Original Article

Assessment of Hearing Improvement after Type I Myringoplasty Using Cartilage vs Temporalis Fascia Grafts in Chronic Suppurative Otitis Media Adult Patients

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ABSTRACT

Background: Type I myringoplasty is a hearing loss procedure that is frequently used to treat chronic otitis media and repair the conduction of hearing and the structure of the tympanic membrane. The use of temporalis fascia graft has been widely applied, although it does not hold up in large, anterior, or high-risk perforations; cartilage graft has better mechanical stability with equivalent hearing loss. The purpose of the study was to compare graft uptake, hearing recovery, time in the operating room, as well as postoperative complications between temporalis fascia and cartilage grafts in adults undergoing Type I myringoplasty.

Methodology: The quasi-experimental study was carried out in the ENT Department, Sir Ganga Ram Hospital, Lahore, between January and March 2025 upon the ethical approval of Fatima Jinnah Medical University. The sample size was determined at 95% confidence and 90% power. A total of one hundred adult patients (16-65 years old) with chronic Type I myringoplasty of the ear were enrolled, and patients with active discharge, prior ear surgery, ossicular pathology, sensorineural hearing loss, or systemic illness were excluded. Temporalis fascia graft (n=50) and composite cartilage island graft (n=50) were used on patients. Pure-tone audiometry was used for hearing assessment. Graft uptake (complete tympanic membrane closure), postoperative air-bone gap, period of operation, and early and late complications were noted during 3 months of follow-up. The SPSS-20 was used to analyze the data, and p=0.05 was viewed as significant.

Results: There were 100 patients (50 each) with an average age of 40.07 ± 14.50 years; half of them were males. The grafts of temporalis fascia graft (TFG) and composite cartilage island graft (CIG) had a similar operative time (82.4 ± 22.2 vs 80.1 ± 23.6 min; p = 0.611). There was no statistically significant difference between postoperative air-bone gap (16.9 ± 8.6 vs 17.5 ± 7.4 dB; p = 0.717), but each of the groups had improved significantly compared to baseline (p < 0.001). There were also comparable graft uptakes (82.0% vs 80.0%; p = 0.799). The complications were infection (14.0% vs 6.0%), persistent perforation (6.0% vs 2.0%), and graft rejection (4.0% vs 2.0%); there was no significant intergroup difference (p = 0.318).

Conclusion: Both temporalis fascia and composite cartilage island grafts provide similar short-term anatomical and functional outcomes in myringoplasty. Either technique may be effectively selected based on surgeon preference or individual patient needs.

Keywords: Chronic otitis media; Tympanoplasty; Myringoplasty; Temporalis fascia; Cartilage graft; Hearing outcomes

INTRODUCTION

Chronic otitis media (COM) continues to be a major public health concern and a leading cause of preventable hearing loss globally, particularly in developing countries where delayed diagnosis, recurrent infections, and limited access are common to specialized care remains a major challenge.[1] The typical features of COM include middle ear cleft inflammation (chronic), with a perforated tympanic membrane (TM), identified by recurrent or chronic mucopurulent otorrhea. Patients usually present with either conductive deafness or hearing loss, otorrhea, membrane retractions or ossicular chains. In the long run, sensorineural hearing loss can result because of the transmission of the infection to inner ear structures if the inflammation persists. Not only can COM influence the functioning of the auditory apparatus, but its consequences on speech and language growth, academic success, socialization, and the quality of life are deep-rooted, particularly in children.[2] The conventional method of repairing the integrity of TM, to reinstate middle ear ventilation, and to restore hearing is surgical management, mainly tympanoplasty or myringoplasty. Tympanoplasty is not only meant to cover the hole, but functional restoration of hearing should be the main aim of

