

Original Research Article

Outcome of underlay versus interlay tympanoplasty in patients with inactive mucosal chronic otitis media with large central perforation: a retrospective comparative study

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Received: 28 November 2020

Revised: 12 December 2020

Accepted: 14 December 2020

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ABSTRACT

Background: Aim and objective were to study the outcome of underlay versus interlay tympanoplasty in patients with inactive mucosal chronic otitis media with large central perforations in terms of graft uptake rate and hearing improvement.

Methods: The present study was conducted retrospectively on 110 patients of inactive mucosal chronic otitis media with large central perforation, 55 patients selected from each group undergoing underlay or interlay technique in a tertiary referral hospital, Department of ENT, ESIC Kalaburagi, Karnataka, from February 1 2018 to January 31, 2020.

Results: Total 110 patients were included in the study. Male:female ratio was 1:2.2. The age group in this study ranged from 13-50 years of age. Preoperative mean air bone gap in groups A and B was 30.28 ± 6.62 , and 30.18 ± 6.87 dB and postoperative mean air bone gap was 19.44 ± 7.66 and 15.13 ± 6.3 dB. In both the groups a significant mean reduction in air bone gap was observed. Mean reduction was maximum in group B. Statistically, intergroup difference in reduction in air bone gap was highly significant ($p < 0.001$). Graft success rate being 89.09% and 94.54% in underlay (group A) and interlay (group B) respectively.

Conclusions: Interlay is a better technique than underlay in chronic otitis media inactive mucosal disease with large central perforation in terms of hearing improvement and graft uptake.

Keywords: Tympanoplasty, Underlay, Interlay, COM

INTRODUCTION

Berthold introduced myringoplasty, which is a procedure to repair or reconstruct the perforated tympanic membrane.^{1,2} Wullstein et al classified tympanoplasty into 5 types, in which type 1 tympanoplasty is also known as myringoplasty where preoperatively middle ear structures are exposed and are checked for functional integrity.³

The indications of myringoplasty (type 1 tympanoplasty) include all the causes for a perforated tympanic membrane which includes infections that is acute otitis media, if the perforation does not heal spontaneously, chronic otitis media, Trauma either acoustic trauma or physical injury, burns, barotrauma or head injuries. The most common cause of iatrogenic trauma is insertion of the ventilatory tube. Most of these perforations such as those caused by trauma and acute suppurative otitis media heal spontaneously.⁴ But persistence of these long-standing perforations with epithelized margin leads to

recurrent ear discharge becoming an indication of tympanoplasty.

Although, different types of grafting materials have been used to reconstruct the tympanic membrane, including skin, fascia, vein, perichondrium, dura mater, and cartilage. Temporalis fascia is the most frequently used grafting material, and most series have reported approximately 90% graft take.^{5,6} Temporalis fascia has advantages which includes its physiological similarity with tympanic membrane, easily available from the same incision as that for cortical mastoidectomy and from the same operative field, it survives longer and resistant to infections.⁷

Historically, many techniques of myringoplasty are described in the literature. A few of the numerous techniques include Underlay, overlay, inlay, interlay, gelfilm sandwich, swinging door, triple, double breasting, anterosuperior anchoring and laser assisted spot welding, fascial pegging technique.⁸⁻¹⁸ Each technique is developed over a period of time as an improvised version of the other. Hence deciding about the technique to be employed depends on the surgeon's preference and the site of perforation. Thereby making it difficult to claim the relative superiority of a single technique. However, "underlay" and the "overlay" techniques are the most commonly employed technique for positioning the graft with respect to the tympanic annulus.¹⁹

The underlay technique is widely used and is relatively simple to perform as the graft is placed entirely medial to the remaining drum (or annulus) and manubrium of malleus. This technique is ideal to repair small and easily visualized perforations, blunting and lateralization of the graft are avoided, the drum heals at the correct level relative to the annulus and the ossicles and it is quick and easy to perform. On the other hand, its disadvantages are that the middle ear space is reduced and adhesions may occur leading to medialization or atelectasis, there is increased failure because of a limited bed size for the graft supplying poor vascularity, exposure of the middle ear is relatively limited and it is not the ideal technique for perforations extending into the anterior annulus since placement of the graft is difficult.²⁰

Interlay technique is described as the graft being placed between inner mucosal layer and middle fibrous layer of tympanic membrane. The technique is also considered to be better in terms of access, as getting an interlay plane (between the fibrous layer and mucosa) is easier and faster.

