

Original Research Article

Comparative study of temporalis fascia graft versus cartilage shield tympanoplasty

Gaurav Chhabra*, Amresh K. Saxena, Sanjay Kumar

Department of ENT and HNS, Subharti Medical College, Meerut, Uttar Pradesh, India

Received: 18 April 2018

Revised: 03 May 2018

Accepted: 04 May 2018

***Correspondence:**

Dr. Gaurav Chhabra,

E-mail: chhabra7585@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The objective of the study was to demonstrate the comparative study in terms of graft uptake rate & hearing gain between cartilage shield tympanoplasty and temporalis fascia tympanoplasty in patients with moderate/large/subtotal perforation.

Methods: Cartilage shield tympanoplasty and temporalis fascia tympanoplasty were conducted in Group A and Group B, respectively, each containing 30 patients with moderate/large/subtotal perforations. Pure tone audiogram (PTA) was performed preoperatively and at postoperative visit i.e. at 12th month, a greater than 10-dB closure of air bone gap (ABG) was considered significant.

Results: The graft uptake rates were 93.33% and 86.67% in Group A and Group B, respectively, at the end of 10th week. In total, 90% in Group A and 88% in Group B had significant improvement in hearing (ABG \geq 10 dB) at 12th week of surgery.

Conclusions: Conchal cartilage is a possible graft material for cartilage shield tympanoplasty, especially in moderate, large & subtotal perforation, as it is showed superior autograft as compared to temporalis fascia, not only because of better graft uptake rate and less partial failure but also due to the comparable hearing improvement in terms of mean AB gap in both types of graft materials.

Keywords: Cartilage, Temporalis fascia, Tympanoplasty

INTRODUCTION

Chronic otitis media (COM) refers to a chronic infection of the mucosa lining the middle ear cleft, which includes the middle ear, attic, aditus, antrum, mastoid air cells and Eustachian tube.¹

COM has been broadly classified into two types:

Tubotympanic disease (safe or mucosal) and Atticoantral disease (unsafe or squamosal). COM (mucosal) is the most common infective condition of ear. Tympanoplasty has been well established since decades as surgery of choice for COM. The promotion of tympanoplasty by

Wullstein and Zollner in 1953 started new era in history of otology in tympanic membrane reconstruction.^{2,3} Primary goal of treatment for COM (mucosal) is elimination of the chronic inflammatory process. The secondary goal is reconstruction of sound conducting mechanism.⁴ Tympanoplasty forms the mainstay of treatment for COM of mucosal/tubotympanic disease. To reconstruct the tympanic membrane, several graft materials are used, initially graft material were epidermal in origin, and later various mesodermal tissue, like vein graft, temporal fascia, cartilage, tensor fascia lata, perichondrium, and periosteum were used.⁵⁻⁷ Temporal fascia is the most widely used graft because it can be harvested from a local operative site. Temporalis fascia has additional advantages over the other grafts owing to

its light, mouldable structure which mimics tympanic membrane. Success rate with temporal fascia in a well aerated middle ear ranges up to 90% in different studies. Nonetheless, success rate decreases markedly in cases with Eustachian tube dysfunction or presence of an adhesive process. Both clinical and experimental studies have now demonstrated that cartilage can be used successfully for tympanic membrane reconstruction. Given the difference between the texture of fascia and cartilage, one could anticipate some problems with both. As we know, temporal muscle fascia is composed of irregularly arranged elastic fibres and fibrous connective tissue. The postoperative dimensions of temporal fascia are therefore unpredictable. Cartilage, on the other hand, has a constant shape, is firmer than fascia and does not contain fibrous tissue so that postoperative dimension are predictable.⁷ Therefore cartilage shield graft is preferred in cases with large perforations, revision surgery, tympanosclerosis, tympanic membrane atelectasis, and Eustachian tube dysfunctions. Being a thick and rigid structure, cartilage can affect the pliability of the tympanic membrane and result in inferior hearing outcome as compared to temporalis fascia graft which is thinner and more pliable.

To overcome the problem of sinking and shrinking of temporalis fascia graft in large and subtotal perforation, in which cartilage with perichondrium was used to repair the tympanic membrane. The greatest advantage of the cartilage graft has been thought to be its very low metabolic rate and it can resist deformation from pressure variation.

Nevertheless there may be some concern regarding poor hearing using cartilage shield rather than temporalis fascia.

