Original Research Article

A comparative study of hearing outcome in patients undergoing type 1 tympanoplasty using temporalis fascia versus sliced tragal cartilage

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ABSTRACT

Background: A tympanoplasty is a surgical procedure to close a tympanic membrane perforation and reconstruct the tympanic membrane and hearing, commonly after chronic otitis media and trauma.

Methods: 50 patients were divided into 2 groups and underwent type-1 tympanoplasty using temporalis fascia versus sliced tragal cartilage. The patient was placed in supine position. Antiseptic painting and draping was done. All cases were operated under local anaesthesia. Post aural approach with post aural Wilde's incision with 15 number blade, the incision was made 5-10 mm posterior to post aural groove. Temporalis fascia graft was harvested. Tragal cartilage, incision was taken over the under surface of the tragus and tragal cartilage was sliced.

Results: The mean duration of symptoms was 12.72 and 15.84 months in group A and B respectively. Reduced hearing was noted in 21 and 24 patients, ear discharge in 21 each and giddiness in 2 and 4 patients respectively in group A and B. The difference was non-significant when the symptoms were evaluated. Improvement in AB gap was significantly better in group B with a p value of 0.042. The mean improvement was 14.2 dB and 17 dB respectively.

Conclusions: Type-1 tympanoplasty using the sliced tragal cartilage may be associated with better improvement in AB gap and can be regularly employed compared to temporalis fascia method.

Keywords: Chronic otitis media, Ear discharge, Temporalis fascia, Tragal cartilage, Tympanoplasty, Tympanic membrane

INTRODUCTION

Chronic otitis media which could be due to acute otitis media, negative middle ear pressure or serous otitis media, causes a permanent abnormality of the tympanic membrane.

Trauma to ear or chronic suppurative otitis media can cause a permanent perforation of tympanic membrane. Surgical closure is required when the perforation doesn't heal spontaneously or by conservative management. The perforation which is repaired restores the area of vibration of the tympanic membrane, thus, improving the hearing. Hence surgery is the mainstay of the treatment. It can be done by myringoplasty or type 1 tympanoplasty. Vein, fat, fascia lata, temporalis fascia, perichondrium

and cartilage are some commonly used autologous graft material.^{1,2} Temporalis fascia and tragal cartilage are the two most commonly used grafting materials due to its close proximity to the operative field.³

Myringoplasty can be defined as the repair of the tympanic membrane surgically. Reconstruction of the tympanic membrane and the ossicular chain is the main aim of tympanoplasty.⁴ Since the introduction of this procedure in the 1950s by Zoellner and Wullstein, various graft materials and different techniques of graft placement have been described for the reconstruction in tympanoplasty.⁴⁻⁷

Temporalis fascia: Most commonly used graft material for closure of pars tensa is temporalis fascia. In 70% to

90% of primary tympanoplasty, temporalis fascia is used. The chances of recurrent perforation with the use of temporalis fascia graft is higher in situations such as retraction pockets, atelectatic ears.⁸ Temporalis fascia is preferred because it is convenient to harvest, can be used as onlay, interlay or underlay graft, there is no size limitations and it is quite similar to tympanic membrane with low basal metabolic rate.

Cartilage material has been criticized because of concerns regarding hearing results. The thickness and composition of cartilaginous TM should represent a compromise between sufficient stability and adequate acoustic sensitivity.⁹⁻¹¹ Various authors have shown that following cartilage tympanoplasty, hearing outcome is poor as compared to temporalis fascia or perichondrium.^{12,13} It is assumed that when a large portion of the tympanic membrane is replaced with cartilage, tympanic membrane becomes more stiff and adds mass.¹²

Sliced tragal cartilage

Tragal cartilage is fibroelastic cartilage, relatively avascular tissue. Cartilage is proved to be a promising graft material to close tympanic membrane perforations. As it is more rigid, the chances of re perforation and retraction is less. But due to its rigid quality and thickness, sound conduction properties of tragal cartilage is controversial. Harvesting the graft from the same endaural incision and slicing it to obtain acoustic benefits, is the new innovation in the technique.⁹ Tragal cartilage has several advantages that it is easily accessible, is a mesodermal graft, has a good chance of postoperative survival, has a conical contour and it is sufficiently large for myringoplasty of a total perforation.