Moreover, it has no fear of residual epithelium. The other studies where the Interlay myringoplasty approach has shown promising results with success rates higher than 90% are (Komune et al; Guo et al; Vishal; Hay and Blanshard).^{2,11,21,22}

METHODS

Study design and setting

A retrospective study was conducted on 110 patients in the age group of 13-50 years, with inactive chronic otitis media with large central perforations who underwent type 1 tympanoplasty in the Department of Otorhinolaryngology, ESIC Medical college and Hospital, Kalaburagi, Karnataka. The study was conducted after getting ethical clearance from the Ethical committee. Informed consent was taken from every patient before the surgical procedure, explaining its outcome and complications.

Study period

This was a retrospectively conducted study from February 1 2018 to January 31, 2020.

Sample size

During the study period mentioned above, 55 patients in each group were retrospectively selected who underwent tympanoplasty by underlay (group A) or interlay (group B) technique.

Statistical analysis

Results were calculated in terms of graft take up rate and hearing improvement. And tabulated using Microsoft excel version 2016. The statistical software used was SPSS 20 to analyse the data. Mean (ANOVA test), standard deviation and t test were applied. P<0.05 was considered significant.

Inclusion criteria

Inclusion criteria were patients with inactive mucosal chronic otitis media with dry large central perforation for atleast 6 weeks, patients willing to give written informed consent for the procedure of tympanoplasty type 1 and patients willing for follow up visits and hearing evaluation

Exclusion criteria

Exclusion criteria were patients with active squamosal type of chronic suppurative otitis media with cholesteatoma, ossicular erosion or discontinuity, tympanosclerosis, patients with mixed hearing loss with sensorineural component, active infective source in ear, nose, throat or paranasal sinuses

Patients meeting the inclusion criteria were thoroughly accessed with history and clinical examination of ear, nose and throat. Any active foci of infection ruled out from nose, paranasal sinuses, and throat. Further examination of ear was done under microscope, tuning fork tests, radiological test (X-ray bilateral mastoid,

schullers view), routine laboratory investigation as a part of pre anesthetic evaluation, and pure tone audiometry were also performed.

This study was conducted on 110 patients and two groups i.e. group A and group B, of 55 patients each. Patients in group A underwent “underlay” tympanoplasty and group B underwent “interlay” tympanoplasty, under general anesthesia through a post auricular Sir William Wildes incision, temporalis fascia graft was harvested through the same incision, graft was placed medial to the annulus in the underlay technique, whereas it was placed between the fibrous and mucosal layer in the interlay technique. Abgel was cut in small pieces and placed in the middle ear, Eustachian tube and external auditory canal for 2 weeks. Mastoid dressing was done. Postauricular suture removed in a week. Postoperatively oral antibiotics, antihistamine, analgesic was started. Patients were advised to avoid coughing, straining, and forceful nose blowing.

At each visit otomicroscopy was done to check for graft uptake and complications if any and tuning fork tests were performed to assess the hearing. At the end of 3rd month pure tone audiometry was repeated. Pre-operative and Post-operative audiograms were compared of each technique to estimate the decrease in the AB gap at 0.5, 1 and 2 kHz frequencies.

RESULTS

A total of 110 patients who underwent myringoplasty by either underlay or interlay were included in the study consisting of 55 each in each group, i.e group A and

group B from February 1st 2018 to January 31st 2020. Total number of males were 34 (30.9%) and females were 76 (69.09 %). The male to female ratio was 1:2.2 with a significant female preponderance. Group A had 15 males (44.11%) and 40 females (52.63%), whereas Group B had 19 males (55.88%) and 36 females. (47.36%) (Figure 1).