In our study we divided COM cases in two groups, 30 cases in each group, in one group we done cartilage shield tympanoplasty and in other group temporalis fascia tympanoplasty. Now, the aim of the study was to assessed the surgical outcome in both the groups and to compared the surgical outcome in terms of graft uptake rate and hearing improvement at the end of 12 weeks after surgery.

METHODS

This was a prospective study conducted in the Department of Otolaryngology at Subharti Hospital from November 2015 to July 2017. A total of 60 patients with COM with moderate/large/subtotal perforations were included in the study. All patients underwent type-I tympanoplasty. Cartilage were used in the 30 patients (Group A), Temporalis fascia grafts were used in 30 patients (Group B).

Inclusion criteria

Inclusion criteria were patients of age between 11 to 50 years, patients with COM (Mucosal /safe type), intact

ossicular chain found preoperatively, dry ear, normal eustachian tube function, pure conductive hearing loss.

Exclusion criteria

Exclusion criteria were age less than 11 years or more than 50 years, traumatic perforation, actively discharging ear, history of previous ear surgery, patients with sensory neural hearing loss (SNHL), eroded ossicular chain found preoperatively, COM (squamosal/AAD).

Pure tone audiogram (PTA) and Impedance audiometer were performed preoperatively and postoperatively with ossicular chain status was checked during intra-operatively in each patient.

Surgical approach

Through post aural approach, under general anaesthesia conchal cartilage was harvested by keeping one side perichondrium intact on the cartilage. A slit was cut over the cartilage graft (Figure 3) (where the perichondrium was elevated) to accommodate the handle of the malleus. Tympanomeatal flap was then raised (Figure 1) in the usual manner. Thereafter, the conchal cartilage graft was placed medial to annulus and the handle of malleus. The tympanomeatal flap was then repositioned back (Figure 2) over the cartilage graft. This cartilage plays and stays in place and provides firm support to the fascia graft medially.



Figure 1: Elevation of tympanomeatal flap.

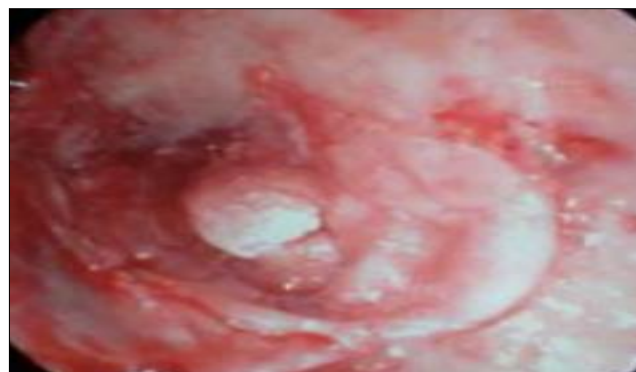


Figure 2: Reposition of tympanomeatal flap.



Figure 3: Conchal cartilage with slit.

Removal of aural pack & stitches on POD5 & 7 respectively and patient was discharged with proper follow up advised i.e. after 1 week of discharging the patient. Afterwards, patients were advised to visit the outpatient department at the 4th week, 6th week 10th week, and 12th week after surgery. Pure tone audiogram (PTA) was carried out in each patient postoperatively at 12th week of follow-up visit. Air conduction and the bone conduction threshold were calculated at frequencies of 500, 1,000, 2,000, and 4,000 Hz.

The preoperative audiogram was compared with the final postoperative audiogram, and ≥ 10 -dB improvement in both air bone gap (ABG) in the air conduction threshold. Otoscopic examination of the operated ears was carried out at 10th week of follow-up visit to assess the graft uptake and complications that would have occurred in the follow-up period.

Software

The data was collected and analysed statistically using SPSS-10 software.

RESULTS

Out of 60 patients, 36 (60%) were female and 24 (40%) were male and this shows our finding suggestive of female predominance i.e. 60% in both groups (Table 1).

Table 1 : Number of patients in both the groups.

Sex	Number of patients	%
Males	24	40
Females	36	60
Total	60	100

Table 2: Size of perforation in both the groups.

Size of the perforation	Number of patients	%
Moderate	21	70
Large	7	23.33
Subtotal	2	6.67
Total	30	100

Type-I tympanoplasty using cartilage shield and temporalis fascia graft were performed in Group A and Group B, respectively. In our study, the age group ranged from 11 to 50 years in both the groups. In the cartilage shield tympanoplasty and temporalis fascia tympanoplasty group moderate sized perforation was the most common type of perforation found in 21 patients (70%) with which the patients were operated (Table 2). In cartilage shield tympanoplasty (Group A) complete graft uptake was seen in 28 patients (93.33%) with partial failure in 2 patients (6.67%).

