

Original Article

COMPARATIVE EFFICACY OF SLICED TRAGAL CARTILAGE VERSUS TEMPORALIS FASCIA IN TYMPANOPLASTY: A STUDY ON HEARING IMPROVEMENT AND GRAFT UPTAKE

HEMENDRA SINGH SHEKHAWAT*, ARUN KUMAR PATEL, KULDEEP SINGH LODHA, NITIN KUMAR ARORA

Department of Otorhinolaryngology, Jhalawar Medical College, Jhalawar, Rajasthan, India
*Corresponding author: Hemendra Singh Shekhawat; *Email: mini.singhshekhawat999@gmail.com

Received: 18 Sep 2024, Revised and Accepted: 25 Oct 2024

ABSTRACT

Objective: Chronic suppurative otitis media (CSOM) often necessitates surgical intervention, with tympanoplasty being a key procedure to restore hearing. The choice of graft material-sliced tragal cartilage versus temporalis fascia remains controversial due to potential differences in acoustic transmission and graft resilience.

Methods: This prospective cohort study included 48 patients with CSOM, randomly assigned to receive either tragal cartilage or temporalis fascia grafts. Outcomes measured were hearing improvement and graft uptake, assessed through audiometric testing and otoscopic evaluations.

Results: Both groups showed significant improvements in hearing postoperatively, with no statistically significant difference in hearing gain ($P=0.3064$). Graft uptake rates were comparable, with a non-significant lower reperforation rate in the cartilage group ($P=0.551$).

Conclusion: The study supports the use of either sliced tragal cartilage or temporalis fascia as effective materials for tympanoplasty, offering substantial hearing improvement and reliable graft uptake.

Keywords: Tympanoplasty, Tragal cartilage, Temporalis fascia, Chronic suppurative otitis media, Hearing improvement, Graft uptake

© 2024 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>) DOI: <https://dx.doi.org/10.22159/ijcpr.2024v16i6.6008> Journal homepage: <https://innovareacademics.in/journals/index.php/ijcpr>

INTRODUCTION

Chronic otitis media (COM) represents a persistent health challenge, significantly impairing quality of life due to its recurrent infections and hearing loss. Tympanoplasty, aimed at eradicating disease from the middle ear and restoring the sound-conducting mechanism, remains a cornerstone in managing COM. Among the myriad techniques and materials available, the choice of graft material plays a pivotal role in the success of tympanoplasty, particularly concerning hearing improvement and graft uptake. This study focuses on comparing two commonly used grafts: sliced tragal cartilage and temporalis fascia, to evaluate their efficacy in hearing restoration and anatomical graft integration [1, 2].

Temporalis fascia, due to its ease of harvest and excellent biocompatibility, has been traditionally the graft of choice for tympanoplasty. It offers a thin, pliable layer that readily adheres to the native tympanic membrane, promoting effective sound transmission. However, its susceptibility to atrophy and retraction under eustachian tube dysfunction conditions often compromises long-term outcomes. Conversely, cartilage grafts, with their inherent resistance to negative middle ear pressure and reduced retraction rates, present a robust alternative. Sliced tragal cartilage, with its thickness and stiffness, provides structural stability, potentially reducing the incidence of postoperative graft failure [3-5].

The debate between using temporalis fascia versus tragal cartilage primarily revolves around their impact on acoustic outcomes. Critics of cartilage tympanoplasty argue that the increased mass and stiffness of cartilage might impede sound transmission, especially at higher frequencies. However, recent advancements in slicing techniques have produced thinner cartilage grafts that purportedly match the acoustic results of fascia while providing the added advantage of structural resilience. This study seeks to objectively assess these claims by comparing postoperative hearing levels and graft uptake rates between patients receiving tragal cartilage and those with temporalis fascia grafts [6-8].

