

RETROSPECTIVE ANALYSIS OF ENDOSCOPIC INTERLAY TYMPANOPLASTY TYPE 1- MODERN APPROACH TO TYMPANIC MEMBRANE RECONSTRUCTION

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ABSTRACT

Background: Tympanoplasty can be performed using various techniques namely underlay, overlay and interlay using the endoscope. Type of technique depends on the pathology and ease of the operating surgeon. Interlay tympanoplasty involves peeling off of the epithelial and fibrous layers of tympanic membrane from the medial mucosal layer, however this is achievable using an endoscope. The placement of graft on the mucosal layer ensures functional take up of the graft. We report interlay technique in endoscope tympanoplasty for the repair of tympanic membrane perforations. **Materials and Methods:** 56 patients who had undergone interlay tympanoplasty type one were enrolled in our study retrospectively and take up of the graft in these patients was assessed. All surgeries were performed at the same center by the same surgeon. Assessment of the graft uptake was reported at the end of 6 months. **Result:** Out of the 56 patients, 64.21 % had large central perforation while only 10.71% had small perforation. At the end of 6 months, 55 patients had a normal tympanic membrane while one patient out of 56 patients reported failure of graft uptake. **Conclusion:** Endoscopic tympanoplasty using Interlay technique has emerged as a minimally invasive and highly effective technique for repair of tympanic membrane perforations. Unlike conventional surgery, this technique has been seen to have less morbidity, no post aural scar and early graft uptake. In our study, tragal perichondrium was used as the graft material in all cases using Endoscopic interlay technique, Graft uptake at the end of 6 months is being reported.

INTRODUCTION

Tympanoplasty was first introduced by Berthold for repair of tympanic membrane and was further popularized and developed by Wullstein and Zollner.^[1] Endoscopes were initially used only to visualize the middle ear.^[2] The earliest use of endoscopes in otology dates back to the 1990s.^[3] Tarabichi published the first report of patients treated using the endoscopic approach alone.^[4]

The underlay method is generally applied for tympanic membrane perforation in posterior site. The overlay method is used for tympanic membrane perforation in anterior site, subtotal perforation or revision of unsuccessful underlay method.^[5] In interlay procedure, the graft is sandwiched between the canal wall and the remnant of tympanic membrane mucosa on one side, and tympanomeatal flap with squamous epithelial and fibrous layers on

the other side.^[6] Tympanoplasty involves eradication of the disease in the middle ear, repair of the perforated tympanic membrane and restoration of hearing. Recently, trans canal endoscopic approaches have become popular.^[7] The tortuous anatomy of the outer ear and bone protrusions negatively affect microscopic views and impair visualization of deep structures. On the other hand, the panoramic and wide angled views obtained by the back-and-forth movements of the endoscope are not affected by the tortuous anatomy of the external ear canal.^[8] The interlay has rarely been reported in trans canal endoscopic ear surgery.^[9] This is because the underlay technique is relatively easier to perform using only one hand,^[10] and many surgeons find it challenging to detach the epithelial layer of the tympanic membrane in the interlay technique. In fact, considering the endoscopic advantages of close

proximity and magnification, the interlay technique may be an option in endoscopic surgery.^[11]

Equipments for endoscopic Approach

1. Endoscope 0-degree, 30-degree, rigid endoscopes with diameter of 2.7 mm and 4.0 mm and length of 16-18 cm.
2. **Video equipment:** High-resolution camera and monitor, light source, fiberoptic cable.
3. **Instruments:** Surgical instruments used for conventional otologic surgeries. A microscope can be made available to enable a switch to microscopic surgery, when necessary.

