

Original Research Article

Comparitive study between button-hole tympanoplasty and tympanoplasty with placement of graft lateral to handle of malleus with or without cortical mastoidectomy in mucosal type of chronic otitis media

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ABSTRACT

Background: Various techniques of underlay graft placement have been described in literature. In this study we compare two simple underlay techniques of temporalis fascia graft placement that is Buttonhole tympanoplasty and tympanoplasty with placement of graft lateral to handle of malleus in mucosal type of chronic otitis media patients undergoing tympanoplasty to find out which among the two is a better technique based on the audiological improvement post-operatively.

Methods: This is a case series study which included 30 patients undergoing type-1 tympanoplasty. Group A with 15 patients underwent Buttonhole tympanoplasty and Group B with 15 patients underwent tympanoplasty with placement of graft lateral to handle of malleus.

Results: Post-operative hearing improvement was assessed after duration of three months. In Group A, 13 (87%) patients showed hearing within normal limits and 2 (13%) patients showed mild conductive hearing loss. In Group B, 9 (60%) patients showed hearing within normal limits and 6 (40%) of patients showed mild conductive hearing loss. Both the techniques were statistically significant.

Conclusions: Both the techniques mentioned are simple and effective procedures. Buttonhole tympanoplasty was considered as superior technique among the two as the handle of malleus provides better anchoring for the temporalis fascia graft, intra-operative manoeuvring of the graft is easier without causing displacement of the graft, there is no reduction in the middle ear space and post-operative hearing improvement is excellent. When the handle of malleus is eroded surgeon can perform tympanoplasty with placement of graft lateral to handle of malleus.

Keywords: Buttonhole tympanoplasty, Placement of graft lateral to handle of malleus, Pure tone audiometry, Chronic otitis media, Underlay technique

INTRODUCTION

Chronic otitis media is of mucosal type is one of the most common causes for the tympanic membrane perforation in the pars tensa. Mucosal type of chronic otitis media can be active mucosal type with permanent defect in the pars tensa with inflamed middle ear mucosa or inactive

mucosal type with permanent defect in the pars tensa but the middle ear mucosa is not inflamed.¹ Various techniques have been developed for the correction of this perforation. Autologous Temporalis fascia graft is one of the common graft materials that used to cover the perforation. The graft that is placed becomes the middle or connective tissue portion of the reconstructed drum,

but the orderly arrangement of concentric and radial collagen fibres as seen in the normal drum is not reconstituted in the graft.² The graft is placed either by underlay (medial) or overlay (lateral) technique with respect to the annulus of tympanic membrane.

Many of the authors have used a modified type of underlay technique which is performed by elevating the tympanic membrane from the handle of malleus and placing the graft lateral to the malleus but medial to the tympanic membrane remnant and the annulus. This technique provides excellent exposure for large perforations of the pars tensa. Another advantage is that the malleus handle acts as an additional point of graft fixation and lowers the risk of graft retraction.^{3,4} In the buttonhole tympanoplasty technique, the temporalis fascia is anchored to the handle of the malleus through the buttonhole that is created on the fascia, it prevents inadvertent movements and displacement of the graft while manoeuvring intra-operatively and anterior retraction of graft post-operatively.⁴ In this study we compare two simple underlay techniques of temporalis fascia graft placement that is Buttonhole tympanoplasty and tympanoplasty with placement of graft lateral to handle of malleus in mucosal type of chronic otitis media patients undergoing tympanoplasty to find out which among the two is a better technique based on the audiological improvement post-operatively.

METHODS

This is a case series study covering a period of eighteen months from December 2017 to May 2019 carried out in the department of otorhinolaryngology at Vijayanagar institute of medical sciences, Ballari. Thirty patients with mucosal type of chronic otitis media were included in this study. These patients were randomly divided into two groups, Group A and Group B; both the groups had 15 patients each. Group A patients underwent Buttonhole tympanoplasty and Group B patients underwent Tympanoplasty with placement of graft lateral to handle of malleus. The study procedure was approved by the institutional ethics committee.