Many different techniques such as composite shield graft, cartilage palisade graft, cartilage perichondrium island flap, butterfly inlay graft, Crown cork technique, cartilage mosaic graft and cartilage reinforcement have been used.^{1,8,9} Due to its thickness, concerns are raised for cartilage tympanoplasty. Zahnart et al suggested that by thinning the cartilage to 0.5 mm, acoustic benefit could be obtained but this advantage is nullified by the unacceptable curling of the graft that occurs when the cartilage is thinned and perichondrium is left attached to one side.^{10,11}

METHODS

This prospective study was conducted with 50 patients between age group 16 years to 60 years with tubotympanic type of chronic suppurative otitis media who were selected from outpatient department in otorhinolaryngology department of Dr. D. Y. Patil Medical College and Research Centre Pimpri, Pune; between September 2018 and August 2020.

Patients were randomized into 2 groups i.e., 25 patients were subjected to myringoplasty with temporalis fascia

and other 25 patients were subjected to myringoplasty with sliced tragal cartilage. Both the groups were compared for audiological outcome i.e., closure of A-B gap.

Inclusion criteria

Chronic suppurative otitis media; inactive mucosal type with central perforation; pure tone audiometry average between 20 to 45db hearing loss; ear to be operated should be dry for at least 2 weeks prior to the surgery; eustachian tube function normal; normal middle ear mucosa and intact ossicular chain.

Exclusion criteria

Re-perforation; sensorineural hearing loss; bilateral squamous ear disease; associated factors like uncontrolled hypertension, diabetes and severe anemia.

Procedure

Post aural approach with post aural Wilde's incision with 15 no. blade, the incision was made 5-10 mm posterior to post aural groove, extending from the upper attachment of the auricle, carried along the curve of the post aural fold down to the tip of mastoid process. Temporalis fascia graft was harvested in 25 patients. To harvest the tragal cartilage, incision was taken over the under surface of the tragus. Cartilage was exposed by raising the perichondrium on both the sides and adequate amount of cartilage was dissected out leaving 5 mm of strip of cartilage superiorly to maintain the shape of the tragus. The cartilage was then sliced using the slicer to reduce its thickness from 1 mm to 0.5 mm to attain acoustic benefit.

Margins of the perforation were visualized and freshened using sharp pick or sickle knife. 6 o'clock and 12 o'clock incision was taken and tympanomeatal flap was raised. Middle ear was visualized and ossicular chain continuity was checked. Handle of malleus was denuded and middle ear gel foam was placed under the handle of malleus. Graft either temporalis fascia or sliced tragal cartilage was then placed over the handle of malleus. Tympanomeatal flap was repositioned. Adequate amount of gel foam was placed over the graft and suturing was done in layers. Mastoid dressing was given which was removed on Post-operative day 2.

Post-operative period

Mastoid dressing was removed on Post-operative day 2 and regular dressings of the wound was done daily. All the patients were given antibiotics, analgesics and decongestants for at least 1 week. Post auricular sutures were removed on Post-operative day 7 and antibiotic ear drops were started to promote healing. All patients were called for regular follow up at 3 months and pure tone audiometry was done to assess the hearing.

RESULTS

This was a prospective study with 50 patients included after obtaining informed consent from them explaining them in their native language. Patients unwilling to give a valid consent were not included in to the study. They

were further divided into 2 groups. The group A underwent type-1 tympanoplasty using temporalis fascia whereas group B underwent type-1 tympanoplasty using sliced tragal cartilage. Below are the baseline characteristics and hearing outcomes between both the groups (Table 1).

Table 1: Baseline characteristics and hearing outcomes between both the groups.

	Temporalis fascia (TC)	Sliced tragal cartilage (STC)	P value	Significance
Mean age	32.08±7.64	31.16±10.59	0.73	Non significant
Male	12	14	0.571	Non significant
Female	13	11	0.571	Non significant
Mean duration of symptoms in months	12.72±6.47	15.84±13.0406	0.29	Non significant
Reduced hearing	21	24	0.157	Non significant
Ear discharge	21	21	1	Non significant
Giddiness	2	4	0.384	Non significant
Pre-operative AB gap	29.2±5.53	27.4	0.288	Non significant
Post-operative AB gap	15±5.59	10.4±5.18	0.0041	Significantly better in STC group
Improvement in AB gap	14.2±4.93	17±4.93	0.042	Significantly better in STC group

There were total 1 subtotal perforation, 16 large central perforations, 26 medium central perforation and 7 small central perforation in the study.

DISCUSSION

The current study compared the hearing outcomes in patients undergoing type-1 tympanoplasty with temporalis fascia versus sliced tragal cartilage. The difference in age groups was non-significant between both the groups with a p value of 0.73. The gender difference was non-significant with a p value of 0.571.