Advantages of endoscopic approach:

- Minimally invasive approach to the middle ear: Endoscopic Tympanoplasty is fully in line with the development of the concept of minimally invasive surgery.
- Panoramic intraoperative vision: When performing Endoscopic Tympanoplasty; and unlike the binocular microscope; endoscope makes it possible to access external auditory canal, bypassing canal wall bulges and tortuosities.
- Does not require large post aural skin incisions.
- Use of Endoscope reduces the anesthesia and surgery time.
- Decrease in hospital stay and early return to routine activities
- Reduced Cost and easy transportability for the patient has been observed.
- Provides better cosmetic outcomes.
- Hidden deep regions, such as the anterior tympanic perforation, facial recess and hypotympanum can be directly visualized.
- High-resolution and relatively clear images can be obtained intraoperatively.

MATERIALS AND METHODS

Study design

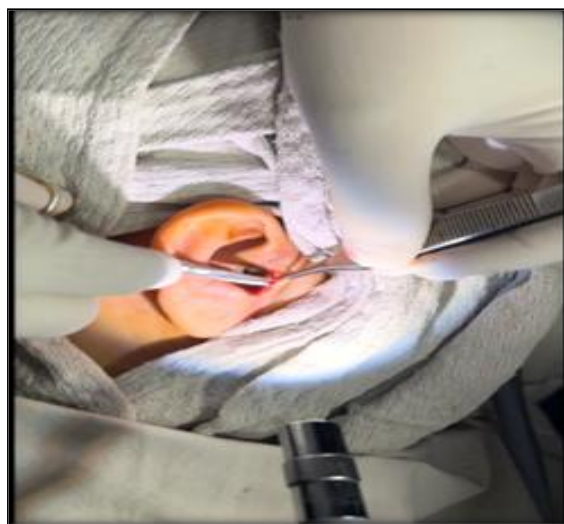
- A retrospective study conducted in the department of ENT.
- Patients who underwent Type 1 Endoscopic interlay tympanoplasty at our Centre, for the treatment of Chronic Otitis Media and had been followed up for 6 months, were included in this study after due consent.
- Surgery was performed at the same center, by the same surgeon, using Endoscopic interlay tympanoplasty.

Inclusion criteria:

- Patients who underwent Endoscopic interlay tympanoplasty type one for treatment of chronic otitis media.
- Patients in the age group of 15-60 years.
- Patients of both the genders were included.

Technique of endoscopic interlay type one tympanoplasty: 0- and 30-degree rigid endoscope of 2.7 mm and 4.0 mm in diameter used based on the tortuosity of the External auditory canal 0- or 30-

degree endoscope may be used. Surgeon preference and comfort also dictate the use of a specific scope. The ear and external auditory canal is cleaned thoroughly. Perforation, middle ear and other structures are examined depending on the size of the perforation. Surgery is performed under Local Anesthesia. Local infiltration including adrenaline at a concentration of 1:200000 done along the posterosuperior quadrant of external auditory canal at a single point and blanching of the skin of EAC is observed. Lateral surface of the tragus is also infiltrated.



Tragal perichondrial graft being harvested.

In situ tragal perichondrial graft harvested. Margins of the perforation are refreshed using a straight or curved needle, as the case may be. The epithelialized edges are peeled off and removed. Using a circular knife, a 360-degree incision is given and tympanomeatal flap is raised exposing the annulus all around. Annulus is elevated and Notch of Rivinus is exposed. Using a blunt instrument, the epithelial layer of the tympanic membrane perforation is peeled off the fibrous layer up to the neck of malleus. The ossicular mobility is checked and if discontinuity is identified, ossiculoplasty is done. Eustachian tube patency is checked. Anterior and posterior isthmus patency is checked and if found blocked is addressed. Tensor fold patency is achieved. This ensures a good and functional take up of the graft eventually. The graft is gently placed on the mucosal remnant of the tympanic membrane and the fibrous epithelial layer is repositioned back on the graft. No gel foam or any such material needs to be placed in the middle ear. The External auditory canal is filled with antibiotic soaked gel foam.



