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COMPARISON OF GRAFT UPTAKE RATES AND HEARING OUTCOMES USING TEMPORALIS FASCIA AND TRAGAL CARTILAGE-PERICHONDRIUM GRAFTS IN TYPE I TYMPANOPLASTY: A PROSPECTIVE OBSERVATIONAL STUDY FROM A TERTIARY CARE HOSPITAL IN NORTH INDIA

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ABSTRACT

Background: Chronic suppurative otitis media is a common otologic disorder associated with tympanic membrane perforation and conductive hearing loss. Tympanoplasty is the standard surgical procedure for repairing tympanic membrane defects, with various graft materials available. The choice of graft material may influence postoperative graft uptake and hearing outcomes.

Objectives: To compare graft uptake rates and hearing outcomes between temporalis fascia and tragal cartilage-perichondrium grafts in patients undergoing type I tympanoplasty.

Methods: A prospective observational comparative study was conducted in the Department of Otorhinolaryngology of a tertiary care hospital in North India from February 2020 to June 2020. A total of 46 patients with chronic suppurative otitis media (mucosal type) undergoing primary type I tympanoplasty were included using consecutive sampling. Patients received either temporalis fascia graft (n=24) or tragal cartilage-perichondrium graft (n=22). Demographic and clinical characteristics were recorded preoperatively. Graft uptake was assessed by otomicroscopic examination, and hearing outcomes were evaluated using pure tone audiometry at 3-month follow-up. Data were analyzed using SPSS version 22.0. A p-value <0.05 was considered statistically significant.

Results: Among the 46 participants, females constituted 54.3% of the study population and the majority belonged to the 18–30-year age group. Overall graft uptake was achieved in 42 patients, yielding a success rate of 91.3%. Successful graft uptake was observed in 87.5% of patients receiving temporalis fascia and 95.5% of those receiving tragal cartilage-perichondrium grafts; however, the difference was not statistically significant ($p=0.339$). Significant postoperative hearing improvement was observed in both groups. The mean air-bone gap improved from 29.8 dB to 15.1 dB in the temporalis fascia group and from 30.6 dB to 16.8 dB in the cartilage-perichondrium group ($p<0.001$ for both). Smaller perforations demonstrated better graft uptake rates than larger perforations, although the association was not statistically significant ($p=0.214$).

Conclusion: Both temporalis fascia and tragal cartilage-perichondrium grafts achieved high graft uptake rates and significant hearing improvement following type I tympanoplasty. Cartilage-

perichondrium grafts demonstrated a trend toward higher graft uptake, but no statistically significant difference was observed. Both graft materials remain effective and reliable options for tympanic membrane reconstruction.

Keywords: Chronic suppurative otitis media; Tympanoplasty; Temporalis fascia; Cartilage-perichondrium graft; Graft uptake; Hearing outcome; Myringoplasty

INTRODUCTION

Chronic suppurative otitis media (CSOM) remains one of the most prevalent otologic disorders worldwide and is an important cause of preventable hearing impairment, particularly in developing countries. Tympanic membrane perforation resulting from chronic middle ear infection can lead to recurrent otorrhea, conductive hearing loss, reduced quality of life, and impaired social and educational functioning. Despite advances in antimicrobial therapy and public health measures, CSOM continues to impose a substantial healthcare burden, especially in low- and middle-income countries where overcrowding, poor hygiene, and limited access to healthcare contribute to disease persistence [1,2].

Tympanoplasty is a well-established surgical procedure aimed at reconstructing the tympanic membrane and restoring the sound-conducting mechanism of the middle ear. Since the pioneering work of Wullstein and Zollner, numerous refinements in surgical techniques and graft materials have been introduced to improve anatomical and functional outcomes [3]. Successful tympanoplasty is generally assessed by graft uptake (intact neotympanum after surgery) and improvement in hearing thresholds. Among these parameters, graft uptake remains a primary indicator of surgical success and long-term disease control [4].

Various autologous graft materials have been employed in tympanoplasty, including temporalis fascia, tragal perichondrium, cartilage-perichondrium composite grafts, and cartilage alone. Temporalis fascia has traditionally been regarded as the graft material of choice because of its availability, ease of harvest, and favorable acoustic properties [5]. However, concerns regarding retraction, atrophy, and reperforation in certain clinical situations have led surgeons to explore the use of cartilage-based grafts, which provide greater structural stability and resistance to negative middle ear pressure [6].

