Cadaveric Endoscopic Transmeatal Approach to the Internal Acoustic Canal and the Middle Ear

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Abstract

This study evaluates the neurosurgical applications of the endoscopic transmeatal approach to the middle ear and internal acoustic canal. Using Storz 0° and 30° endoscopes, two step-by-step procedures were performed in the University of Wisconsin-Madison Microneurosurgery Laboratory. Key anatomical structures, including the tympanic membrane, ossicles, semicircular canals, cranial nerves VII and VIII, and the anterior inferior cerebellar artery, were successfully identified. The endoscope facilitated visualization of the lateral pons, trigeminal nerve, and superior petrous vein. The findings suggest that the endoscopic transmeatal approach offers a minimally invasive option for accessing the middle ear and internal acoustic canal in select cases.

Introduction

The study objectives are to present the neurosurgical perspective for the endoscopic transmeatal approach to the middle ear and internal acoustic canal, and to examine this approach for potential neurosurgical applications.

Lateral skull base surgery is complex, with new approaches continually being developed to meet surgical challenges. Smaller lesions diagnosed early may be amenable to treatment with minimally invasive endoscopic techniques.

Methods and Materials

We documented two step-by-step endoscopic transmeatal approach procedures into the middle ear and the internal acoustic canal using Storz 0º and 30º endoscopes at the University of Wisconsin-Madison Microneurosurgery Laboratory. This included photographic and video documentation with technical notes on the surgical techniques and the identification of key anatomical landmarks. A retroauricular C-shaped incision was made, followed by resection of the tympanic membrane and drilling of the external acoustic canal to increase exposure and improve the working angle.