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the procedure. TM reconstruction products have been done using a variety of graft material that has been used since the introduction of this technique by Wullstein, and ever since, various techniques have employed temporalis fascia, perichondrium, fat, cartilage, vein and dura mater.[3-9] Of them, temporalis fascia has long been regarded as the graft material of choice because it can be easily harvested and easily combined.[5] Its results, however, might be less dependable under circumstances of dysfunction of the Eustachian tube, subtotal/ total perforations, or adhesive otitis media. In this case, cartilaginous grafts, particularly tragus and conchal grafts, would be a better choice because of their anti-infectious, anti-retraction, and anti-resorption properties.[10-12] Cartilage is structurally stable, can be nourished by diffusion, and is resistant to fibrosis; thus, it is an ideal choice in difficult middle ear patients.[11] But grafts of temporalis fascia might not be as dependable in the presence of dysfunction of the Eustachian tube, adhesive otitis media, and large and anterior tympanic membrane perforations, in which retraction and reperforation of the grafts are more common. The cartilage grafts, especially tragal and conchal cartilage, have thus become popular due to their mechanical stability, negative middle-ear pressure resistance and reduced rates of resorption. Cartilage, which is structurally stable, nourished by diffusion, and resistant to fibrosis, is well adapted to the high-risk ear. In spite of similar hearing results described in international literature on cartilage and fascia grafts, with some showing better anatomy of cartilage grafts, there is a significant heterogeneity in cartilage graft methods and outcome reporting, which means that there is a limitation to generalizability of the existing evidence.[12-14] Further, there is a dearth of locoregional data with a standardized method of surgery and systematic outcome evaluation. Such a knowledge gap would require systematic comparisons between graft materials where outcome is measured in terms of chronological operative time, intraoperative safety, early postoperative outcome and infection, and late outcome in terms of graft uptake, residual perforation, and hearing improvement using air-bone gap closure. Thus, the aim of the study was to compare the duration of operation, success of the graft in the form of a temporalis fascia or composite cartilage island, recovery of hearing, and incidences of complications in adult patients who received Type I myringoplasty due to chronic otitis media under controlled conditions.

METHODOLOGY

This quasi-experimental study was conducted at the ENT Department, Sir Ganga Ram Hospital, Lahore, for 3 months from 01.01.2025 to 31.03.2025**.** A total of 100 patients (50 in each group) were enrolled. The sample size was calculated using a 95% confidence level and 90% power, based on the expected graft uptake success rate of 90% in the cartilage graft group and 65% in the temporalis fascia group, as reported in previous literature.[15] Patients aged 16 to 65 years, of both genders, and eligible for Type I Myringoplasty (myringoplasty) who provided written informed consent were included. Those with active ear discharge, prior ear surgery on the affected side, ossicular chain discontinuity or middle ear pathology requiring ossiculoplasty, sensorineural hearing loss, systemic illness or immunocompromised state, or known hypersensitivity to anesthesia or surgical materials were excluded. Baseline demographic and clinical data, including age, gender, side of perforation, and degree of hearing loss, were recorded. After ethical approval from Fatima Jinnah Medical University, 100 eligible patients were enrolled. Written informed consent was obtained. Patients were divided into two groups: Group A (n = 50), tympanoplasty using temporalis fascia graft (TFG), and Group B (n = 50), tympanoplasty using composite cartilage island graft (CIG) harvested from tragal cartilage. Preoperative assessment included history, clinical ENT examination, otoscopy, pure tone audiometry (PTA), and tympanic membrane evaluation. All patients have been subjected to Type I myringoplasty as a general anesthetic procedure by a postauricular approach. Once the margins of the perforations were refreshed and the tympanomeatal flap brought up, middle-ear status and integrity of the ossicles chain were assessed. Under Group A, a temporalis fascia graft was harvested, dried and inserted in the underlay technique. In Group B, a cartilage island graft was taken with surrounding perichondrium on the tragus and placed in the same manner, with the underlay, the cartilage being thinned, as necessary, to give the best acoustic characteristics. The tympanomeatal flap was rearranged, and the external auditory canal was stuffed.[16]