Inclusion criteria

Patients with mucosal type of chronic otitis media. Patients undergoing type-1 tympanoplasty (Wullstein Zollner's classification). Patients giving consent for the procedure.

Exclusion criteria

Patients with squamosal type of chronic otitis media. Patients undergoing any other types of tympanoplasty (like type 2, 3, 4, 5 and 6). Patients with sensorineural hearing loss. Patients with medical co-morbidities.

Surgical procedure

Buttonhole tympanoplasty⁵

Similar to any tympanoplasty surgery. After canal infiltration of local anaesthetic (lignocaine and adrenaline) preparation, Korner's flap is elevated. Using post auricular approach temporalis fascia graft is harvested and depending on the disease status, combined with/ without mastoidectomy. Margins of the perforation are freshened and tympanomeatal flap is elevated. Skeletonisation of malleus is done. Dehydrated temporalis fascia graft is taken and using straight/curved pick, a buttonhole 2-3 mm in diameter is made in the graft (Figure 1). In cases where the tip of malleus is in contact with the promontory, a malleus nibbler is used to remove that portion of the tip of malleus handle. The graft is then placed in situ with the help of controlled suction and curved pick and meticulously inserted into the handle of the malleus and spread out. Dry gel foam is placed in the middle ear by slightly lifting up the tympanomeatal flap. Tympanomeatal flap and Korner's flap replaced. Finally, small pieces of dry followed wet gel foam are laid over the reconstructed tympanic membrane.



Figure 1: Button-hole being made on the temporalis fascia graft.

Tympanoplasty with placement of graft lateral to handle of malleus⁶

After canal infiltration of local anaesthetic (lignocaine and adrenaline) preparation the tympanomeatal flap is then elevated from 7 to 1 o'clock position and the annulus is carefully lifted from its sulcus. The mesotympanum is then entered, and the tympanomeatal flap is elevated inferior and superiorly. The posterior malleolar ligament and fold are detached from the posterior spine. After detaching the lateral malleolar fold and elevating the pars flaccida, the neck and lateral process of the malleus are exposed. At this point, it is essential to ensure that the superior canal skin is broadly elevated forward. Next, using a sickle knife, the cartilage

cap of the lateral process is removed, thereby creating a reliable subperiosteal plane between the tympanic membrane and anterior face of the malleus. The tympanic membrane is elevated from the malleus until only a small ligament at the tip of the malleus remains. This final attachment is best divided with a micro scissor or Iris scissors. After addressing middle ear pathology, small pieces of gel foam are placed in the middle ear. A dried fascia graft is placed lateral to the malleus using an underlay technique. The remnant native drum is then draped over the fascia graft and inspected to ensure that all tympanic membrane epithelium is unfurled and there are no gaps. Finally, small pieces of dry gel foam followed by wet gel foam are laid over the reconstructed tympanic membrane.

Antibiotic ointment soaked aural wick was placed in the external auditory canal. Post aural wound was sutured in layers and mastoid dressing was applied. Following the surgery patients were shifted towards. Intravenous antibiotics were given for two days (that day 0 and day 01 post-operative day). On post-operative day 02 mastoid dressing was removed, square plaster was applied. Patients were discharged on post-operative day-02 with oral antibiotics for duration of one week and oral antihistaminics for duration of 15 days. Aural wick was removed after duration of 3 weeks post-operative period. Following aural wick removal patients were prescribed with topical ear drops for duration of two weeks. Patients were followed up weekly for one-month duration, then once in two weeks till 3 months duration post-operatively. Pure tone audiometry was done after duration of 3 months post-operatively.

Statistical analysis

Data was collected by using a structure proforma. Data was entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. Qualitative data was expressed in terms of percentages and proportions, quantitative data was expressed in terms of mean and standard deviation and descriptive statistics of each variable was presented in terms of mean, standard deviation, standard error of mean.

