AMERICAN JOURNAL OF MEDICAL AND CLINICAL SCIENCES, 2025
VOL 10, NO. 2, PAGE 1 – 4

RESEARCH ARTICLE

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Transcanal Endoscopic Approach for Removal of Residual Cholesteatoma

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ABSTRACT

Residual cholesteatoma is a cholesteatoma that remains incompletely excised during the initial surgical procedure. Management options for residual disease typically include either the traditional postauricular mastoidectomy or a transcanal endoscopic approach, depending on the location and extent of the residual pathology. We report the case of a 22-year-old male who presented with recurrent left-sided otorrhea lasting seven months. He had previously undergone a left modified radical mastoidectomy for chronic otitis media with cholesteatoma seven months prior to his current symptoms. A high-resolution computed tomography (HRCT) scan of the temporal bone, performed postoperatively, revealed soft tissue density in the epitympanum, mesotympanum, and mastoid bowl, along with evidence of ossicular chain disruption. A transcanal endoscopic approach was utilized for the removal of the residual disease. This case highlights the viability of the transcanal approach in selected patients with residual cholesteatoma, provided that high-quality preoperative imaging is available and the procedure is performed by an experienced otologist skilled in endoscopic ear surgery.

ARTICLE HISTORY

Received 25 Apr 2025
Accepted 09 May 2025
Published 18 May 2025

KEYWORDS

Transcanal Endoscopic Approach, Residual Cholesteatoma, Endoscopic Ear Surgery.

Introduction

Cholesteatoma is a disease of the middle ear and mastoid that is characterised by the accumulation of the keratinising squamous epithelium, leading to local inflammation and destruction [1] and it has tendency to recurs. The annual incidence of cholesteatoma is reported between six to fifteen cases per 100 000 [1] and it can either be congenital or acquired. The pathogenesis of cholesteatoma involves the invasion of the surrounding structures and infiltration into the internal carotid artery, jugular vein, sigmoid sinus and dura [2]. The treatment option is usually surgical intervention such as canal wall up (CWU) or canal wall down (CWD) mastoid surgery depending on the extension of disease and the aim of the surgery is to provide a safe and dry ear. However, the major problem with CWU or CWD mastoid surgery is the high prevalence of the residual diseases. The incidence rate of residual cholesteatoma in CWU and CWD surgery are between 3 to 15% and less than 15% respectively [3]. Recent literatures have proposed the use of transcanal endoscopic approach for a limited residual cholesteatoma. We hereby described a case of a case of a limited residual cholesteatoma post CWD procedure who underwent transcanal endoscopic approach for removal of the residual cholesteatoma.

Case Presentation

A 22-year-old gentleman presented with recurrent episodes of left otorrhoea for four months. There was no associated otalgia, worsening of hearing loss, tinnitus, vertigo, headache or facial asymmetry. He had an uneventful left modified radical mastoidectomy seven months prior to presentation for left chronic otitis media with cholesteatoma. Intra-operatively, the cholesteatoma was found occupying epitympanum in the mastoid, antrum, sinodural angle, sinus tympani, retrolabyrinthine, zygomatic air cell and middle ear which was removed. The ossicles were not eroded, and the facial nerve was preserved. Post operatively, his hearing was reduced on the left ear.

Otoscopic examination revealed a whitish mass medial to the anterosuperior part of pars tensa. There was an attic perforation with widening of the epitympanum. The fundus of the attic perforation was not visualised (Figure 1). The left mastoid bowl is contracted and well epithelialized. Cranial nerve examinations were unremarkable. Rinne's was negative over the left ear and Weber was lateralized to the affected ear indicating left conductive hearing loss. Free field voice test demonstrated normal to mild hearing loss in both ears. His preoperative pure tone audiogram showed moderate low frequency conductive hearing loss with air-bone gap of 30 to 40 dB over the left ear and normal hearing on the right ear.

High resolution computed tomography (HRCT) of the temporal bone demonstrated soft tissue density within epitympanum, mesotympanum and mastoid bowl of the left ear with disruption of the ossicular chain seen (Figure 2 & 3).