Methodologically, this comparative study utilizes a double-blind, randomized, controlled trial design to ensure unbiased results and

reproducibility. Audiometric evaluations preoperatively and at sequential postoperative intervals serve as primary outcome measures, focusing on air-bone gaps and speech reception thresholds. Secondary outcomes include graft uptake observed through otoscopic and imaging studies, with a follow-up period sufficient to assess both immediate and long-term graft performance [9].

Through this research, we aim to clarify the clinical scenarios under which each graft type exhibits superior performance, thereby guiding otologic surgeons in personalized treatment planning. The findings are expected to contribute significantly to the existing literature, providing evidence-based recommendations for graft selection in tympanoplasty aimed at optimizing auditory outcomes and patient satisfaction. This study's implications extend beyond surgical preferences, influencing material innovation, surgical training, and patient counseling, ultimately enhancing the therapeutic arsenal available for chronic otitis media management.

MATERIALS AND METHODS

Study design and setting

This was a prospective cohort study conducted in the Department of ENT at Jhalawar Medical College, approved by the Institutional Ethical Committee. The study spanned one and a half years, with patients followed up for three months postoperatively.

Participants

Forty-eight patients suffering from chronic suppurative otitis media (CSOM)-mucosal type, with central perforation, were enrolled. The inclusion criteria were:

- Ages 15 to 55 y.
- Evidence of conductive hearing loss within 45 dB on pure tone audiometry.
- Dry ear for at least six weeks prior to surgery.
- Controlled nasal and paranasal sinus conditions. Participants provided informed consent and were divided into two groups: those

receiving sliced tragal cartilage and those receiving temporalis fascia grafts.

Exclusion criteria

- Patients younger than 15 or older than 55 y.
- CSOM-squamosal type or unsafe types, and traumatic perforation.
- Sensorineural hearing loss.
- Active nasal or paranasal sinus disease.

Surgical technique

Patients underwent tympanoplasty using either sliced tragal cartilage or temporalis fascia based on group assignment. Surgeries were performed under general anesthesia with patients in the supine position head rotated to the opposite side. The cartilage group underwent a permeal approach, typically endoscopically, with a tragal cartilage graft prepared to an optimal thickness of 0.5 mm. The fascia group received a postaural approach using a harvested temporalis fascia graft. Both techniques involved underlay placement of the graft, meticulous management of the perforation edges, and tympanomeatal flap elevation.

Postoperative care and follow-up

All patients were instructed on ear care, including water precautions and sleeping positions. Antibiotics, analgesics, and decongestants were prescribed as needed. Follow-up visits were scheduled at 1, 3, and 6 w, and at 3 mo, with audiometric evaluations to assess hearing improvement and graft uptake.

Outcome measures

Primary outcomes included the degree of hearing improvement, type of hearing loss, and air-bone gap assessed through pure tone audiometry. Secondary outcomes focused on graft uptake and any surgical complications.

Statistical analysis

Data were collected using a pre-designed proforma and analyzed using statistical software. Continuous variables were expressed as

means and standard deviations, while categorical variables were presented as frequencies and percentages. Comparative analyses between the groups were performed using Fisher's exact test for categorical variables and unpaired 't' tests for continuous variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The comparative efficacy of sliced tragal cartilage versus temporalis fascia in tympanoplasty was assessed through demographic, audiologic, and postoperative outcomes in a total of 48 patients (24 in each group). The demographic characteristics showed no significant differences in age ($P=0.0637$) and gender distribution ($P=0.3299$) between the two groups. Similarly, the distribution of chronic suppurative otitis media (CSOM) types did not significantly differ between groups ($P=0.6616$), indicating a well-matched cohort for comparative analysis.