RESULTS

This study included 30 patients with chronic otitis media, active or inactive mucosal type. Group A had 9 females and 6 males, Group B patients had 7 males and 8 females. Age of the study population ranged from 11 to 50 years. In both Group A and Group B, majority of the patients were in 21 to 30 years age group. Majority of the patients had left ear chronic otitis media in both Group A and Group B. Laterality of the disease is showed in (Table 1).

All the 30 patients had tympanic membrane perforation involving the pars tensa. Group A had 6 (40%) patients with small central perforation, 5 (33%) with large central perforation and 4 (27%) patients with sub-total perforation. Group B had 5 (33%) patients with small

central perforation, 5 (33%) with large central perforation and 5 (33%) patients with sub-total perforation. Type of perforation in each group is shown in (Table 2).

Table 1: Laterality of the disease.

| Laterality | Group A N (%) | Group B N (%) | Total N (%) |
|------------------|------------------|------------------|----------------|
| Right | 4 (27) | 2 (13) | 6 (20) |
| Left | 6 (40) | 9 (60) | 15 (50) |
| Bilateral | 5 (33) | 4 (17) | 9 (30) |
| Total | 15 | 15 | 30 |

Table 2: Type of perforation.

| Type of perforation | Group A N (%) | Group B N (%) | Total N (%) |
|----------------------------------|------------------|------------------|----------------|
| Small central perforation | 6 (40) | 5 (33) | 11 (37) |
| Large central perforation | 5 (33) | 5 (33) | 10 (33) |
| Subtotal perforation | 4 (27) | 5 (33) | 9 (30) |
| Total | 15 | 15 | 30 |

In patients with bilateral chronic otitis media, the ear with maximum hearing loss on the pure tone audiometry investigation was selected for the surgery. In Group A majority of the patients underwent right ear surgery that is 8 (53%) patients and in Group B majority of the patients underwent left ear surgery that is 11 (73%). Operated side in each group is shown in (Table 3).

Table 3: Operated side in each group.

| Operated side | Group A N (%) | Group B N (%) | Total N (%) |
|---------------|------------------|------------------|----------------|
| Right | 8 (53) | 4 (27) | 12 (40) |
| Left | 7 (47) | 11 (73) | 18 (60) |
| Total | 15 | 15 | 30 |

Need for mastoidectomy was decided based on whether the disease was active or inactive. All the patients with active mucosal type of chronic otitis media underwent mastoidectomy and patients with inactive mucosal type of chronic otitis media underwent only myringoplasty. In Group A, 12 (80%) patients underwent mastoidectomy and in group B 7 (47%) underwent mastoidectomy. This has been represented in (Table 4).

The hearing loss in patients in this study was assessed by using pure tone audiometry and was classified by using WHO classification of hearing loss as normal (≤ 25 dB), mild (26-40 dB), moderate (41-60 dB), severe (61-80 dB) and profound (> 80 dB).⁷ In the pre-operative pure tone audiometry of the Group A patients, 7 (47%) had moderate conductive hearing loss and 8 (53%) had severe conductive hearing loss.

Table 4: Tympanoplasty with and without mastoidectomy in the 2 groups.

| Mastoidectomy | Group A N (%) | Group B N (%) | Total N (%) |
|------------------------------|------------------|------------------|----------------|
| With mastoidectomy | 12 (80) | 7 (47) | 19 (63) |
| Without mastoidectomy | 3 (20) | 8 (53) | 11 (37) |
| Total | 15 (100) | 15 (100) | 30 (100) |

Table 5: Group A, pre-operative and post-operative PTA.

| Type of hearing loss | Group A pre-operative PTA (%) | Group A post-operative PTA (%) |
|-----------------------------|-------------------------------|--------------------------------|
| Normal (≤25 dB) | 0 | 13 (87) |
| Mild (26-40 dB) | 8 (53) | 2 (13) |
| Moderate (41-60 dB) | 7 (47) | 0 |
| Severe (61-80 dB) | 0 | 0 |
| Profound (>80 dB) | 0 | 0 |
| Total | 15 (100) | 15 (100) |

p value is 0.001.