He underwent examination under microscopy, transcanal

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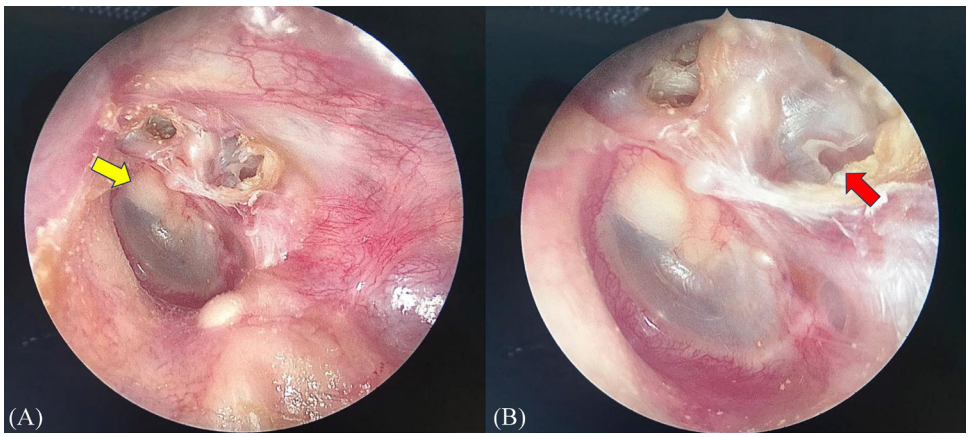

Figure 1: Otoendoscopic images showing (A) a whitish mass seen medial to the anterosuperior part of pars tensa (yellow arrowhead) with attic perforation (red arrowhead). The fundus of attic perforation was not visualised upon a closed-up view in (B).

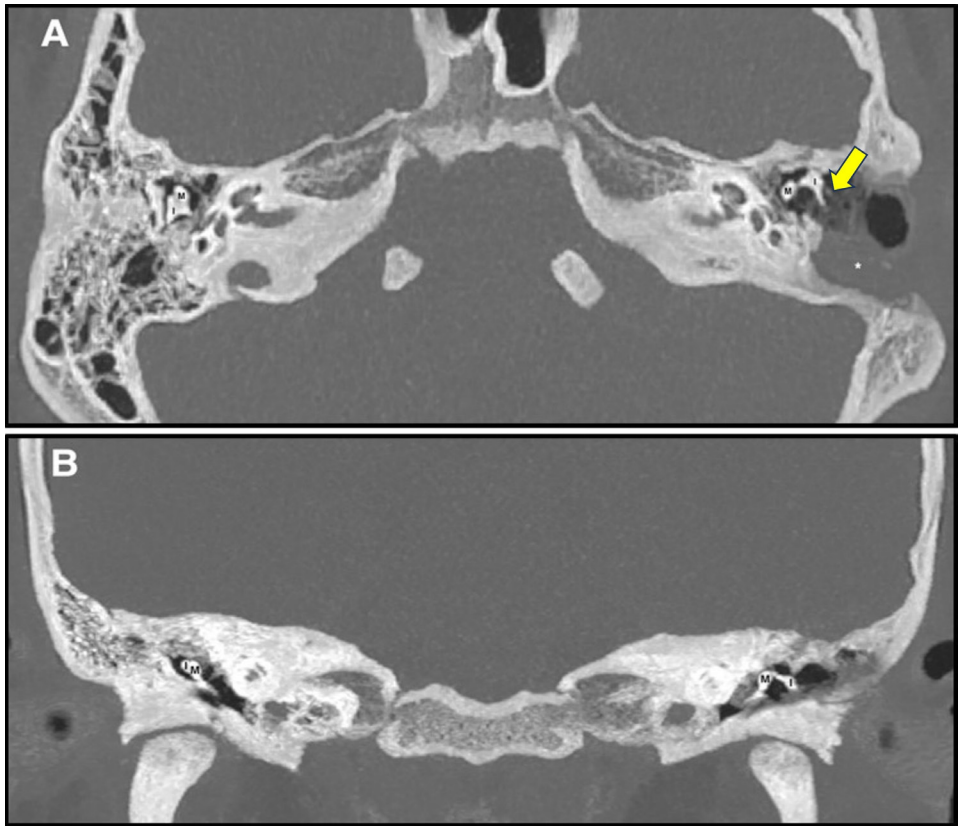

Figure 2: A HRCT image in (A) axial view shows disrupted left incudomalleolar joint as compared to a normal configuration seen on the right ear. The incus (I) is dislocated laterally in relation to the malleus (M). A soft tissue density is seen around the short process of the incus causing mild erosion at its lateral aspect and the long process of the left incus was eroded and shortened (yellow arrowhead). (B) A HRCT coronal view showing the laterally displaced left incus. There are soft tissue densities adjacent to it and in the left mesotympanum lying medial to the left malleus.

endoscopic approach for removal of cholesteatoma and tragal graft myringoplasty. Intraoperatively, the cholesteatoma was seen at epitympanum, mesotympanum and overlying the lateral semicircular canal. There was no involvement of the mastoid cavity. The handle of malleus is medialised and the lenticular process of incus was eroded. In view of limited disease, removal of residual cholesteatoma was done via transcanal endoscopic approach. The head of malleus and incus were removed and the facial nerve was identified and preserved during the operation. He was discharged home without consequences and his postoperative pure tone audiogram revealed moderate conductive hearing loss with air bone gap of 50 to 60 dB over the left ear. He is on three monthly follow up and remains well with no recurrence over 12 months postoperatively.