Similarly, in Group B, graft uptake rate in patients in the temporalis fascia tympanoplasty complete graft uptake was seen in 26 patients (86.67%) with partial failure in 4 patients (13.33%).

Table 3 : Graft uptake rate in both the groups.

Graft status	Group A		Group B	
	Numbers in cartilage tympanoplasty	%	Numbers in temporalis fascia tympanoplasty	%
Complete graft uptake	28	93.33	26	86.67
Residual perforation (quadrant wise)	2 (ASQ-1, AIQ-1)	6.67	4 (ASQ-2 AIQ-2)	13.33
Total	30	100	30	100

chi sq=0.741; df=1; p<0.38.

Table 4: Mean AB GAP (in dB) in both the groups.

Size of perforation	Group A		Group B	
	Number of patients	Mean AB GAP (in dB)	Number of patients	Mean AB GAP (in dB)
Moderate	21	17.1	21	16.8
Large	7	18.3	7	17.9
Subtotal	2	18.7	2	18.5

p>0.05.

Postoperative retraction was found in 1 patient in Temporalis fascia group though no case of retraction was found in cartilage shield group. This signifies that postoperative graft uptake in cartilage shield tympanoplasty and temporalis fascia tympanoplasty group was proved statistically insignificant ($\chi^2=0.741$ $df=1$ $p<0.38$) (Table 3). Hearing gain in terms of ABG was found to be improved in all types of perforation (moderate/large/ subtotal) in both Group A and Group B. The mean preoperative ABGs in moderate, large, subtotal perforation were 41.2, 43.9, 46.2 dB in Group A compared with Group B where corresponding values were 40.7, 42.3, 45.7 dB. Similarly, mean postoperative ABGs were 17.1, 18.3, 18.7 dB in Group A and 16.8, 17.9, 18.5 dB in Group B, respectively (Table 4). The mean improvement in ABG was ≥ 10 dB in both the Group. Hearing gain signifies that use of cartilage shield or temporalis fascia graft does not affect postoperative hearing gain which was also proved statistically insignificant ($p>0.05$).

No significant intraoperative complications were noted in the procedures in patients of either group, and no patient was found with lateralization of the graft or blunting of the anterior angle.

DISCUSSION

The main aim of our study is to compare better graft material for repairing of the TM defect to get neotympanum with near normal hearing gain, so to achieve this goal we did type 1 tympanoplasty using modified Duckett technique.⁸ There were different methods of cartilage tympanoplasty also popular for the grafting procedure like island technique, wheel technique, inlay butterfly technique, shield technique and palisade technique.^{9,10}

Although temporalis fascia and cartilage grafts can both be used effectively for the purpose, cartilage is preferred over temporalis graft, especially for moderate/large/subtotal perforations which shows better graft uptake. Like the temporalis fascia graft, cartilage can also be abundantly harvested from the concha without causing cosmetic deformity to the ear, as we seen in tragal cartilage. A review of the literature by Onal et al and Demirpehlivan et al studies reveals previously conducted demonstrating the effectiveness of cartilage graft over the temporalis fascia for type-I tympanoplasty.¹¹ In the present study, we have obtained encouraging postoperative results of conchal cartilage grafting over the temporalis fascia in type-I tympanoplasty in terms of graft uptake rate in patients with conchal cartilage which was 93.33%, in contrast with the fascia group which had an uptake rate of 86.67% at the 10th week ($p>0.5$). Similarly, the mean postoperative ABG in the fascia group was 15 dB, in contrast with the cartilage tympanoplasty group in which it was found to be 11 dB ($p=0.512$). In total, 100% of patients in the both the groups patients showed significant improvement in

hearing ($ABG \geq 10$ dB), which is consistent with a previous study by Yetiser et al.¹²

