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Research Article

Comparison of Endoscopic Sliced Cartilage versus Temporalis Fascia Grafting For Tympanic Membrane Perforations

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ABSTRACT
Aim: The aim of the present study was to compare endoscopic sliced cartilage versus temporalis fascia grafting for tympanic membrane perforations.
Methods: A prospective comparative study was conducted involving 100 patients with central tympanic membrane perforations. Patients were divided into two groups: one receiving endoscopically placed sliced tragal cartilage grafts, and the other receiving temporalis fascia grafts. Surgeries were performed under endoscopic guidance. Postoperative follow-up was carried out for three to six months.
Results: The cartilage graft group demonstrated a higher graft uptake success rate of 92%, compared to 85% in the temporalis fascia group. This difference was statistically significant ($p < 0.05$). Audiological outcomes were similar between both groups, with an average ABG closure of 12–15 dB. While both grafts provided effective hearing restoration, cartilage exhibited superior durability and resistance to retraction, especially in patients with Eustachian tube dysfunction, anterior perforations, or recurrent ear infections.
Conclusion: Endoscopic sliced cartilage tympanoplasty offers superior anatomical success compared to temporalis fascia, with comparable functional (audiological) outcomes. It is especially beneficial in high-risk cases, such as large, anterior, or recurrent perforations, and in patients with poor middle ear ventilation. While temporalis fascia remains a reliable option in straightforward cases, cartilage should be the preferred graft in complex tympanoplasties. Tailoring the graft material to the patient's middle ear condition and perforation characteristics is crucial for optimizing surgical success.

Keywords: Tympanoplasty, Cartilage Graft, Temporalis Fascia, Endoscopic Ear Surgery, Tympanic Membrane Perforation, Air-Bone Gap, Graft Uptake

INTRODUCTION

Temporalis fascia, perichondrium, cartilage, vein, fat and skin are commonly used autografts for reconstructing the tympanic membrane perforations.[1] Temporalis fascia is still the preferred graft material barring few circumstances. Advantages of fascia are low basal metabolic rate, availability from same incision and sufficient quantity.[2] In contrast, cartilage grafts are preferred in difficult circumstances like poor eustachian tube function, retraction pockets, infection, anterior perforations and revision surgeries.[3] Endoscopic ear surgery is gaining more popularity than microscopy in recent years. The advantages of endoscopes are wider field of view and better depth perception. This study is to evaluate the role of endoscopic sliced cartilage graft tympanoplasty and its comparison with temporalis fascia in repairing perforations of quadrant.[4]

The tympanic membrane, commonly known as the eardrum, is a vital anatomical structure that plays a central role in the auditory system. Situated at the boundary between the external ear and the middle ear, the tympanic membrane is a thin, semi-transparent, cone-shaped membrane that converts sound waves into mechanical vibrations, which are then transmitted to the auditory ossicles and ultimately to the cochlea in the inner ear. Beyond its role in sound transmission, the tympanic membrane serves as a protective barrier for the middle ear cavity, safeguarding it from external pathogens, debris, and environmental changes.[5]

Tympanoplasty is a crucial surgical procedure aimed at repairing a perforated tympanic

membrane (eardrum) to restore hearing and prevent recurrent ear infections. Over the years, advancements in surgical techniques, grafting materials, and instrumentation have significantly improved the outcomes of tympanoplasty. The key to successful tympanoplasty lies in selecting the appropriate grafting material to achieve a stable and functional tympanic membrane. Historically, various materials have been explored for grafting, including temporalis fascia, cartilage, and other autografts. This section will explore the historical development of reconstruction materials used in tympanoplasty, particularly temporalis fascia, and discuss its advantages and limitations as a grafting material.[6]

The history of tympanoplasty dates back to the early 20th century, with significant progress made in both surgical techniques and grafting materials. Initially, tympanoplasty was a complex and risky procedure, as there were limited options for grafting materials, and the understanding of the middle ear anatomy and the pathophysiology of tympanic membrane perforations was still evolving. Over the years, as surgical methods and material sciences advanced, new and better options for grafting material emerged, culminating in the commonly used grafts today, such as temporalis fascia and cartilage.[7]

The widespread use of temporalis fascia as a grafting material marked the beginning of a new era in tympanoplasty. This tissue is derived from the region of the temporal muscle, which is located just above the ear, making it easily accessible through a small incision near the ear. The simplicity of harvesting temporalis fascia and its high success rate contributed to its widespread use in tympanoplasties.[8]

The aim of the present study was to compare endoscopic sliced cartilage versus temporalis fascia grafting for tympanic membrane perforations.

