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Research Paper

Endoscopic excision of a tympanic paraganglioma: Training the next generation of ear surgeons

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Abstract Tympanic paragangliomas are uncommon vascular tumors of neural crest origin. Classically these lesions have been surgically managed via a transcanal or transmastoid approach using binocular microscopy. We describe a case in which a tympanic paraganglioma was removed via a transcanal approach, using the endoscope exclusively. Endoscopic ear surgery enhances visualization, helping to ensure complete tumor removal, while reducing unnecessary dissection and its associated morbidity. For small middle ear neoplasms, a purely endoscopic approach is feasible, with excellent results. Resident education in ear surgery has also been enhanced by the use of endoscopes. The wide field of view provided by the endoscope helps trainees understand the intricate three-dimensional anatomy of the middle ear cleft.

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Introduction

Tympanic paragangliomas (glomus tympanicum) are highly vascular tumors, with an incidence of 1 in 1.3 million people per year.[1] The tumor originates from chromaffin cells of the paraganglia, which are neural crest derived structures. Paragangliomas are typically benign, indolent neoplasms that may present at an early stage with pulsatile tinnitus, and at later stages with hearing loss, dizziness, and cranial nerve neuropathies. Surgical excision, whether via a transcanal or postauricular approach, remains the mainstay of treatment. The advent of endoscopic ear surgery techniques presents an alternative, minimally-invasive approach to surgical excision of these tumors.

The most commonly used classification system for jugulotympanic paragangliomas was devised by Fisch in 1979.[2] This system is helpful when determining the surgical approach to a particular tumor, and for monitoring outcomes and complications. We describe a case of a Fisch class A tympanic paraganglioma, excised completely endoscopically via a minimally-invasive, transcanal approach, with the use of a carbon dioxide (CO_2) laser.

Case description

A 74 year old woman presented to our outpatient otolaryngology clinic with right aural fullness and right pulsatile tinnitus for approximately 6 months. Her past medical history was significant for hypertension, diabetes type 2, and chronic renal insufficiency. She had no history of ear surgeries, ear infections, vestibular problems, otalgia, or hearing loss. Examination revealed a reddish hue on the promontory in the right ear. Left ear exam was normal. Audiogram confirmed normal hearing thresholds bilaterally. Tympanometry showed normal middle ear pressures and normal drum mobility bilaterally. Computed tomography (CT) of the temporal bones revealed a small, 2 mm soft tissue density on the cochlear promontory without any extension or invasion. Both temporal bones were otherwise normal (Fig. 1). Based on history, examination, and radiologic findings, a diagnosis of tympanic paraganglioma (glomus tympanicum) was made.

The patient was taken to the operating room for a middle ear exploration and excision of the tympanic paraganglioma. General anesthesia was administered. The surgery was performed transcanal, entirely under endoscopic visualization. A standard tympanomeatal flap was elevated under endoscopic visualization with a rigid endoscope, 3 mm diameter, zero degree angle. A small, 2 mm globular pulsatile vascular tumor was easily visualized on the promontory. The blood vessels supplying the tumor from different directions were also clearly visible. The entire extent of the tumor was seen with the endoscope, without the need to separate the drum from the malleus, thus minimizing unnecessary dissection (Fig. 2). Using a CO_2 laser (OmniGuide, Lexington, MA), the feeder vessels were cauterized first (Fig. 3). Next, the tumor was removed entirely with a cup forceps (Fig. 4). The base of the tumor was cauterized with the CO_2 laser, and no further bleeding was encountered. A four-quadrant examination of the middle ear space was undertaken with a 30° angled rigid endoscope. No other abnormalities were noted. The tympanomeatal flap was redraped in its normal anatomic position. Care was taken to preserve the chorda tympani and replace the tympanic annulus into its groove.

Final pathology confirmed the diagnosis of a paraganglioma. Immunohistochemical staining revealed cells positive for synaptophysin, CD56, and focally positive for chromogranin, as well as positive S-100 staining in sustentacular cells. All these findings support the diagnosis of paraganglioma. Immediately after surgery, the patient's pulsatile tinnitus resolved. Aural fullness resolved shortly thereafter. Eight months postoperatively, there was no recurrence of aural fullness or pulsatile tinnitus. Hearing remained normal.

Discussion

Complete surgical excision is the mainstay of treatment of tympanic paraganglioma tumors, although close

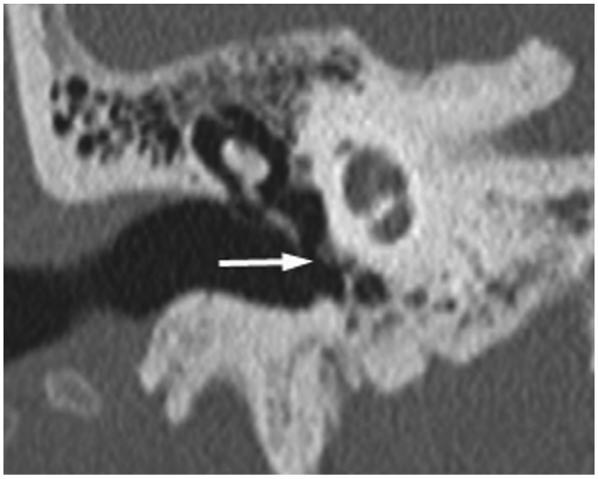

Figure 1 CT scan of the right temporal bone, showing a small tympanic paraganglioma on the cochlear promontory (arrow).