Tm flap and annulus elevated circumferentially; elevations provide access to middle ear. Integrity of ossicles and their mobility checked. Graft kept in place by interlay technique. Tm flap repositioned back.

RESULTS

56 patients who were included in our study comprised of 34 males and 22 female patients. The patients included in our study were in the age group 15-60 years, with the mean age of being 37.5 years with the standard deviation of 12.99 years.

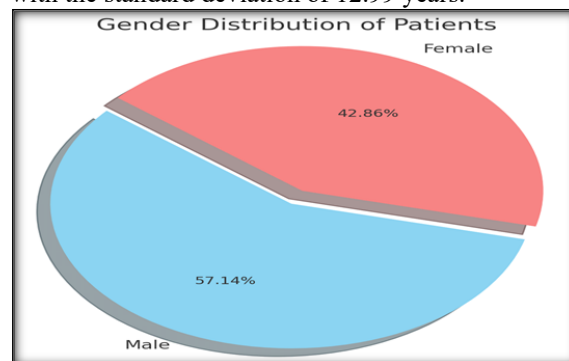


Table 1: Gender Distribution of Patients

Gender	Count	Percentage (%)
Males	32	57.14%
Females	24	42.86%

Table 2: Perforation Size Distribution.

Type of Perforation	Count	Percentage (%)
Small	6	10.71%
Medium	14	25.00%
Large	36	64.29%

Out of the total 56 patients 6 (10.71%) had a small size perforation, 14(25%) had a medium size perforation and 36(64.29%) had a large size perforation.

In the present study out of 56 patients, 55 had a normal tympanic membrane at the end of 6 month with the graft uptake rate of 98.21%.

Table 3: Graft Uptake Results

Category	Patients (n)	Percentage (%)
Graft Uptake	55	98.21%
Graft Failure	1	1.79%

DISCUSSION

Endoscopic interlay type I tympanoplasty has emerged as a minimally invasive, highly effective technique for the repair of tympanic membrane perforations. Unlike traditional microscopic methods, the endoscopic approach provides a wide-angled, panoramic view of the middle ear without the need for post aural incisions or extensive canaloplasty. This results in superior visualization of the perforation margins, ossicular chain, and middle ear pathology, thereby facilitating precise graft placement and minimizing surgical trauma. This approach preserves the outer epithelial layer, maintains the normal architecture of the tympanic membrane, and promotes rapid healing. The interlay method has been associated with high graft uptake rates, minimal postoperative infection, and low residual perforation rates. With the use of endoscope, reduction in the anaesthesia time was seen compared to post aural surgery. Gain of operating time has been documented by Choi et al. They showed that the mean operative time for microscopic and Endoscopic

Tympanoplasty was 88.9 and 68.2 min, respectively.^[12] Dundar et al reported that during Endoscopic Tympanoplasties the duration of surgery was significantly shorter than during microscopic tympanoplasties in children.^[13]

In this study we have recorded the graft uptake rate of 98.21 % which is higher than the success rate reported by Patil et al,^[14] (96%) on 100 patients. Similar study results reported by Kumona et al,^[15] Jain et al,^[16] El feky et al,^[17] and Kumar et al,^[18] have shown the graft uptake rate of 94.2%, 96.6%, 90% and 93.3% respectively.

The minimally invasive nature of endoscopic surgery translates into reduced operative time, less postoperative discomfort, faster recovery, and improved cosmetic outcomes, particularly appealing to both younger and elderly patient populations. However, the endoscopic approach requires adaptation due to its one-handed surgical technique, where the surgeon operates instruments with one hand while holding the endoscope in the other. Proper training and experience are essential to overcome this learning curve. Additionally, the absence of

stereoscopic vision may pose challenges in depth perception, although many surgeons quickly adapt by relying on visual cues and experience.

CONCLUSION

Endoscopic interlay type I Tympanoplasty offers a safe, effective, and cosmetically superior alternative to traditional microscopic approaches, with excellent functional and anatomical outcomes.

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