Pre-operative AB gap was 29.20 and 27.4 dB respectively with non-significant p value at 0.288. The post-operative AB gap was 15 dB and 10.4 dB respectively with significant p value of 0.0041. The post-operative AB gap was significantly better in sliced tragal cartilage group. Improvement in AB gap was significantly better in group sliced tragal cartilage with a p value of 0.042. The mean improvement in group Temporalis fascia was 14.2 dB and in sliced tragal cartilage group was 17 dB.

As observed from the findings, the improvement in hearing was better in sliced tragal cartilage group. Hence, sliced tragal cartilage can be considered as superior to temporalis fascia utilizing type-1 tympanoplasty.

Yang et al compared cartilage graft and fascia in type 1 tympanoplasty; concluded that tympanoplasty using cartilage grafts has a better graft take rate than that using temporalis fascia grafts.¹⁴ There are no significant differences between cartilage grafts and temporalis fascia

grafts for hearing outcomes. Contrary to the sliced cartilage sub-group, full-thickness cartilage grafts generate better hearing outcomes than temporalis fascia grafts.

Mbarek et al They carried a retrospective study about 380 patients operated in our department between 1998 and 2005.¹⁵ Patients were classified into two groups: 90 (23.6%) undergo cartilage tympanoplasty and 290 (76.4%) fascia tympanoplasty. In each group, we calculated the average of pre and postoperative air bone gap (ABG) and the average air conduction gain (ACG) at 250-4,000 Hz. Successful closure of the tympanic membrane perforation was achieved in 97% of the cartilage group as compared to 94% of the fascia group. The average ACG was 21±11 dB in cartilage group and 20±22 dB in fascia group. With an average follow-up of 2 years, residual perforation was observed in 2.2% in cartilage group. Reperforation of fascia graft and retraction were noted in 2.1 and 1%, respectively. The authors show the great reliability of cartilage tympanoplasty to close tympanic membrane perforations and recommended using cartilage as a first choice, especially in stable or evolutive chronic otitis media, and in recurrent perforation of the tympanic membrane.

In study by Khan et al the ABG closure was 7.10±3.01 dB in the cartilage group and 7.99±4.22 dB in the temporalis fascia group.¹⁶ There was a higher mean ABG noted in the temporalis fascia group. This was in synchronization with our study. Yang et al in a systematic review and meta-analysis observed that using cartilage

grafts had better hearing outcomes when compared to temporalis fascia.¹⁷

Mild hearing improvement was noted in 7 (28%) patients each in either of the group. Significant improvement was noted in 15 (60%) patients in group A and 17 (68%) patients in group B. No improvement was observed in 3 (12%) patients in group A and 1(4%) patient in group B. Onal et al graft successful uptake rates were 65.9% for the temporalis fascia group and 92.3% for the cartilage group which were in line to our study results.¹⁸

Kim et al in a study evaluated using sliced cartilage and temporalis fascia in type 1 tympanoplasty.¹⁹ There was successful graft uptake in 77.1% in cartilage group with mean AB gain of 9.78 dB whereas in temporalis fascia group graft uptake rate was 70.9% with a mean AB gain of 9.71 dB.

In presence of middle-ear pathology, retraction pockets and atelectatic ears, temporalis fascial grafts are prone to undergo post-operative atrophy leading to poor hearing outcomes.^{20,21} Cartilage grafts are more resistant to infections, resorption and retraction when compared to temporalis fascia grafts.²²⁻²⁴ Hence, cartilage grafts were superior when compared to temporalis fascia graft.

CONCLUSION

As observed from our study it was noted that there is significantly better improvement in AB gap in patients who underwent type-1 tympanoplasty using sliced tragal cartilage when compared to those in whom temporalis fascia was used. The hearing outcomes were similar in both the groups with a non-significant difference in graft status and improvement in hearing perception. We suggest type-1 tympanoplasty using the sliced tragal cartilage may be associated with better improvement in AB gap and can be regularly employed in patients undergoing type-1 tympanoplasty.