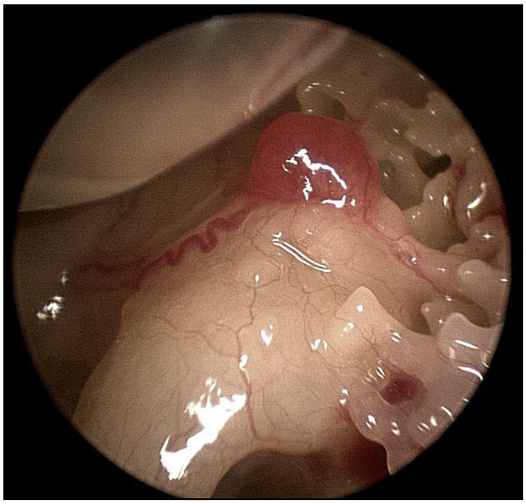

Figure 2 Tympanic paraganglioma seen on the cochlear promontory with several feeder vessels.

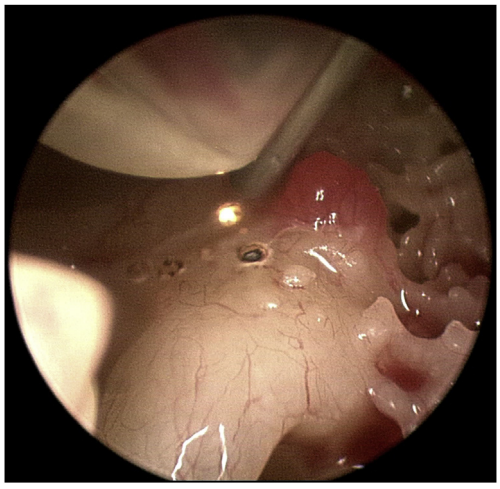

Figure 3 Using a CO_2 laser to cauterize the feeder vessels of a tympanic paraganglioma.

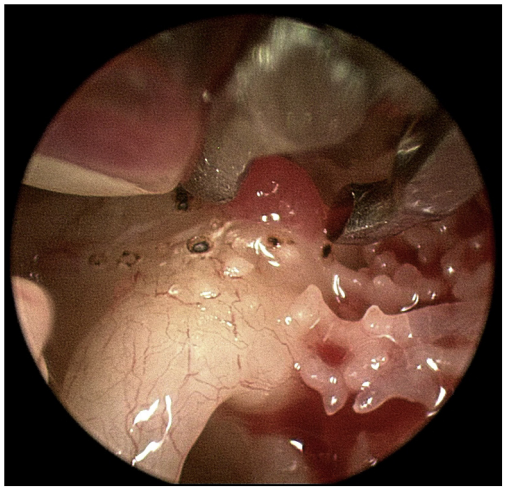

Figure 4 Removing the tympanic paraganglioma from the cochlear promontory using a small cup forceps, under endoscopic vision.

observation and radiation therapy have been described in select cases for patients who are unable or unwilling to undergo surgery. With recent advances in the field of endoscopic and minimally-invasive ear surgery techniques, the utilization of endoscopes has dramatically increased, as otologic surgeons adopt these innovative new modalities.

Cohen et al[3] devised a classification system for endoscopic ear surgery in 2016. The purpose of the classification system was to quantify extent of the use of the endoscope vs. microscope, standardize nomenclature, and facilitate future outcomes research. In our case, the surgical approach can be classified as a Class 3, with the endoscope used exclusively for all visualization and dissection. Marchioni et al[4] was among the first to describe a purely endoscopic approach to benign middle ear neoplasms in 2013. In this small series, the authors describe a purely endoscopic technique for removal of middle ear tumors of limited size using bipolar cautery. Along with others, they illustrate the benefit of improved visualization afforded by the rigid endoscope and the resultant minimal morbidity compared to classic ear surgery techniques. Select middle ear neoplasms can be safely managed via an endoscopic approach affording superior views, while following principles of minimally-invasive surgery, reducing unnecessary dissection such as a postauricular incision and its associated morbidity.

Resident education has been greatly enhanced by the use of endoscopes in ear surgery. Everyone in the room, including the surgeon, staff and assistants all see the same crisp high definition video. With its wide field of view, ear endoscopy helps the residents understand the intricate three-dimensional anatomy of the middle ear. Trainee interest, participation, and mastery of anatomy are all enhanced in endoscopic ear surgery.

Conclusions

Small tympanic paragangliomas can be safely and effectively removed using an entirely endoscopic, minimally-invasive surgical technique with the aid of a CO_2 laser. The use of endoscopes in ear surgery enhances visualization, helping to ensure complete tumor removal, while reducing unnecessary dissection that is done purely for exposure. Ear endoscopy is also a great tool for education of the next generation of ear surgeons. The wide field of view provided by the endoscope helps trainees understand the intricate three-dimensional anatomy of the middle ear cleft.

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Conflicts of interest

None.

Financial disclosures

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