Audiological outcomes

Preoperatively, the cartilage group exhibited a higher mean hearing threshold (35.04 ± 2.45 dB) compared to the fascia group (32.04 ± 1.51 dB), with this difference reaching statistical significance ($P=0.0001$). Postoperatively, both groups demonstrated significant hearing improvement; however, the cartilage group showed a post-op audiogram of 24.66 ± 2.16 dB while the fascia group was slightly better at 22.25 ± 1.7 dB, both highly significant ($P=0.0001$). The hearing gain at 3 mo post-operation was similar between the groups, with the cartilage group achieving a gain of 10.37 ± 2.01 dB and the fascia group 9.79 ± 1.88 dB ($P=0.3064$), indicating no significant difference in hearing improvement between the graft types.

Graft uptake and complications

The rates of reperforation were lower in the cartilage group (4.17%) compared to the fascia group (8.33%), although this difference was not statistically significant ($P=0.551$). Otoscopic examination revealed similar patterns of cartilage positioning (CP) across large, medium, and small categories, with no significant differences observed between the two groups. The cartilage group had 33.33% large CP and 29.17% small CP, while the fascia group recorded 25% large CP and 25% small CP ($P>0.05$ for all comparisons).

Table 1: Baseline demographic and clinical characteristics of study participants

Parameter	Cartilage group (n=24)	Fascia group (n=24)	P-value
Age (y, mean±SD)	31.2±8.76	26.79±7.61	0.0637
Gender (male %)	20.83%	33.33%	0.3299
Type of CSOM	B/I CSOM 33.33%	B/I CSOM 25%	0.6616
	LT CSOM 33.33%	LT CSOM 29.17%	
	RT CSOM 33.33%	RT CSOM 45.83%	

Table 2: Audiological outcomes at 3 mo post-operatively

Outcome parameter	Cartilage group (n=24)	Fascia group (n=24)	P-value
Pre-op Audiogram (dB, mean±SD)	35.04±2.45	32.04±1.51	0.0001
Post-op Audiogram (dB, mean±SD)	24.66±2.16	22.25±1.7	0.0001
Hearing gain (dB) at 3 mo	10.37±2.01	9.79 ±1.88	0.3064

Table 3: Graft uptake and complications

Complication type	Cartilage group (n=24)	Fascia group (n=24)	P-value
Reperforation (Yes, %)	4.17%	8.33%	0.551
Otoscopic findings:			
-Large CP (%)	33.33%	25%	0.6733
-Medium CP (%)	37.5%	50%	
-Small CP (%)	29.17%	25%	

DISCUSSION

The primary objective of this study was to evaluate the comparative efficacy of sliced tragal cartilage and temporalis fascia in tympanoplasty, focusing on hearing improvement and graft uptake.

Our findings indicate that both materials provide significant hearing enhancement, with no statistically significant difference between the two in terms of hearing gain at 3 mo post-operation. These results suggest that both tragal cartilage and temporalis fascia are viable options for tympanoplasty, aligning with previous research that

supports the use of either material based on clinical judgment and patient-specific factors [10, 11].

The non-significant p-value concerning hearing gain between the groups ($P=0.3064$) supports the hypothesis that modern preparation techniques for cartilage have potentially minimized the acoustic disadvantages historically attributed to its increased mass and stiffness. Additionally, the similar rates of reperforation and cartilage positioning outcomes further corroborate the equivalence in the functional durability between the two graft types. This is particularly noteworthy given the theoretical benefits of cartilage in resisting negative middle ear pressures, suggesting that its use could be particularly advantageous in patients with eustachian tube dysfunction [12-14].

However, the initial superior preoperative hearing threshold in the fascia group and the slightly better postoperative hearing observed in this group might suggest a minimal yet clinically insignificant advantage in terms of initial sound transmission. This could be attributed to the thinner nature of the fascia graft, which may better replicate the natural tympanic membrane's movement.

CONCLUSION

This study concludes that both sliced tragal cartilage and temporalis fascia are effective graft materials for tympanoplasty, with no significant difference in hearing improvement and graft uptake. Surgeons can choose between these materials based on individual patient anatomy and specific middle ear conditions, guided by the findings that both materials provide reliable outcomes with minimal complications.

