

INSIGHTS FROM 60 CASES: INTERLAY TYPE I TYMpanoplasty IN PATIENTS WITH INACTIVE MUCOSAL CHRONIC OTITIS MEDIA WITH LARGE CENTRAL PERFORATION

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Abstract

Background: This study investigates Interlay Type I Tympanoplasty's effectiveness using temporalis fascia graft in patients with inactive mucosal chronic otitis media (COM) featuring large central perforations. Objectives include evaluating graft uptake, A-B gap improvement, and pure tone average gain. **Materials and Methods:** At K.R. Hospital, affiliated with Mysore Medical College and Research Institute, 60 cases of inactive CSOM with large central perforations were studied from January 2021 to June 2022. Pre-operative pure tone audiometry was conducted. Type I tympanoplasty with temporalis fascia graft using the interlay technique was performed. Follow-ups occurred at 2 weeks and 3 months, with post-operative pure tone audiometry at 3 months. Evaluation focused on graft uptake, A-B gap improvement, and pure tone average gain. **Result:** Graft uptake succeeded in 93.33% (56 cases), consistent with literature. Four cases (6.67%) experienced graft failure due to acute otitis media after upper respiratory infections. Out of 60 cases, 56 showed success in pure tone average gain and A-B gap improvement. Pre-op mean pure tone average: 34.65dB ± 5.46dB, post-op: 17.64dB ± 6.45dB, with a mean gain of 16.85dB ± 6.01dB. Pre-op mean A-B gap: 29.82 ± 3.33dB, post-op: 12.86 ± 5.34dB, a significant difference (p<0.001). **Conclusion:** Interlay Type I tympanoplasty is an excellent technique for treating inactive CSOM with large central perforations, showcasing high graft uptake and significant hearing improvement. However, post-operative infection remains the primary cause of graft failure.

INTRODUCTION

Chronic Otitis Media (COM) is an inflammatory process in the middle ear space that results in long term, or more often, permanent changes in the tympanic membrane including atelectasis, dimer formation, perforation, tympanosclerosis, retraction pocket development, or cholesteatoma. This disease causes hearing loss, and has a major impact on the social life of a person in the form of hearing disability.

It poses a significant health challenge in developing nations, affecting both children and adults. India stands out as one of the countries burdened with a high prevalence of chronic otitis media. Among the various types of chronic otitis media, the mucosal or tubotympanic type, also known as the safe type, is prevalent. Tympanoplasty serves as a management option for this mucosal type of chronic otitis media.^[1]

Type I tympanoplasty is a surgical procedure designed to mend the tympanic membrane, typically employed when the sole pathology present is a perforation of the tympanic membrane. Initially introduced by Berthold, this technique gained further prominence and refinement through the contributions of Wullstein and Zollner.^[2] Literature reports indicate that the ultimate outcomes of tympanoplasty, particularly in terms of graft acceptance rates, range from 74% to 97%. These variations are attributed to factors such as surgical expertise, the chosen technique, and the location and size of the perforation.^[1]

In pursuit of excellence and precision, otologists have honed several adaptable techniques for tympanoplasties. These encompass the underlay, overlay, interlay, gelfilm sandwich, swinging door, tittle C, double breasting, fascia pegging, anterosuperior anchoring, and spot welding techniques with laser assistance. Among these, the

three techniques most widely recognized for graft positioning are the "underlay," "overlay," and "interlay" methods.^[3]

At the core of these three methods lies the positioning of the graft within the tympanic remnant. In the underlay technique, the graft is situated medial to the mucous layer. In the overlay method, the graft is positioned lateral to the fibrous layer following the elevation of the epithelial layer of the tympanic membrane. In the interlay method, the graft is inserted between the fibrous and mucous layers of the tympanic membrane.^[4]

The objective of this study is to assess the outcomes regarding graft acceptance and improvements in hearing achieved through the utilization of the interlay technique.

MATERIALS AND METHODS

Objectives: The goal of this study is to evaluate the effectiveness of the Interlay tympanoplasty technique in addressing chronic otitis media with inactive mucosal disease characterized by large central perforations. This objective will be achieved through the following aims:

1. Hearing gain in terms of air bone gap.
2. Outcome of graft uptake.
3. To study complications associated with interlay technique.

Source of Data: This study titled "Insights from 60 Cases: Interlay Type I Tympanoplasty in Patients with Inactive Mucosal Chronic Otitis Media with Large Central Perforation" was conducted at K.R. Hospital, affiliated with Mysore Medical College and Research Institute, from January 2021 to June 2022, after obtaining Ethical Committee approval.

Patients presenting to the outpatient department and fulfilling the below mentioned criteria were taken up for study after obtaining informed consent.

Inclusion Criteria

- a) Patients aged between 15 to 60 years.
- b) Patients with mucosal type of COM with large central perforation.
- c) Patients with dry ear for at least 6 weeks.