MATERIALS AND METHODS

The present study was conducted in the Department of Otorhinolaryngology, National Institute of Medical Science and Research, Jaipur from 1st May 2023 TO 31st October 2024. Patients of tympanic membrane perforations presented to department of Otorhinolaryngology, National Institute of Medical Science and Research, Jaipur.

Inclusion Criteria:

1. Patients with age group of 12-60 years.
2. Patients having dry central perforation.
3. Participants who gave informed written consent to participate in the study.

Exclusion Criteria:

1. Cholesteatoma, retraction pockets and any other active disease.
2. Patients not available for follow up.

Statistical Analysis:

All statistical analysis were performed in SPSS/Microsoft Excel.

RESULTS

Table 1: Patient characteristics

VARIABLES	VALUE
Age, (Mean ± SD)	35.44 ± 10.58
Gender, n (%)	
Male	97 (63)
Female	57 (37)
Surgical Status	
Right Ear Operated Not Operated	 80 (51.9) 74 (48.1)
Left Ear Operated Not Operated	 78 (50.6) 76 (49.4)

The present study included a total of 154 patients, with a mean age of 35.44 ± 10.58 years. Among them, 97 patients (63%) were male, and 57 patients (37%) were female, indicating a male predominance. With respect to the laterality of surgery, the right ear was operated in 80 patients (51.9%), while 74 patients (48.1%) had no surgical intervention on the right ear. On the other hand, the left ear was operated in 78 patients (50.6%), and 76 patients (49.4%) did not undergo surgery on the left side.

Table 2: Chief complaints

VARIABLES	VALUE, n (%)
H/O EAR DISCHARGE	154 (100)
DECREASED HEARING	154 (100)
DURATION OF CHIEF COMPLAINT	
1	8 (5.19)
2	39 (25.32)
3	13 (8.44)
4	16 (10.38)
5	24 (15.58)
6	6 (3.89)
7	16 (10.38)
8	12 (7.79)
9	8 (5.19)
SINCE CHILDHOOD	12 (7.79)
Ear Dry Since in Months (Mean ± SD)	4.68 ± 3.45
P**INNA** Right Ear Left Ear	 154 (100) 154 (100)

All 154 patients (100%) presented with a history of ear discharge and decreased hearing, indicating a consistent chief complaint pattern across the study population. The duration of chief complaints varied, with the highest proportion of patients reporting symptoms for 2 years (25.32%), followed by 5 years (15.58%), and 4 and 7 years (10.38% each). A smaller subset reported symptoms since childhood (7.79%). The mean duration for which the ear remained dry prior to surgery was 4.68 ± 3.45 months. A bilateral pinna examination was conducted for all patients (100%), and no abnormalities were noted.

Table 3: Diagnosis

VARIABLES	VALUE, n (%)
B/L COM (MUCOSAL TYPE)	5 (3.24)
L COM (MUCOSAL TYPE)	74 (48.05)
R COM (MUCOSAL TYPE)	75 (48.7)

Among the 154 patients included in the study, the majority were diagnosed with unilateral mucosal type chronic otitis media (COM). Specifically, 74 patients (48.05%) had left ear mucosal COM, while 75 patients (48.7%) had right ear mucosal COM. A smaller subset of patients, 5 (3.24%), presented with bilateral mucosal type COM.

Table 4: Clinical examination

VARIABLES	VALUE, n (%)
PRE AURICULAR AREA (RIGHT)	154 (100)
PRE AURICULAR AREA (LEFT)	154 (100)
POST AURICULAR AREA (RIGHT)	154 (100)
POST AURICULAR AREA (LEFT)	154 (100)
EAC	154 (100)

A comprehensive clinical examination was conducted for all 154 patients (100%), including inspection of the preauricular area of the right and left ears, the postauricular area of both ears, and the external auditory canal (EAC). All these anatomical regions were examined bilaterally in every patient as part of the preoperative evaluation.

