Case Report

Endoscope-Assisted Resection of Intravestibular Schwannoma: A Video Case Report

Cassie Pan, BS; Andrew Sewell, MD; Elias Michaelides, MD

Intravestibular schwannomas are a rare cause of unilateral sensorineural hearing loss. Management of these tumors involves translabyrinthine resection, for which complete visualization around the angles of the vestibule may be limited under an operating microscope. We present the first reported case of an endoscope-assisted resection of an intravestibular schwannoma, along with the operative video recording. Using additional information gained from endoscopic examination of the tumor and its resection site, we also propose a mechanism by which this patient's intravestibular schwannoma caused hearing loss. Use of the endoscope in resection of intravestibular schwannomas may have advantages over the traditional operating microscope in improving visualization of the narrow and angled vestibule, confirming the integrity of surrounding structures, and ensuring complete tumor removal.

Key Words: Intravestibular schwannoma, intralabyrinthine schwannoma, endoscopic resection, translabyrinthine, labyrinthectomy.

INTRODUCTION

Intravestibular schwannomas are an uncommon cause of unilateral sensorineural hearing loss, for which surgical treatment involves translabyrinthine resection. The confined space of the vestibule can make adequate visualization of the vestibule difficult under an operating microscope. We present a case report, along with the operative video recording, of an endoscope-assisted resection of an intravestibular schwannoma, highlighting the advantages of endoscopic visualization of the vestibule during and after tumor removal. To our knowledge, this is the first documented case involving use of an endoscope in the removal of an intravestibular schwannoma.

CASE REPORT

A 49-year-old male presented with sudden right-sided hearing loss, ear pressure, and tinnitus, with progressively worsening symptoms over the prior 6 months. He denied unsteadiness or vertigo. He was initially treated by his general otolaryngologist with antiallergy medications and underwent magnetic resonance imaging (MRI) that showed a right-sided, 3-mm enhancing mass located at the junction of the basal turn of the cochlea and the adjacent vestibule, consistent with acoustic neuroma. On physical exam, Weber lateralized to the right, and Rinne was positive bilaterally. Pure-tone audiometry revealed profound right sensorineural hearing loss with pure-tone average of 98 dB. Bone conduction and word recognition could not be tested due to the severity of the hearing loss. Right ipsilateral acoustic reflex was absent. Videonystagmography showed intact vestibular function bilaterally. The patient subsequently completed a 14-day course of oral steroids.

The patient's right-sided profound hearing loss, ear pressure, and tinnitus remained stable for the next 10 months, at which point he began experiencing severe vertigo episodes in which he felt like his surroundings were spinning. These vertiginous episodes would last over 2 hours at a time and were accompanied by nausea, headache, and aural fullness. Repeat MRI (Fig. 1) at this time showed no change from his initial MRI. After discussion of the surgical risks, the patient consented to translabyrinthine resection of his tumor for his intolerable vertigo.

The operating microscope was used through the labyrinthectomy, at which point we switched to the endoscope, which offered improved visualization around angles of the narrow vestibule for resection of the tumor (see Supporting Information, Video, in the online version of this article). Intraoperatively, the tumor was noted to be a 3-mm well-encapsulated mass, sitting loosely in the vestibule without any noticeable attachments (Fig. 2). In this same operation, the patient also underwent cochlear implantation. Final pathology demonstrated a schwannoma.

On follow-up in the clinic 1 week postoperatively, the patient's vertigo had significantly improved, and his postauricular incision appeared to be healing well. One month...
after cochlear implant initial activation, right cochlear implant–aided soundfield thresholds were obtained in the normal to borderline-normal hearing loss range, ranging from 15 to 25 dB HL from 250 to 6,000 Hz with an aided speech reception threshold obtained at 20 dB HL. Speech performance testing was completed at 50 dB HL, with AZ Bio recorded sentence and consonant-nucleus-consonant (CNC) monosyllabic word tests. Scores were obtained at 33% for sentences and 34% for CNC words. All testing was performed with masking in the left ear through an insert phone.

**DISCUSSION**

Endoscopic ear surgery has gained popularity in clinical practice over the past decade. The benefits of using the endoscope, in contrast to the traditional operating microscope, have been well documented in ear surgery. These advantages include improved visualization around difficult angles and deep recesses, and the decreased need for extra exposure to achieve adequate illumination and visualization of the operative field. In a survey of ear surgeons who use endoscopes in their surgical practice, the vast majority of endoscopic procedures involved removal of cholesteatoma and tympanoplasty. We report the first documented case of an endoscope-assisted resection of an intravestibular schwannoma.