In pure tone audiometry of the Group B patients, 1 (7%) patient showed hearing within normal limits, 7 (47%) patients showed mild conductive hearing loss and 7 (47%) patients showed moderate conductive hearing loss. Post-operative hearing improvement was assessed after duration of three months post-operative period, 9 (60%) patients showed hearing within normal limits and 6 (40%) of patients showed mild conductive hearing loss. It is represented in the (Table 6). The p value of Group B that is tympanoplasty with placement of graft lateral to handle of malleus is 0.02 and it is statistically significant.

Table 6: Group B, pre-operative and post-operative PTA.

| Type of hearing loss | Group B pre-operative PTA (%) | Group B post-operative PTA (%) |
|-----------------------------|-------------------------------|--------------------------------|
| Normal (≤25d B) | 1 (7) | 9 (60) |
| Mild (26-40 dB) | 7 (47) | 6 (40) |
| Moderate (41-60 dB) | 7 (47) | 0 |
| Severe (61-80 dB) | 0 | 0 |
| Profound (>80 dB) | 0 | 0 |
| Total | 15 (100) | 15 (100) |

p value is 0.02.

Post-operative hearing improvement was assessed after a duration of three months post-operative period, 13 (87%) patients showed hearing within normal limits and 2 (13%) patients showed mild conductive hearing loss. It is represented in the (Table 5). The p value of Group A, that is Buttonhole tympanoplasty is 0.001, and it is statistically significant.

DISCUSSION

Tympanoplasty is one of the common procedures performed by an otorhinolaryngologist. Over the years there have been many techniques developed for the placement graft to repair the perforated tympanic membrane. In our study we compare two simple underlay techniques of temporalis fascia graft placement that is Buttonhole tympanoplasty and tympanoplasty with placement of graft lateral to handle of malleus in mucosal type of chronic otitis media patients undergoing tympanoplasty to find out which among the two is a better technique based on the post-operative audiological improvement.

In our study, 30 patients were divided into two groups randomly. Group A had 15 patients who underwent Buttonhole tympanoplasty, among them most of the patients had left ear chronic otitis media that is 4 patients. Group B also had 15 patients who underwent tympanoplasty with placement of graft lateral to handle of malleus and most of patients had left ear chronic otitis media that is 9 patients. In Group A 5 patients had bilateral ear disease and in Group B 4 patients had bilateral disease. In Group A about 6 patients had small central perforation and Group B about 5 patients had small central perforation. Large central perforation was observed in 5 patients of Group A and 5 patients of Group B. Sub-total perforation was observed in about 4 patients of Group A and 5 patients of Group B. The side to undergo surgery in case of bilateral ear disease was decided based on ear which had higher hearing loss in pure tone audiometry. Majority of the Group A patients underwent Right ear surgery that is 8 patients and majority of the Group B patients underwent Left ear surgery that is 11 patients. The need for mastoidectomy was decided based on whether the ear disease active or inactive. If the ear was dry for duration of six months or beyond, Mastoidectomy was not done. In our study 12 patients in Group A and 7 patients in Group B underwent type-1 tympanoplasty with Mastoidectomy respectively, 3 patients in Group A and 8 patients in Group B underwent type-1 tympanoplasty without mastoidectomy.

The hearing loss in patients was classified based on WHO classification of hearing loss. Post-operatively pure tone audiometry was done three months after the surgery. Sharankumar in their study, where they have assessed pre-operative and post-operative of hearing following tympanoplasty, have done pure tone audiometry at 3 months and 6 months post-operatively.⁸ Based on the this study maximum hearing improvement occurs in the first