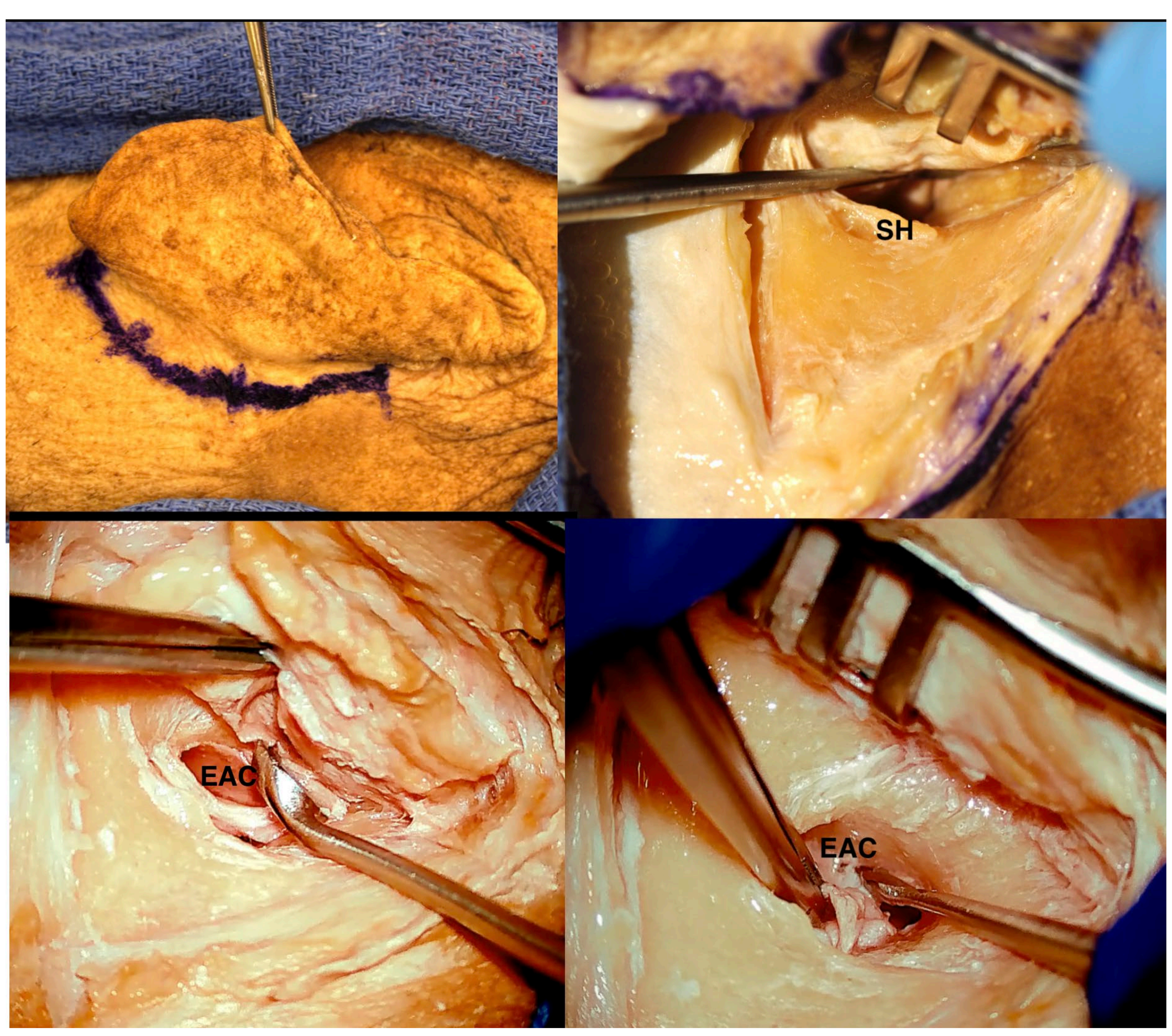

Figure 1. Retroauricular C-shaped incision. Identification of the Spine of Henle (SH) and the External acoustic canal. Incision and resection of the external auditory canal skin and later the timpani membrane.

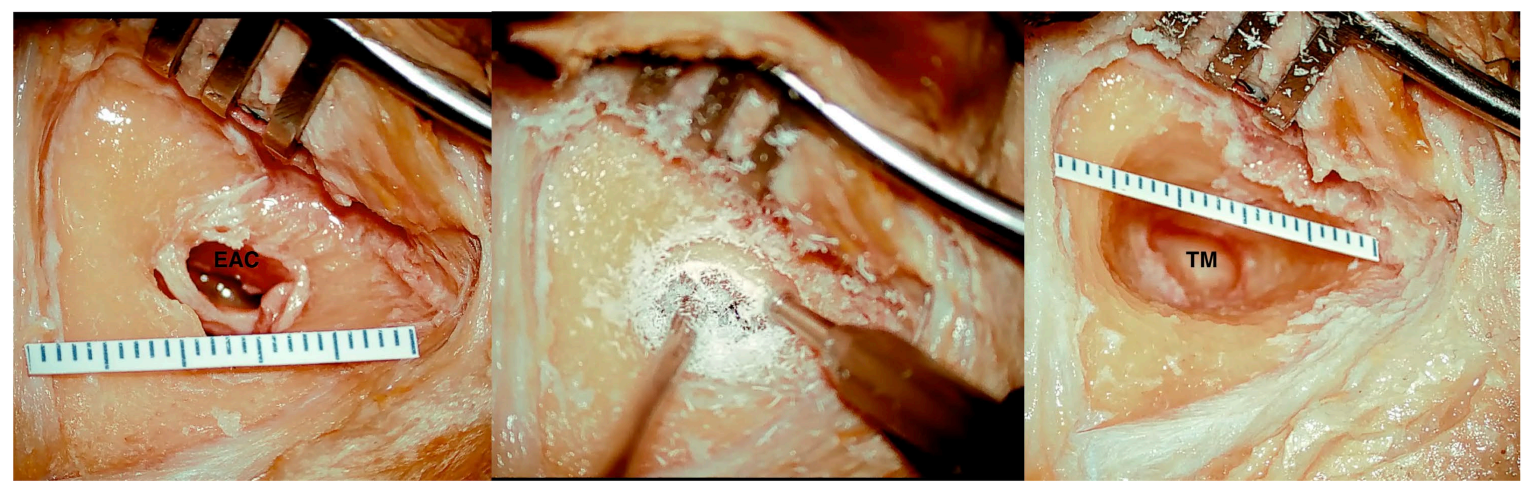

Figure 2. Exposure of the external acoustic canal (EAC) and drilling to increase exposure and improve the working angle, deepen the dissection the tympanic membrane (TM) is identified.