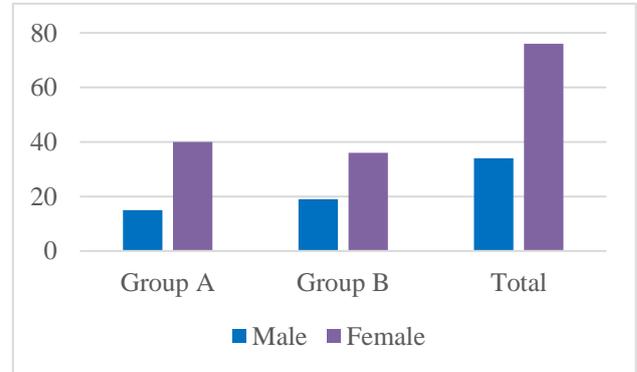


Figure 1: Distribution of male and females in both the groups.

Age group ranged from 13-50 years of age. The mean age was 26.94±8.87 and maximum number of patients being in the age group of 21–30 years

Air bone gap ranged from 15 to 40 dB in two groups. In both the groups a significant mean reduction in air bone gap was observed. Mean reduction was maximum in group B than group A. Statistically, intergroup difference in post-operative reduction in air bone gap was significant (p<0.001).

Table 1: Comparison of pre op and post op AB gap in group A and group B.

	Preop		Postop		Change	Significance of change
	Mean	SD	Mean	SD	Mean	P value
Group A (underlay)	30.28	6.62	19.44	7.66	-10.84	<0.0001
Group B (interlay)	30.18	6.87	15.13	6.3	-15.05	<0.0001
P value	>0.05		<0.01			

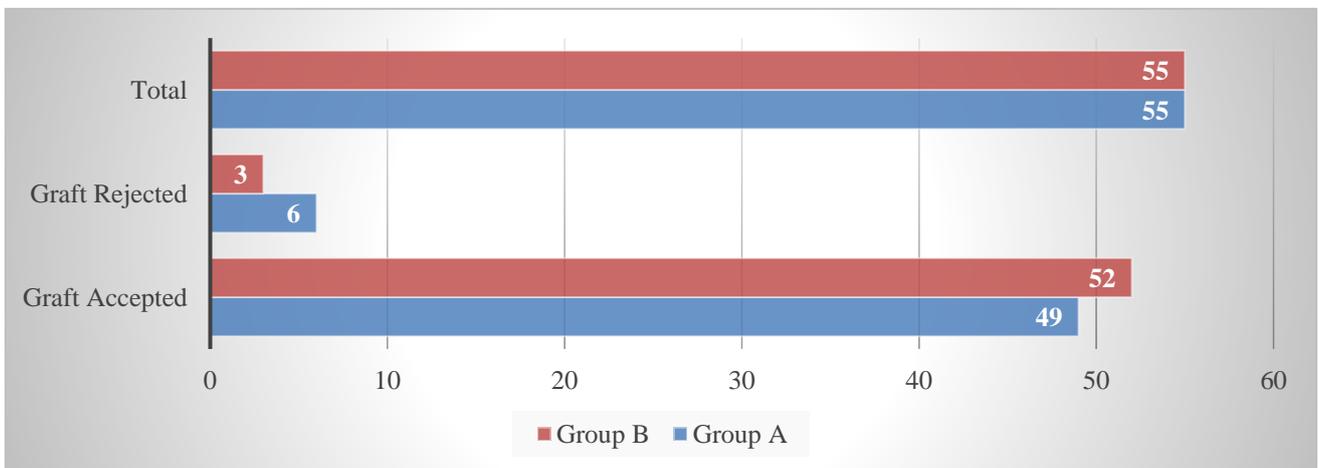


Figure 2: Graft uptake in both the groups.

Mean hearing gain (closure in air-bone gap)

Preoperative mean air bone gap in groups A and B was 30.28±6.62, and 30.18±6.87 dB and postoperative mean air bone gap was 19.44±7.66 and 15.13±6.3 dB.