Exclusion Criteria

- a) Patients with active mucosal COM.
- b) Active or inactive squamosal COM.
- c) Ossicular discontinuity/ necrosis, tympanosclerosis.
- d) Revision surgeries.
- e) Patients with sensorineural/mixed hearing loss.

Procedure: For each patient, a comprehensive proforma was completed, documenting their medical history, clinical examination findings, investigations including preoperative pure tone audiometry (PTA). In all cases, the tympanomeatal flap is carefully elevated, encircling the ear canal up to the level of the fibrous annulus. Following identification of the tympanic annulus, dissection of the epithelial layer begins from the inferior tympanic membrane (TM), where the annulus is firmly attached to the temporal bone, thereby reducing the risk of inadvertently

elevating all layers of the TM. Subsequently, the fibrous annulus is removed from the bony sulcus using a curved blunt hook, lifting the fibro-squamous layer of the remaining TM along with the annulus and leaving the mucosal layer behind.⁵ Evaluation of the ossicular chain's continuity and mobility is conducted by palpating it with a smooth curved pick and eliciting the round window reflex. A temporalis fascia graft is then placed between the fibro-squamous and mucosal layers of the tympanic membrane, ensuring it rests on the mucosal layer and bony canal above the handle of the malleus.⁶ Gelfoam pledgets soaked in antibiotic ear drop solution are inserted into the middle ear cavity, followed by repositioning of the tympanomeatal flap at its original position. Finally, confirmation of the absence of any gap between the reconstructed tissue and the TM is ensured, and antibiotic-soaked gel foam is placed in the external auditory canal for added protection.

Follow-up evaluations were scheduled at 2 weeks and 3 months post-surgery, during which audiometric assessment using pure tone audiometry was conducted at the 3-month mark.

RESULTS

Out of the total 60 cases, 42 were female (70%) and 18 were male (30%), resulting in a male-to-female ratio of 1:2.3. The highest number of patients (35 cases, or 58.3%) fell within the age range of 31-45 years. Additionally, there were 20 patients (33.3%) between the ages of 18 and 30, while 5 patients (8.4%) were aged between 45 and 60 years [Table 1]. Among the cases examined, 13 (21.6%) exhibited bilateral involvement, while the right ear was affected in 19 cases (31.7%) and the left ear in 28 cases (46.7%) as illustrated in [Figure 1].

Among the 60 cases under investigation, graft acceptance was observed in 56 instances (93.33%), while graft rejection occurred in 4 cases (6.67%) as illustrated in [Figure 2].

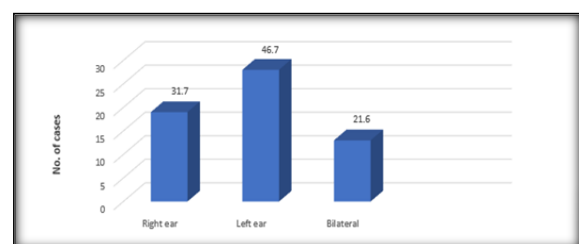


Figure 1: Side affected

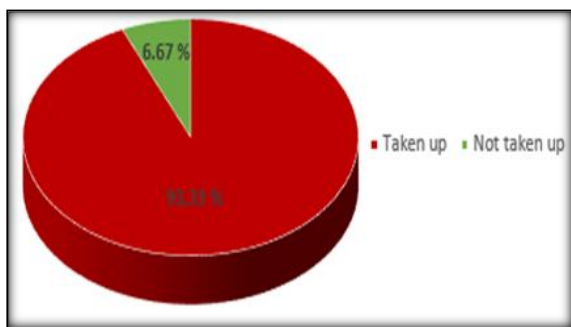


Figure 2: Graft Status

Within the confines of our investigation, it was discerned that the preoperative mean air-bone gap (ABG) stood at 29.82 ± 3.33 dB, whereas the mean postoperative ABG recorded 12.86 ± 5.34 dB. This disparity underscores a notable divergence in ABG levels pre- and post-surgery [Table 2].

The mean preoperative pure tone average was documented as 34.65 ± 5.46 dB, while the mean postoperative pure tone average at the 3-month interval was recorded as 17.64 ± 6.45 dB. Consequently, our study revealed a mean hearing gain of 16.85 ± 6.01 dB [Table 3].

Table 1: Age wise distribution of patients.

Age (in years)	No. of patients	Percentage (%)
18-30	20	33.3
31-45	35	58.3
45-60	5	8.4
Total	60	100

Table 2: Mean pre-operative A-B gap (dB) vs Mean post-operative A-B gap (dB)

Mean pre-operative A-B gap (dB)	Mean post-operative A-B gap (dB)
29.82 ± 3.33	12.86 ± 5.34

A-B = air-bone; dB = decibel

Table 3: Mean hearing gain (dB)

Mean pre-operative pure tone average (dB)	Mean post-operative pure tone average (dB)	Mean hearing gain (dB)
34.65 ± 5.46	17.64 ± 6.45	16.85 ± 6.01

dB = decibel

DISCUSSION



Figure 3: Pre-op endoscopic image of large central perforation of left tympanic membrane



Figure 4: Follow up image at 2 weeks post left interlay tympanoplasty

Chronic otitis media (COM) presents a significant health concern in India, with a considerable burden observed across all age groups. The prevalence of COM, particularly in its mucosal or tubotympanic type, is notably high in India. Given the chronic nature of the condition and its potential complications, including hearing loss and recurrent infections, a robust surgical approach is paramount for its management. A proficient surgical intervention not only addresses the structural abnormalities but also aims to restore hearing function and prevent further complications.