These results suggestive of better property of the conchal cartilage, as it is a good grafting material, and that it is in fact a stable graft that is resistant to negative middle ear pressure but sufficiently elastic for good sound conduction. Furthermore, it has a constant shape, is firmer than fascia and it does not contain fibrous tissue so that postoperative dimension are predictable, and it is easily accessible, well tolerated resistant to resorption, inflammatory reactions or rejection are rare. Furthermore, cartilage is also nourished by diffusion and it is incorporated well in the tympanic membrane, and it also not involve additional costs & may be a valid alternative to the conventional temporalis fascia graft for the reconstruction of moderate/large/subtotal perforation. All patients presented with significant improvement in hearing (≥ 10 dB) in the postoperative period, which is consistent with a study conducted by Dornhofferl comparing the cartilage island and cartilage palisade technique for type-I and type-II tympanoplasties & demonstrated that the anatomical and functional outcomes were similar in both the groups; i.e. $ABG < 10$ dB was found in 70% of cases using the cartilage island technique and in 73% of cartilage palisades cases.¹³ Kadir Özdamar et al also studied the hearing improvement (air bone gap closure) in cartilage tympanoplasty group and temporal muscle fascia group. Similarly, Güneri et al, Ozbek et al and Wielgosz et al have also claimed a better graft uptake rate and hearing outcome in cartilage tympanoplasty compared with temporalis fascia in type-I tympanoplasty.¹⁴

CONCLUSION

Conchal cartilage is a possible graft material for cartilage shield tympanoplasty, especially in moderate, large and subtotal perforation, because of better graft uptake rate, less partial failure but also due to the comparable hearing improvement in terms of mean AB gap in both types of graft materials.

Consequently, both cartilage shield graft and temporalis fascia graft can be utilized as graft materials independently with good success rate in tympanoplasty surgeries but above result suggestive of cartilage shield grafting can be considered as the first-line treatment in COM with moderate/large/subtotal perforations, with satisfactory outcomes.

Funding: No funding sources

Conflict of interest: None declared

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

REFERENCES

1. Levinson RM. Cartilage-Perichondrial Composite Graft Tympanoplasty in the Treatment of Posterior

- Marginal and Attic Retraction Pockets. *Laryngoscope.* 1987;97:1069-74.
2. Wullstein HL. Funktionelle operation im mittelohr mit hilfe des freien spaltlappentransplantates. *Arch Ohren-Nasen-u.Kehlkopfh.* 1952;161:422–35.
 3. Zöllner F. The principles of plastic surgery of the sound-conducting apparatus. *J Laryngol Otol.* 1955;69:657–9.
 4. Salen B. Tympanic Membrane Grafts of Full Thickness Skin, Fascia and Cartilage with Its Perichondrium, an Experimental and Clinical Investigation. *Acta Oto-Laryngologica.* 1968;244:5-73.
 5. Tabb HG. Closure of perforations of the tympanic membrane by vein grafts: a preliminary report of 20 cases. *Laryngoscope.* 1960;70:271–4.
 6. Salen B. Tympanic membrane grafts of full-thickness skin, fascia and cartilage with its perichondrium, an experimental and clinical investigation. *Acta Otolaryngol Suppl Stockh.* 1968;(244):5–73.
 7. Nissen AJ, Nissen RL, Yonkers AJ. A historical review of the use of bone and cartilage in otologic surgery. *Ear Nose Throat J.* 1986;65:493–6.
 8. Duckert LG, Müller J, Makielski KH, Helms J. Composite autograft ‘shield’ reconstruction of remnant tympanic membranes. *Am J Otol.* 1995;16:21–6.
 9. Vashishth A, Mathur NN, Choudhary SR, Bhardwaj A. Clinical advantages of cartilage palisades over temporalis fascia in type I tympanoplasty. *Auris Nasus Larynx.* 2014;41(5):422–7.
 10. Güneri EA, İkiz AO, Erdağ TK, Sütay S. Cartilage tympanoplasty: indications, techniques, and results. *J Otolaryngol Head Neck Surg.* 2009;38(3):362–8.
 11. Demirpehlivan IA, Onal K, Arslanoglu S, Songu M, Ciger E, Can N. Comparison of different tympanic membrane reconstruction techniques in type I tympanoplasty. *Eur Arch Otorhinolaryngol.* 2011;268(3):471–4.
 12. Yetiser S, Hidir Y. Temporalis Fascia and Cartilage-Perichondrium Composite Shield Grafts for Reconstruction of the Tympanic Membrane. *Annals Otol Rhinol Laryngol.* 2009;118:570-4.
 13. Dornhoffer JL. Hearing results with cartilage tympanoplasty. *Laryngoscope.* 1997;107:1094–9.
 14. Ozbek C, Ciftçi O, Tuna EE, Yazkan O, Ozdem C. A comparison of cartilage palisades and fascia in type I tympanoplasty in children: anatomic and functional results. *Otol Neurotol.* 2008;29(5):679–83.

Cite this article as: Chhabra G, Saxena AK, Kumar S. Comparative study of temporalis fascia graft versus cartilage shield tympanoplasty. *Int J Otorhinolaryngol Head Neck Surg* 2018;4:951-5.