All operations were performed under general anesthesia by the skilled ENT surgeons using the postauricular approach. Operative time was calculated in minutes from skin incision and final dressing. Patients were followed up in their postoperative period for 2 weeks, 1 month, and 3 months. The outcomes were measured at 3-month follow-up. Success of graft uptake was defined as full healing of the typing membrane, with no perforation. Hearing change was measured through air-bone gap (ABG) change employing PTA. Complications including infection, graft rejection, and continuing perforation were recorded. All observations were noted in a formatted study proforma. Data were entered and analysed on SPSS version 20. Quantitative variables (age, ABG, operative time) were in the form of mean ± SD. Qualitative variables (gender, graft uptake, complications were presented as frequency and percentage. Independent samples t-test and Mann–Whitney U test were

Table 1: Baseline characteristics of the study participants (N=100)

Baseline Characteristics	TFG (n = 50)	CIG (n = 50)	Total (n = 100)	p-value
Age (years), mean ± SD	39.16 ± 14.21	40.98 ± 14.77	40.07 ± 14.50	0.54
Preoperative ABG (dB), mean ± SD	29.52 ± 6.83	29.84 ± 6.70	29.68 ± 6.77	0.80
Gender				
Male	29 (58.0)	28 (56.0)	57 (57.0)	0.84
Female	21 (42.0)	22 (44.0)	43 (43.0)	

Independent t-test was used for comparison of means. Chi-square test was used for comparison of proportions.

used for comparison of quantitative outcomes. Chi-square test was used for qualitative outcomes. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 100 patients were enrolled, with 50 patients in the temporalis fascia graft (TFG) group and 50 in the composite cartilage island graft (CIG) group. The baseline characteristics of the study participants are summarized in Table 1.

The comparison of operative outcomes between the two groups revealed no statistically significant differences. The mean operative time in the temporalis fascia graft (TFG) group was 82.4 ± 22.2 minutes, compared to 80.1 ± 23.6 minutes in the composite cartilage island graft (CIG) group (p = 0.611). Similarly, the mean postoperative air-bone gap (ABG) was 16.9 ± 8.6 dB in the TFG group and 17.5 ± 7.4 dB in the CIG group, showing no significant difference (p = 0.717). These results indicate that both grafting techniques provide comparable surgical efficiency and short-term audiological outcomes. The graft uptake success rate was similar in the two groups. Achievement of successful graft uptake in the temporal fascia graft (TFG) group was 82.0%, and successful grafting in the composite cartilage island graft (CIG) group was 80.0% (p=0.799). This signified that both grafting methods for closure of the tympanic membrane are statistically comparable at 3-month follow-up.

The incidence of postoperative complications in the two groups was low. The majority of patients in both groups did not have any complications. A total of 7 (14.0%) of patients in the TFG group became infected, 3 (6.0%) had persistent perforation, and 2 (4.0%) suffered graft rejection. Comparatively, the CIG group reported lower complication rates of 3 (6.0%) infections, 1 (2.0%) persistent perforation and 1 (2.0%) graft rejection. There was no significant difference between groups (p = 0.318), which shows that both grafting methods are usually safe with a similar complication profile. Postoperative infections were managed conservatively with aural toileting and culture-directed topical and systemic antibiotics, while persistent perforations and graft failures were observed initially and managed with revision surgery when clinically indicated.

Patients in both groups improved greatly in hearing with tympanoplasty. The TFG group also showed a reduction in the ABG of 29.95 ± 6.70 dB before the operation to 17.71.08.13 dB after the operation (p < 0.001). On the same note, in the CIG group, the average ABG reduced to 17.65 ± 7.54 dB, as compared to 29.45 ± 6.66 dB (p < 0.001). These findings prove the effectiveness of both grafting methods in restoring conductive hearing loss.