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REFERENCES

1. Athanasiadis-Simanis A. Tympanoplasty: tympanic membrane repair. In: Gulya AJ, Minor LB, Poe DS, editors. Glasscock-shambaugh surgery of the ear. 6. Shelton: Peoples Medical Publishing House; 2010:465-488.
2. Athanasiadis-Simanis A. Tympanoplasty: tympanic membrane repair. In: Gulya AJ, Minor LB, Poe DS, editors. Glasscock-shambaugh surgery of the ear. 6. Shelton: Peoples Medical Publishing House; 2010:468-478.
3. Mawson SR. Myringoplasty; the surgical repair of tympanic membrane perforations. J Laryngol-otol 1958;72(1):56-66.
4. Albirmawy OA. Comparison between cartilage-perichondrium composite 'ring' graft and temporalis fascia in type one tympanoplasty in children. J Laryngol Amp Otol. 2010;124:967-74.
5. Zoellner F. The principles of plastic surgery of the sound conducting apparatus. J Laryngol Otol. 1955;69:657-9.
6. Wullstein HL. Functional operations in the middle ear with split-thickness skin graft. Arch Otorhinolaryngol. 1952;161:422-35.
7. Rizer FM. Overlay versus underlay tympanoplasty. Part I: historical review of the literature. Laryngoscope. 1997;107:1-25.
8. Gamra OB, Mbarek C, Khammassi K, Methlouthi N, Ouni H, Hariga I, et al. Cartilage graft in type I tympanoplasty: audiological and otological outcome. Eur Arch Oto-Rhino-Laryngol. 2008;265(7):739-42.
9. Singh I, ed. Textbook of human histology. New Delhi: Jaypee Brothers Medical Publishers; 2004:89-93
10. Iacovou E, Vlastarakos PV, Papacharalampous G, Kyrodimos E, Nikolopoulos TP. Is cartilage better than temporalis muscle fascia in type I tympanoplasty? Implications for current surgical practice. Eur Arch Oto-Rhino-Laryngol. 2013 Nov 1;270(11):2803-13.
11. Lee CF, Chen JH, choure YF, Hsu LP, Chen PR, Liu TC. Optimal graft thickness for different sizes of tympanic membrane perforation in cartilage myringoplasty: a finite element analysis. Laryngoscope. 2007;117:705-25.
12. Dornhoffer JL. Hearing results with cartilage tympanoplasty. Laryngoscope. 1997;107:1094-9.
13. Gerber MJ, Mason JC, Lambert PR. Hearing results after primary cartilage tympanoplasty. Laryngoscope. 2000;110:1994-9.
14. Yang T, Wu X, Peng X, Zhang Y, Xie S, Sun H. Comparison of cartilage graft and fascia in type 1 tympanoplasty: systematic review and meta-analysis. Acta Otolaryngol. 2016;136(11):1085-90.
15. Gamra OB, Mbarek C, Khammassi K, Methlouthi N, Ouni H, Hariga I, et al. Cartilage graft in type I tympanoplasty: audiological and otological outcome. Eur Arch Oto-Rhino-Laryngol. 2008;265(7):739-42.
16. Khan MM, Parab SR. Comparative study of sliced tragal cartilage and temporalis fascia in type I tympanoplasty. J Laryngol Otol. 2015;129(1):16.
17. Yang T, Wu X, Peng X, Zhang Y, Xie S, Sun H. Comparison of cartilage graft and fascia in type 1 tympanoplasty: systematic review and meta-analysis. Acta Otolaryngologica. 2016;136(11):1085-90.
18. Onal K, Arslanoglu S, Songu M, Demiray U, Demirpehlivan IA. Functional results of temporalis fascia versus cartilage tympanoplasty in patients

- with bilateral chronic otitis media. *J Laryngol Otol.* 2012;126:22-510.
19. Kim JY, Oh JH, Lee HH. Fascia versus cartilage graft in type I tympanoplasty: audiological outcome. *J Craniofac Surg.* 2012;23:e605-8.
 20. Gamra OB, Mbarek C, Khammassi K, Methlouthi N, Ouni H, Hariga I, et al. Cartilage graft in type I tympanoplasty: audiological and otological outcome. *Eur Arch Oto-Rhino-Laryngol.* 2008;265(7):739-42.
 21. Khan MM, Parab SR. Primary cartilage tympanoplasty: our technique and results. *Am J Otolaryngol.* 2011;32(5):381-7.
 22. Buckingham RA. Fascia and perichondrium atrophy in tympanoplasty and recurrent middle ear atelectasis. *Ann Otol Rhinol Laryngol.* 1992;101:755-8.
 23. Kerr A, Byrne J, Smyth G. Cartilage homografts in the middle ear: a longterm histological study. *J Laryngol Otol.* 1973;87:1193-200.
 24. Levinson RM. Cartilage-perichondrial composite graft tympanoplasty in the treatment of posterior marginal and attic retraction pockets. *Laryngoscope.* 1987;97:1069-74.

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