Discussion

Cholesteatoma recidivism includes both residual and recurrent cholesteatoma. Residual cholesteatoma refers to the persistence of disease due to incomplete removal of the cholesteatoma matrix, often resulting from limited surgical exposure or the complex anatomy of the middle ear and temporal bone structures [4,5]. Over the past decades, the outcomes of cholesteatoma surgery have significantly improved, largely due to advancements in surgical instrumentation and the development of refined techniques that enhance visualization within the temporal bone. Despite these improvements, residual disease remains a significant challenge in cholesteatoma management. Reported incidence rates of

residual cholesteatoma vary widely, ranging from 12.3% to 67.0%, with a male-to-female ratio of approximately 1.3:1 [6]. The incidence of residual cholesteatoma is significantly affected by the surgical approach, with higher rates reported following CWU procedures, ranging between 10% and 40% [7]. Moreover, residual disease tends to be more prevalent in children compared to adults [8], likely due to anatomical and physiological differences that complicate complete removal.

In our case, the residual cholesteatoma was identified in both the mesotympanum and epitympanum. The epitympanum is known to be one of the most common sites for residual cholesteatoma [9]. This is consistent with the broader understanding that residual disease frequently occurs in anatomically complex regions of the middle ear and attic, where access and visualization during mastoidectomy are particularly challenging. These difficult-to-reach areas include the retrotympanum, supratubal recess, sinus tympani, and facial recess [4,5]. Supporting this observation, Ohki et al performed an endoscopic assessment following microscopic ear surgery and identified common sites of residual cholesteatoma. Their findings emphasized the attic as a frequent site of residual cholesteatoma, with residual matrix commonly observed in the tegmen tympani, tympanic sinus, facial recess, anterior epitympanum, medial scutal surface, and around the stapes footplate [10].

Several additional factors have been associated with cholesteatoma recidivism, including the development of new retraction pockets following surgery. It has been hypothesized that these retraction pockets form as a result of poor middle ear aeration, which creates negative pressure within the tympanic cavity [5]. Aeration of the middle ear is primarily regulated by the Eustachian tube, and persistent Eustachian tube dysfunction may contribute to the formation of retraction pockets after surgery, thereby increasing the risk of recurrent cholesteatoma. Supporting this, Volgger et al. conducted a retrospective study involving 108 patients with residual cholesteatoma and found that factors such as prior adenoidectomy, cholesteatoma extension into the sinus tympani, antrum, and mastoid, CWU procedures, as well as postoperative retraction and tympanic membrane perforation, were significantly associated with a higher risk of residual disease [6]. Interestingly, the study also reported that factors such as mastoid pneumatization**,** ossicular erosion**,** and congenital cholesteatoma were not significantly associated with residual disease.

The transcanal endoscopic approach is commonly indicated for the management of cholesteatoma or for the revision of accessible residual or recurrent disease. This technique is particularly suitable for cases where the cholesteatoma is confined to the tympanic cavity or attic, and has not extended beyond the level of the lateral semicircular canal [11]. Additionally, it is generally recommended when the size of the cholesteatoma is less than 8 mm [12]. One of the key advantages of the transcanal endoscopic approach is its ability to offer enhanced visualization. Endoscopes are available in various angulations, allowing a panoramic view of anatomically challenging and concealed areas such as the sinus tympani, attic, and hypotympanum [13,14]. Another significant benefit of this approach is that it is minimally invasive, especially when compared to conventional mastoidectomy, which typically involves a postauricular incision. This minimally invasive nature also allows for better tissue preservation [14].

However, the approach has certain limitations. It is inherently a single-handed procedure, which can pose challenges for less experienced surgeons and involves a steep learning curve. Additionally, the accumulation of blood and bone dust during the procedure can obscure the visual field, necessitating frequent cleaning of the endoscope. To address this, the underwater technique has been introduced, in which the surgical field is submerged in a body-temperature isotonic solution, thereby improving visibility and reducing the need for repeated cleaning [15].

The technique also carries potential risks. The intense light emitted by the endoscope can generate significant heat, potentially leading to thermal injury of middle ear structures. This thermal effect may result in protein denaturation, collagen contraction, and tissue dehydration, which can contribute to infralabyrinthine dysfunction [16].

Conclusion

The transcanal endoscopic approach is a valuable option for the removal of residual cholesteatoma, particularly in cases of limited disease. Although it is a minimally invasive technique, it presents both advantages and limitations. Therefore, careful patient selection is crucial to ensure optimal surgical outcomes and to minimize potential complications.

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