In both the groups a significant mean reduction in air bone gap was observed. Mean reduction was maximum in group B. Statistically, intergroup difference in reduction in air bone gap was highly significant ($p < 0.001$) (Table 1).

Graft status (accepted or rejected)

In the present study Graft failure was observed in 9 cases in total 110 patients (8.1%) resulting in a residual perforation, with overall Success rate being 91.8 %. In group A, 6 out of 55 (10.9%) and in group B 3 out of 55 (5.4%) patients had graft failure with success rate being 89.09% and 94.54% in underlay (group A) and Interlay (group B) respectively (Figure 2).

DISCUSSION

Chronic otitis media is one of the most curable cause of deafness, particularly in developing countries like India (which according to WHO reports is among the nations with the highest burden), needs tympanoplasty for its correction.²⁴

It is the sequelae of acute otitis media and presents with ear discharge for more than 12 weeks duration through a permanent tympanic membrane perforation and hearing loss. It is divided into safe/mucosal/tubotympanic type and unsafe/squamosal/atticoantral type. Tubotympanic type of chronic otitis media is management with tympanoplasty and cortical mastoidectomy.

Tympanoplasty type 1 or myringoplasty is the surgical repair of the perforated tympanic membrane. The main objective of myringoplasty has traditionally been the closure of the tympanic membrane perforation to prevent chronic infections and to make the ear safe. Consequently, the second objective is to improve the hearing loss which resulted due to perforation of the tympanic membrane. There is still no consensus about the optimal technique, which is often employed on the basis of the surgeon's preference and skills, and not on the type of the tympanic membrane perforation.²⁰

Tympanoplasty can be performed using various different approaches i.e overlay, underlay or interlay depending upon the placement of the graft with respect to the annulus. Out of these the Underlay technique is widely used. Interlay has emerged as a new technique recently and has given good results in terms of graft uptake and post-operative hearing gain.

Here, 55 patients of each group were included in the study into group A (underlay technique) and group B

(overlay). Outcome of the results in terms of mean hearing gain in terms of closure in AB gap in group A and Group B preoperatively was 30.28 dB and 30.18 dB respectively and postoperatively 19.44db and 15.13 dB respectively. Postoperative reduction in the AB gap was statistically significant in both the groups with $P < 0.01$, however mean reduction in AB gap was maximum in group B.

The overall Graft success rate was 91.8%, where group A (underlay technique) has 89.09% success rate and group B (interlay technique) has 94.54%. Failure of graft uptake was seen in 10.9% and 5.4% in group A and group B respectively.

No complication was noticed in any of the two procedures.

Other studies were, Kawatra et al concluded Interlay technique has a significantly better graft uptake and hearing improvement as compared to underlay technique.²⁵ Jain et al had graft uptake rate to be 96.6% in interlay technique and 95.4% of the patients, reported an improvement in terms of hearing.²⁶ Komune et al reported a 94.2% graft uptake rate.²⁷

In the study by Patil et al complications took place in 6 (6%) patients. Out of 6 cases, 4 (4%) had a residual perforation and 2 (2%) cases developed a partial flap necrosis.²⁸

Limitations

Retrospective data of the post-operative period was available only up to 3 months and hence patient could not be followed later to comment on residual perforation or long-term benefits of one particular technique.

CONCLUSION

In our study it showed that both underlay and interlay technique of tympanoplasty had better outcome in terms of hearing gain, however postoperative reduction in the AB gap was maximum in interlay when compared to under technique. Whereas graft uptake was better in interlay tympanoplasty. These results show that interlay is a better technique than underlay in chronic otitis media inactive mucosal disease with large central perforation.

ACKNOWLEDGEMENTS

Author would like to thank all the senior colleague for their guidance and support and junior colleagues for helping complete this article.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Rajneesh, Valse D, Pawar S, Doddamani AK. Outcome of underlay versus interlay tympanoplasty in patients with inactive mucosal chronic otitis media with large central perforation: a retrospective comparative study. *Int J Otorhinolaryngol Head Neck Surg* 2021;7:121-5.