Vestibular schwannomas, which are common tumors arising from cranial nerve VIII in the internal auditory canal, may rarely arise as primary tumors of the inner ear. These tumors, collectively known as intralabyrinthine schwannomas (ILS) or primary inner ear schwannomas, most commonly present with American Academy of Otolaryngology–Head and Neck Surgery class D hearing loss (usually sensorineural), with over one-third of patients also having vestibular disturbances. A recent population-based study in the United States estimates the incidence of ILS to be 0.81 per 100,000 person-years over the past decade, rising to 1.1 over the past 5 years, with the increase likely due to improved disease detection rather than a true increase in incidence.

The Modified Kennedy Classification has been proposed for describing ILS by location, including intracochlear (involving only the cochlea), intravestibular (involving the vestibule ± semicircular canals), and intravestibulocochlear (involving the cochlea and vestibule ± semicircular canals). Intracochlear tumors represent more than 50% of ILSs, with intravestibular tumors being second most common (7%–29%). As noted previously, hearing loss is the most common presenting symptom of ILS, which is logical for intracochlear tumors as a result of direct compression of the cochlear nerve, organ of Corti, or the labyrinthine artery. However, the vast majority of intravestibular tumors also present with hearing loss, as with the patient presented in this report, but this is mechanistically less straightforward due to the lack of invasion of cochlear structures.

In our case of an intravestibular schwannoma leading to hearing loss, the improved visualization of the tumor and vestibule through the endoscope provided us with additional information on the potential underlying pathophysiology to explain our patient’s hearing loss (see Supporting Information, Video, in the online version of this article). First, we found that the flexibility and mobility of the endoscope were advantageous for comprehensive and dynamic imaging of the confined and angled spaces of the vestibule. Furthermore, the high resolution and magnification of the angled endoscopic view offered confirmation of complete resection by full visualization of the clean tumor bed following resection. We were able to confirm that the tumor was well encapsulated, lacked attachments to surrounding structures, and left no signs of damage to its surroundings. These endoscopic findings lead us to suspect that this patient’s hearing loss may have been caused by compression of the ductus reuniens and saccule by the tumor, as opposed to direct invasion of inner ear structures. Compression of these structures would lead to a hydropic state (which would also explain the patient’s vertigo) and/or metabolic derangements.
within the labyrinth, ultimately resulting in damage to the organ of Corti and hearing loss. Both of these possible etiologies of hearing loss due to intravestibular schwannomas have been suggested in the literature.4

Treatment strategies for ILS depend on the location of the tumor, symptom severity, and tumor growth over time.9,10 Authors advocate for conservative (wait-and-scan) management in patients without intractable vertigo and with serviceable hearing.4,11 In contrast, surgery has been shown to provide improvement in symptoms in patients with significant vertiginous symptoms.11 Whereas some authors have recently reported more conservative surgical techniques for intracochlear schwannomas, including transtemporal endoscopic approaches and preservation of semicircular canal function, removal of intravestibular schwannomas still involves labyrinthectomy.12,13 In conjunction with an operating microscope in the translabyrinthine resection of intravestibular schwannomas, use of an endoscope may facilitate improved visualization of the narrow vestibule, confirm the degree of involvement of surrounding structures, and ultimately ensure complete tumor removal. In our case, we were also able to glean further insight into the potential mechanisms by which this tumor caused hearing loss and vertigo. In terms of further applications, the benefits of excellent endoscopic visualization of the vestibule may also extend to operations for more common diseases of the labyrinth, including examination of the vestibule following labyrinthectomy for Meniere’s disease to ensure complete removal of retained neuroepithelium.

CONCLUSION

We report the first documented case of an endoscope-assisted resection of an intravestibular schwannoma, a rare tumor that presented with severe hearing loss and intractable vertigo. We found that in the vestibule, an endoscopic approach for tumor resection offered improved visualization of the vestibule over an operating microscope and facilitated confirmation of full resection. The better visualization of the endoscope also provided insight into the potential mechanisms by which this patient’s intravestibular schwannoma caused hearing loss and vertigo. Use of an endoscope may be especially suited for resection of tumors in the narrow and angled space of the vestibule.

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BIBLIOGRAPHY