Figure 5: Follow up image at 3 months post interlay tympanoplasty

Multiple studies evaluated interlay tympanoplasty for chronic otitis media with varying success rates: Komune et al.^[7] (1992) reported 98.4% success,

Kawatra et al.^[8] (2014) found 93.3% success, Ashley Hay et al.^[9] (2014) observed 91% closure rate favouring anterior interlay, Patil et al.^[4] (2015) achieved 96% success in inactive tubotympanic CSOM, Gaurav Kumar et al.^[10] (2016) and Jain et al.^[3] (2017) reported 93.3% and 96.6% success in large central perforations and dry TT CSOM, respectively. Sanjay Kumar et al.^[11] (2018) noted 90% graft acceptance, while El Feky et al.^[6] (2019) achieved 90% closure rate in large central tympanic membrane perforations, and Sharma et al.^[2] (2019) found 96% and 90% graft uptake in interlay and underlay techniques, respectively. In our investigation comprising 60 cases, graft acceptance was observed in 56 instances [Figure 3-5], while in 4 cases, there was an indication of failure evidenced by the persistence of a residual perforation. The occurrence of graft uptake in 93.33% of cases closely aligns with the reported literature.

Noteworthy is the circumstance wherein all four instances of graft failure, constituting 6.67% of the total cases, were attributed to patients developing acute otitis media subsequent to an episode of upper respiratory tract infection.

In the present study involving 60 cases, meticulous examination of follow-up pure tone audiometry data at the 3-month mark facilitated the computation of hearing gain and the amelioration in the A-B gap vis-à-vis pre-operative measurements. Among the 60 cases, a remarkable 56 exhibited success in both the augmentation of pure tone average and the enhancement of the A-B gap. A scant minority of cases displayed negligible alteration between pre-operative and post-operative pure tone average and A-B gap parameters. Notably, the mean pre-operative pure tone average of 34.65 dB \pm 5.46 dB notably decreased to 17.64 dB \pm 6.45 dB post-operatively, delineating a noteworthy mean pure tone gain of 16.85 dB \pm 6.01 dB. Furthermore, the preoperative mean air-bone gap (ABG) of 29.82 dB \pm 3.33 dB was substantially reduced to 12.86 dB \pm 5.34 dB postoperatively, demonstrating a significant disparity in ABG levels pre- and post-surgery. Upon scrutinizing the mean values of pre- and post-operative pure tone average (dB) and A-B gap (dB), it was discerned that the pre-operative pure tone average (dB) registered a higher value with a substantial difference of 16.85 dB compared to the post-operative measurement, whereas the mean post-operative A-B gap dwindled to 12.86 dB \pm 5.34 dB, manifesting statistical significance with a p-value of <0.001. In Patil et al.'s^[4] (2015) study the preoperative mean ABG was 36.42 \pm 12.01 dB, decreasing significantly to 9.7 \pm 6.71 dB postoperatively (p<0.001). Gaurav Kumar et al.^[10] (2016) conducted interlay myringoplasty on 90 patients with large central perforations, observing a preoperative mean ABG of 27.50 \pm 5.53 dB, which decreased to 13.7 \pm 5.56 dB after 16 weeks. Jain et al.^[3] (2017) studied 500 cases of dry TT CSOM undergoing interlay type I tympanoplasty, finding a mean postoperative ABG

reduction to 10.12 \pm 5.84 dB, indicating improved hearing.

Four cases within our study exhibited residual perforation attributed to upper respiratory tract infections, resulting in acute otitis media and subsequently, no improvement in auditory function. Nonetheless, our study did not manifest any instances of complications associated with medialization, lateralization, granular myringitis, or epithelial pearls, in contrast to findings from investigations involving overlay and underlay techniques.

CONCLUSION

Interlay type I tympanoplasty emerges as a highly commendable technique, showcasing superiority not only in the percentage of graft acceptance but also in its efficacy in ameliorating air-bone gap and enhancing pure tone average gain, particularly in cases of inactive chronic otitis media of the mucosal type presenting with large central perforations. Moreover, the incidence of associated complications appears notably diminished in comparison to alternative techniques. Notably, postoperative infection stands out as the predominant factor contributing to graft failure. Hence, the adoption of interlay type I tympanoplasty should be considered with greater frequency, especially in patients presenting with large central perforations, surpassing the utilization of other conventional methods.

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