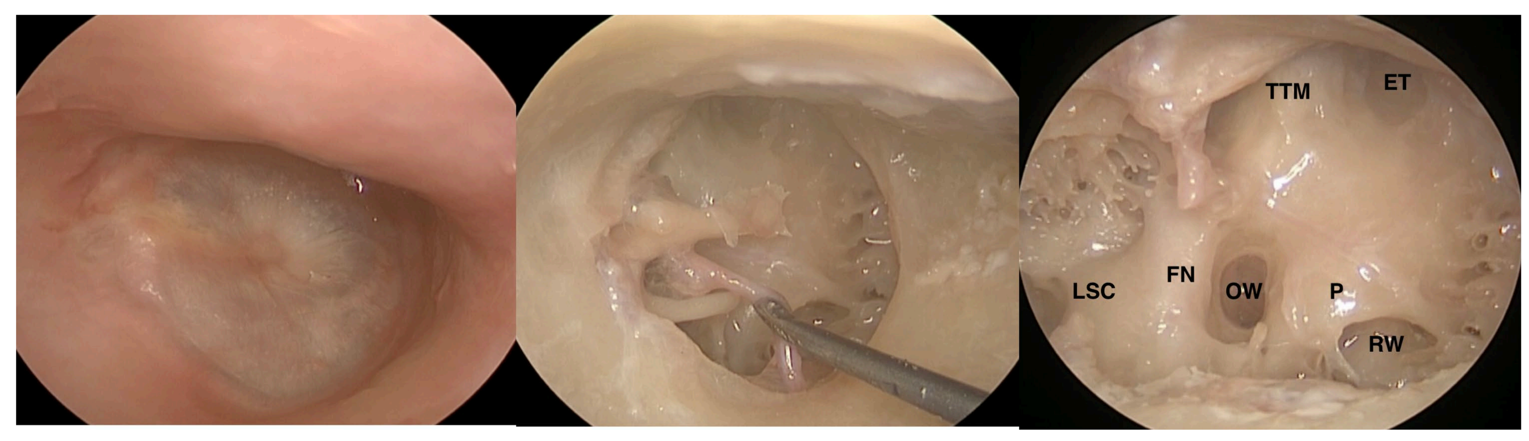

Figure 3. Timpanic membrane before resection. Identification of the ossicles and the chorda tympani (in the tip of the dissector). After ossicles removal and drilling to expand the view of the tympanic cavity: Round window (RW), oval window (OW), Promontories (P), Facial Nerve (FN), lateral semicircular canal (LSC), tensor tympani muscle (TTM) and opening of the Eustachian tube (ET).

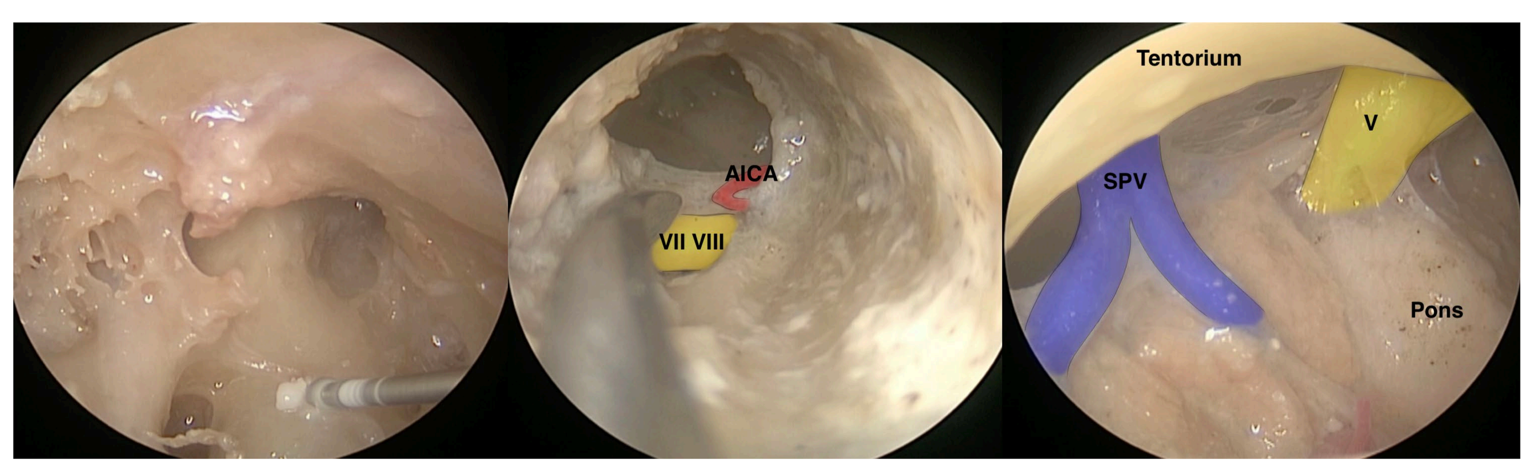

Figure 4. Drilling the promontorium to reach the internal acoustic canal (IAC). Internal acoustic canal with identification of cranial nerves VII and VIII with the loop of the anterior inferior cerebellar artery (AICA). Introduction of the endoscope in the IAC and identification of the superior petrous vein, tentorium, trigeminal nerve (V) and Pons.

Results

We successfully performed two endoscopic transmeatal approaches, identifying the tympanic membrane and subsequently the round window, all three ossicles, and the promontory, lateral and superior semicircular canals. Also identified were the eustachian tube, chorda tympani, tensor tympani muscles, and the topography of the internal carotid artery and jugular bulb. This approach also facilitated the opening of the internal acoustic canal with a high-speed drill, identification of the VII and VIII cranial nerves, and the anterior inferior cerebellar artery loop. Introducing the endoscope into the internal acoustic canal enabled us to visualize the lateral surface of the pons, the tentorium, the trigeminal nerve, and the superior petrous vein.

Discussion

The endoscopic transmeatal approach provides a direct, minimally invasive route to the middle ear and internal acoustic canal. Compared to traditional open approaches, this method enhances visualization of key neurovascular structures while preserving surrounding anatomy. Potential applications in neurosurgery include targeted interventions for small vestibular schwannomas and other skull base pathologies.

Conclusions

The Endoscopic Transmeatal Approach offers a minimally invasive option for accessing the middle ear and internal acoustic canal that may be used in selected cases.

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