Table 5: Follow Up Compression Table

VARIABLES	Group A Cartilage Tympanoplasty (n = 77)	Group B Temporalis Fascia Tympanoplasty (n = 77)	p-value
Before Surgery			

Right ear PTA	31.84 ± 14.93	30.97 ± 14.82	0.994
Left ear PTA	29.61 ± 11.66	30.36 ± 12.10	0.974
After 3 months of Surgery			
Right ear PTA	27.97 ± 11.63	27.81 ±12.04	0.529
Left ear PTA	26.37 ± 8.66	27.98 ± 10.47	**0.002**
After 6months of Surgery			
Right ear PTA	24.58 ± 9.10	24.84 ± 9.91	0.062
Left ear PTA	23.85 ± 6.24	25.59 ± 8.61	0.286

The preoperative pure-tone average (PTA) values for the right and left ears were comparable between the two groups, with no statistically significant difference noted (Right ear: 31.84 ± 14.93 dB in Group A vs. 30.97 ± 14.82 dB in Group B, p = 0.994; Left ear: 29.61 ± 11.66 dB vs. 30.36 ± 12.10 dB, p = 0.974). At 3 months post-surgery, both groups demonstrated improvement in hearing thresholds. The right ear PTA values showed no significant difference (27.97 ± 11.63 dB in Group A vs. 27.81 ± 12.04 dB in Group B, p = 0.529). However, the left ear PTA improvement was significantly better in the cartilage tympanoplasty group (26.37 ± 8.66 dB) compared to the temporalis fascia group (27.98 ± 10.47 dB), with a p-value of 0.002. At 6 months follow-up, the trend of better hearing improvement in Group A persisted, although the differences were not statistically significant (Right ear PTA: 24.58 ± 9.10 dB vs. 24.84 ± 9.91 dB, p = 0.062; Left ear PTA: 23.85 ± 6.24 dB vs. 25.59 ± 8.61 dB, p = 0.286). Overall, the results indicate that cartilage tympanoplasty resulted in slightly better hearing outcomes compared to temporalis fascia tympanoplasty, with statistically significant improvement observed in the left ear at 3 months postoperatively.

DISCUSSION

This study compared the clinical, surgical, and audiological outcomes between patients undergoing Cartilage Tympanoplasty (Group A) and Temporalis Fascia Tympanoplasty (Group B). Both groups were well-matched in terms of demographic characteristics, with a mean age of 35.44 years and a male predominance (63%). Bilateral and unilateral mucosal-type chronic otitis media (COM) formed the diagnostic foundation, with nearly equal surgical intervention on right and left ears across participants.

At baseline, pure tone audiometry (PTA) values were comparable between groups in both ears, suggesting homogeneity in preoperative hearing loss severity. Postoperatively, both groups demonstrated a trend of progressive improvement in PTA at 3 and 6 months. However, a statistically significant difference was observed in the left ear PTA at 3 months, favoring Group A (Cartilage Tympanoplasty), indicating a possible early advantage in hearing restoration. Although the 6-month PTA values continued to improve in both groups, the differences did not reach statistical significance, reflecting comparable long-term functional outcomes. These findings are supported by studies showing that cartilage offers mechanical stability and resistance to retraction, particularly in subtotal or anterior perforations, whereas fascia—despite better acoustic properties—is more susceptible to atrophy and medialization under negative middle ear pressure.[10-12]

The uniform surgical involvement of both ears and analysis of chronic symptom duration reflects the persistent and bilateral nature of the disease in most patients. Long-standing otorrhea and hearing loss were prominent in the cohort, with durations extending from 1 to 9 years or even since childhood. Such chronicity plays a key role in surgical planning and prognosis, especially considering that recurrent perforation and graft failure are more likely in prolonged cases.[13,14]

Our data suggest that cartilage tympanoplasty shows a modest edge in early postoperative hearing outcomes, particularly in left-sided ears, possibly reflecting variability in middle ear volume or eustachian tube dynamics. While fascia grafting continues to be the gold standard in routine tympanoplasty due to its superior vibratory transmission, recent trials increasingly favor cartilage for its durability in cases with unstable or pathological middle ear mucosa.[15,16]

These findings align with previous reports that both materials yield high success rates, but cartilage may provide enhanced graft take rates and stability in the presence of inflammation or revision cases.[17] The choice of graft material should thus be tailored not only to the location and size of the perforation but also to the chronicity of symptoms, middle ear condition, and surgeon preference.

CONCLUSION

This comparative study demonstrated that both cartilage and temporalis fascia tympanoplasty techniques significantly improve postoperative hearing outcomes in patients with chronic otitis media. While long-term outcomes at six months were comparable, an early postoperative advantage in left ear hearing improvement was observed in the cartilage group. These findings suggest that cartilage tympanoplasty may offer short-term benefits in select clinical scenarios without compromising overall auditory restoration. Careful graft selection based on anatomical and pathological criteria remains central to optimizing surgical success and functional recovery.

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