal of the tumor under the microscope to ensure completion of resection.[6-8] Herein, the authors present an illustrative case to highlight the significance of using endoscopy via MFA for visualization and complete resection of small intracanalicular VSs at the IAC fundus, which was not initially visualized by the microscope alone.

CASE REPORT

We present the case of a 37-year-old female with a 1-year history of vertigo, unilateral hearing loss, and ear discomfort. At the time of onset, our patient underwent a brain MRI examination that showed an intracanalicular contrast-enhancing lesion on the left side and the presumptive diagnosis of VS was made. Initially the patient opted for observation of the lesion; however, 1 year later, a new MRI (**Figure 1**) showed a slight increase in the size of the lesion, measuring 3.6 × 2.5 mm. Because of the progression of symptoms over the year, the patient decided to undergo surgery.

On physical examination, the patient was neurologically intact except for mildly reduced hearing on the left side. On audiometric testing a bilateral sensorineural hearing loss was identified, worse on the left side (pure tone average 17dB, word recognition score 100%). Given that the patient still had serviceable hearing on the tumor side, MFA through the Kawase triangle was chosen after discussion with the patient.

The procedure was performed under general anesthesia, with the patient supine with a left side shoulder bump and her head turned to the right side. Intraoperative somatosensory evoked potentials and neuromonitoring of cranial nerves VII and VIII including transcranial motor for cranial nerve VII were used.

A straight preauricular incision, anterior to the tragus, was done and a 5 × 5 cm middle fossa craniotomy was performed. The dura was elevated from the petrous bone (**Figure 2A**) protecting the greater superficial petrosal nerve, and the meatal plane was identified and drilled to open 270 degrees of the IAC (**Figure 2B**). The dura was opened (**Figure 2C**), and the nerves were identified visually and confirmed using an electrical stimulator monopolar probe. Under microscopic visualization, no tumor was identified (**Figure 2D**) and the hypothesis of a benign inflammatory lesion that had resolved spontaneously was considered. The decision was made to bring an angled endoscope (45 degrees) into the field for a further 360-degree inspection. We used a pneumatic endoscope holder to avoid unnecessary movement of the endoscope and possible injury of the surrounding structures. The endoscope moved into and out of the surgical field under microscopic visualization to ensure a safe trajectory. The setup of the room while using the endoscope is illustrated in **Figure 3**. With the help of the endoscope, a very laterally situated lesion occupying a small portion of the posterior superior quadrant was identified (**Figure 2E**). Under endoscopic visualization, the lesion could be dissected away from the nerves and completely resected (**Figure 2F**). The IAC dura was closed with collagen matrix. The middle fossa bone flap was replaced, and standard closure of the skin was performed (**Suppl Video 1**).

Video

Video available at WORLDNEUROSURGERY.org

The patient was discharged on postoperative day 4 without any new neurologic deficits including intact facial nerve function and preservation of hearing as shown in audiometric testing 2 months after surgery. Histopathologic examination confirmed the diagnosis of a schwannoma. Audiometry testing performed at 3 months demonstrated pure tone average 8dB and a word recognition score of 100%. At 1-year follow-up, the patient is doing well without complaints related to the procedure and no signs of recurrence on brain MRI (**Figure 4**).

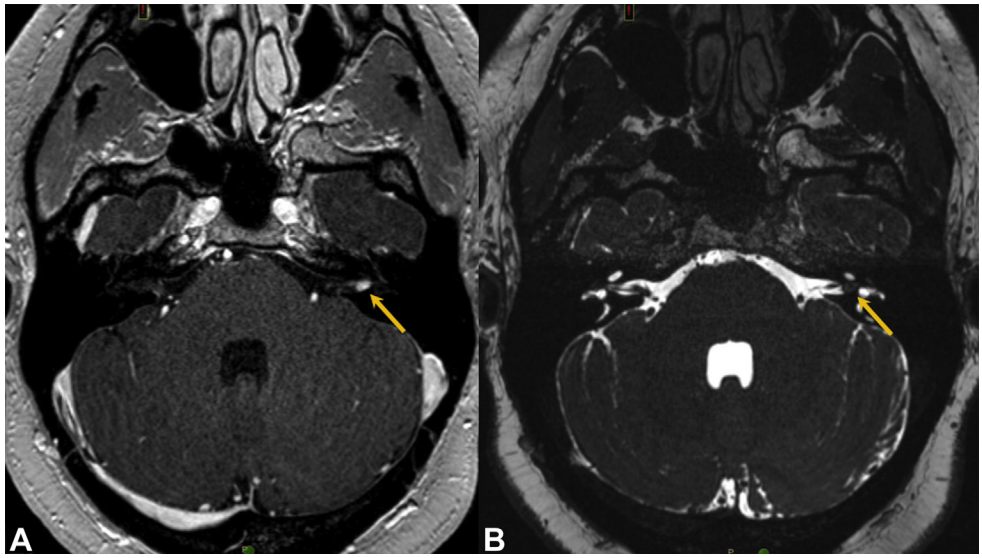

Figure 1. Preoperative magnetic resonance imaging showing an intracanalicular contrast-enhancing lesion (*yellow arrows*) in the left internal auditory canal measuring 3.6 × 2.5 mm. (**A**) Axial T1-weighted contrast-enhanced image. (**B**) Axial T2-weighted image.