DISCUSSION

In this quasi-experimental study, the use of temporalis fascia graft (TFG) versus composite cartilage island graft (CIG) to repair type-I tympanoplasty was found to demonstrate a comparable high graft success rate and considerable hearing improvement. These results concur with other existing evidence that fascia and cartilage grafts yield similar results in hearing despite anatomical variations. A systematic review indicated that cartilage grafts have better structural stability, but hearing results are no different compared to fascia grafts.[17] A previous meta-analysis of eighteen RCTs, comprising 1273 patients with a reported follow-up period ranging from 6 weeks to 24 months, revealed that cartilage grafts yield significantly higher graft uptake rates, whereas postoperative ABG improvement does not significantly differ from tympanoplasty using temporalis fascia.[18] Similarly, in this study, postoperative ABG was significantly reduced in both groups, and differences between TFG and CIG were statistically insignificant, aligning with other studies demonstrating comparable auditory performance between cartilage island and fascia graft techniques.[19] Contrary to the assumption that cartilage mass might impair sound conduction, numerous clinical series have shown satisfactory audiological outcomes when cartilage is appropriately thinned or shaped, such as in island or palisade graft techniques.[20] Our findings further support this concept, reinforcing that cartilage grafts, when properly manipulated, do not compromise vibratory function. The safety profile of both grafts was also statistically comparable in this study, which is consistent with literature reporting low complication rates with either material.[21] In the current research, operative time, hearing improvement, graft uptake, and complication rates were similar in terms of temporalis fas-

cia graft and composite cartilage island graft in adult patients with Type I myringoplasty as measured by short-term outcomes at 3-month follow-up. These results are aligned with the recent evidence that cartilage grafts have anatomical findings that are equal to or even better than temporalis fascia without auditory effect. A recent comparative study found that cartilage grafts had a greater rate of success with regard to graft uptake[22] but similar postoperative hearing outcomes compared to fascia grafts, and this observation is corroborated by a recent meta-analysis study, which showed that cartilage grafts were found to be less retracted and re-perforated than fascia grafts, and cartilage grafts also offered an equal number of air-bone gaps between cartilage and fascia grafts. This helps support the fact that the meta-analysis on cartilage grafts has shown that partial-thickness cartilage grafts have a better hearing outcome compared to full-thickness grafts and also maintain mechanical strength.[23] The low incidence of early postoperative complications in both groups in the present study further aligns with these reports, reinforcing that cartilage grafting is a safe and effective alternative to temporalis fascia for short-term anatomical and functional outcomes when standardized surgical techniques are employed.

CONCLUSION

Type I myringoplasty performed on patients with chronic otitis media using both temporalis fascia graft and composite cartilage island graft demonstrated similar anatomical and functional results at the end of the short-term period. At 3-month follow-up, there were no significant differences in the operative time, postoperative hearing improvement, graft uptake rates and complication profile between the two techniques. Such results indicate that composite cartilage island graft is a secure and good substitute for temporalis fascia graft, especially in ears where graft failure is likely.

Author Contributions

MA: Conceptualization, Methodology, Writing – Review & Editing, Writing – Discussion, Validation, Supervision, Project Administration.
SR: Investigation, Data Curation, Formal Analysis, Writing – Review & Editing.
MG: Investigation, Data Curation, Writing – Original Draft.
FA: Data Curation, Formal Analysis, Writing – Original Draft.
SIM: Conceptualization, Methodology, Supervision, Writing – Review & Editing.

Artificial Intelligence (AI) Use Disclosure

ChatGPT (OpenAI) was used during the preparation of this manuscript for language editing and improvement of manuscript clarity. The AI tool was not used to generate or manipulate original research data, perform statistical analysis, or independently develop scientific conclusions or interpretations. All AI-assisted text and suggestions were critically reviewed, edited, and approved by the authors. The authors remain fully responsible for the accuracy, originality, integrity, scientific content, data interpretation, and conclusions of the manuscript.

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