3 months post-operative period that is why we have assessed post-operative audiological improvement 3 months post-operatively. In Group A preoperatively 8 patients have mild conductive hearing loss and 7 patients had moderate conductive hearing loss. Postoperatively all the patients showed improvement in the hearing, about 13 patients showed hearing within normal limits and 2 patients showed mild conductive hearing loss. The p value was 0.001 which is statistically significant. A study done by Shankar et al, is a novel study to describe the procedure of Buttonhole tympanoplasty, in their study they found significant hearing improvement among 44 of the total 46 study population, 2 patients had re-perforation and graft failure secondary to neglected upper respiratory tract infection in second post-op month.⁵ In our study none of the patients had graft failure or re-perforation. According to the study done by Shankar et al, the advantage of Buttonhole tympanoplasty is that; on placing the graft and anchoring it to the handle of the malleus, all around movement of the graft is possible, the graft does not get retracted onto the promontory as it is held in position, it aids in the creation of neotympanum, It prevents displacement of the graft while manoeuvring intra-operatively, it is easy to learn and follow and post-operative also graft lateralization and subsequent hearing loss is prevented.⁵

In Group B, among the 15 patients pre-operatively 1 patient had hearing within normal limits, 7 patients had mild conductive hearing loss and 7 patients had moderate conductive hearing loss. Post-operatively 9 patients had hearing within normal limits and 6 patients had mild conductive hearing loss. The p value is 0.02 which is not statistically significant. In a study done by Yawn et al, they have found improvement in 140 patients among the 141 patients and 121 remained without significant retraction or re-perforation.⁶ In our study the improvement in the post-operative hearing in Group B patients is good and it was statistically significant.

Both the techniques mentioned are simple procedures that can be easily mastered even by the beginners. These procedures reduce the time duration of the surgery and post-operative improvement in the hearing is good. But we consider Buttonhole tympanoplasty as a superior technique among the two as the handle of malleus provides better anchoring for the temporalis fascia graft, intra-operative manoeuvring of the graft is easier without causing displacement of the graft, there is no reduction in the middle ear space and post-operative hearing improvement is excellent. Few drawbacks of the procedure is that the temporalis fascia graft needs to be dry for passing the buttonhole through the handle of malleus, once the graft becomes wet graft it becomes difficult to find the buttonhole created; another drawback is that this technique cannot be used when the handle of malleus is eroded; during these scenarios surgeon can perform tympanoplasty with placement of graft lateral to

handle of malleus. Further studies with a bigger sample size and longer follow up period are encouraged.

CONCLUSION

In our study two simple underlay techniques of placing the temporalis fascia graft is compared. We have found that Buttonhole tympanoplasty is a superior technique compared tympanoplasty with placement of graft lateral to handle of malleus as it provides better anchoring for the temporalis fascia graft, intra-operative manoeuvring of the graft is easier without causing displacement of the graft, there is no reduction in the middle ear space and post-operative hearing improvement is excellent but when the handle of malleus is eroded surgeon can perform tympanoplasty with placement of graft lateral to handle of malleus.

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REFERENCES

1. Browning GG. Aetiopathology of inflammatory of inflammatory condition of the external and middle ear. In: Kerr AG, editor. *Scott-Browns Otolaryngology*. 6th ed. London: Arnold; 1997: 3396-3397.
2. Schuknecht HF. *Pathology of the ear*. 2nd ed. Philadelphia: Lea and Febiger; 1993: 191-253.
3. Rizer FM. Overlay versus underlay tympanoplasty. Part II: the study. *Laryngoscope*. 1997;107:26-36.
4. Stage J, Pedersen BK. Underlay tympanoplasty with the graft lateral to the malleus handle. *Clin Otolaryngol Allied Sci*. 1992;17:6-9.
5. Shankar G, Narendranath A. Button Hole Tympanoplasty. *Res Otolaryngol*. 2014;3(5):81-83.
6. Yawn RJ, Carlson ML, Haynes DS, Rivas A. Lateral-to-Malleus Underlay Tympanoplasty. *Otol Neurotol*. 2014;35(10):1809-12.
7. World Health Organization. *World Health Organization International Classification of Impairments, Disabilities Handicap*. WHO: Geneva; 1980.
8. Shetty S. Pre-Operative and Post-Operative Assessment of Hearing following Tympanoplasty. *Indian J Otolaryngol Head Neck*. 2011;64(4):377-81.

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