FUNDING

Nil

AUTHORS CONTRIBUTIONS

All authors have contributed equally

CONFLICT OF INTERESTS

Declared none

REFERENCES

1. Palva T, Virtanen H, Makitie AL. Management of chronic suppurative otitis media in children. *J Laryngo Otol*. 2002;116(10):836-41.
2. Lim DJ, Birck H. Changes in the middle ear in chronic otitis media. *Acta Oto Laryngol*. 1976;82(5-6):376-83.
3. Usmani H, Quadir A, Siddiqui RA, Sharma SC. Ondansetron and dexamethasone in middle ear procedures. *Indian J Otolaryngol Head Neck Surg*. 2003;55(2):97-9. doi: [10.1007/BF02974613](https://doi.org/10.1007/BF02974613).
4. Prasad SC, Nair A. Slicing the conchal cartilage graft: a new technique for cartilage tympanoplasty. *Indian J Otolaryngol Head Neck Surg*. 2013;65(3):248-51.
5. Hunter JB, O Connell BP, Wanna GB. Systematic review and meta-analysis of surgical complications following cochlear implantation in canal wall down mastoid cavities. *Otolaryngol Head Neck Surg*. 2016;155(4):555-63. doi: [10.1177/0194599816651239](https://doi.org/10.1177/0194599816651239).
6. Gristwood RE. Cartilage grafts in tympanoplasty. *Otol Neurotol*. 2013;34(6):1070-1.
7. Zahnert T, Huttenbrink KB, Murbe D, Bornitz M. Experimental investigations of the use of cartilage in tympanic membrane reconstruction. *Am J Otol*. 2000;21(3):322-8. doi: [10.1016/s0196-0709\(00\)80039-3](https://doi.org/10.1016/s0196-0709(00)80039-3), PMID [10821543](https://pubmed.ncbi.nlm.nih.gov/10821543/).
8. Overbosch HC. Homograft myringoplasty with micro-sliced septal cartilage. *Pract Otorhinolaryngol (Basel)*. 1971;33(5):356-7. PMID [5159317](https://pubmed.ncbi.nlm.nih.gov/5159317/).
9. Khan MM, Parab SR. Primary cartilage tympanoplasty: our technique and results. *Am J Otolaryngol*. 2011;32(5):381-7. doi: [10.1016/j.amjoto.2010.07.010](https://doi.org/10.1016/j.amjoto.2010.07.010), PMID [20832904](https://pubmed.ncbi.nlm.nih.gov/20832904/).
10. M Mohsen Wafaie. Comparative study of the clinical and audiological outcome of myringoplasty using temporalis fascia graft versus tragal cartilage graft. *AAMJ*. 2010 Apr 2;8.
11. Yung M, Vivekanandan S, Smith P. Randomized study comparing fascia and cartilage grafts in myringoplasty. *Ann Otol Rhinol Laryngol*. 2011;120(8):535-41. doi: [10.1177/000348941112000808](https://doi.org/10.1177/000348941112000808), PMID [21922978](https://pubmed.ncbi.nlm.nih.gov/21922978/).
12. 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 Otorhinolaryngol*. 2013;270(11):2803-13. doi: [10.1007/s00405-012-2329-4](https://doi.org/10.1007/s00405-012-2329-4), PMID [23321796](https://pubmed.ncbi.nlm.nih.gov/23321796/).
13. Reddy R. Comparative study of results of cartilage perichondrium vs temporalis fascia grafting in active tubotympanic type of chronic suppurative otitis media. *J Evol Med Dent Sci*. 2014 Jun;3(24):6714-20. doi: [10.14260/jemds/2014/2809](https://doi.org/10.14260/jemds/2014/2809).
14. Yakup Yeg N. Comparison of temporalis muscle fascia and full-thickness cartilage grafts in type 1 tympanoplasty. *Int J Clin Exp Med*. 2016;9(5):8731-6.