Several studies have reported high graft success rates with both temporalis fascia and cartilage grafts, although the superiority of one material over another remains a subject of debate. Cartilage grafts have demonstrated excellent anatomical outcomes, particularly in large perforations, revision surgeries, and cases with Eustachian tube dysfunction [7]. Conversely, some authors have suggested that the increased rigidity of cartilage may influence postoperative hearing outcomes despite superior graft uptake rates [8]. Therefore, selection of an appropriate graft material continues to depend on surgeon preference, patient characteristics, and disease-related factors.

In India, CSOM constitutes a major public health concern and accounts for a substantial proportion of outpatient visits to otorhinolaryngology departments. Studies from different regions of the country have reported variable tympanoplasty success rates, reflecting differences in patient demographics, disease severity, surgical expertise, and graft materials utilized [9]. North India, with its diverse population and significant burden of chronic ear disease, provides an important setting for evaluating surgical outcomes and optimizing treatment strategies.

Although multiple studies have assessed the efficacy of different graft materials, available evidence remains heterogeneous, and regional data comparing graft uptake rates in routine clinical practice are limited. Furthermore, many published studies have been conducted in larger cohorts or specialized centers, making it necessary to evaluate outcomes in real-world tertiary care settings. Understanding

the comparative effectiveness of commonly used graft materials may assist surgeons in selecting the most suitable graft for individual patients and improve overall surgical success.
Therefore, the present study was undertaken at a tertiary care hospital in North India to compare graft uptake rates among patients undergoing tympanoplasty using different graft materials and to assess factors associated with successful graft integration. The specific objective was to compare postoperative graft uptake rates and hearing outcomes between commonly employed graft materials in patients undergoing type I tympanoplasty.

METHODOLOGY

Study Design: This was a hospital-based prospective observational comparative study conducted to compare graft uptake rates and hearing outcomes using different graft materials in patients undergoing type I tympanoplasty.

Study Setting: The study was conducted in the Department of Otorhinolaryngology of a tertiary care teaching hospital in North India. All preoperative assessments, surgical procedures, and postoperative follow-up evaluations were performed at the study center according to standard institutional protocols.

Study Duration: The study was conducted from February 2020 to June 2020.

Study Population: The study population comprised patients diagnosed with chronic suppurative otitis media (mucosal type) presenting with tympanic membrane perforation and planned for elective type I tympanoplasty during the study period.

Inclusion Criteria

Patients aged 18–60 years.
Diagnosed cases of chronic suppurative otitis media (mucosal type) with dry central tympanic membrane perforation.
Patients scheduled for primary type I tympanoplasty.
Patients willing to participate and provide written informed consent.
Patients available for postoperative follow-up.

Exclusion Criteria

Patients with active ear discharge at the time of surgery.
Patients with cholesteatoma or atticoantral disease.
Revision tympanoplasty cases.
Patients requiring ossiculoplasty or mastoidectomy.
Patients with sensorineural hearing loss.
Patients with craniofacial anomalies affecting middle ear function.
Patients unwilling to participate or lost to follow-up.

Sample Size: The sample size was calculated for comparison of graft uptake rates between commonly used graft materials in tympanoplasty. Assuming an expected graft uptake rate of approximately 90% based on previously published literature, a confidence level of 95%, and an absolute precision of 9%, the minimum required sample size was calculated using the formula:

$$n = \frac{Z^2 pq}{d^2}$$

Where:

(n) = required sample size
(Z) = 1.96 at 95% confidence level
(p) = expected graft uptake rate (0.90)

(q) = 1 − p (0.10)
(d) = absolute precision (0.09)

$$n = \frac{(1.96)^2 \times 0.90 \times 0.10}{(0.09)^2}$$

n = 43

Considering possible attrition during follow-up, 46 eligible patients were enrolled in the study.

Sampling Technique: A consecutive sampling technique was employed. All eligible patients fulfilling the inclusion criteria and presenting during the study period were recruited until the desired sample size of 46 participants was achieved.

Data Collection Tools and Procedure: Detailed demographic and clinical information was recorded using a predesigned structured case record form. Baseline evaluation included history taking, otoscopic and microscopic examination, tuning fork tests, and pure tone audiometry. Perforation size and site were documented. Patients underwent type I tympanoplasty using either temporalis fascia graft or tragal cartilage-perichondrium graft according to surgeon preference and intraoperative requirements. Standard underlay technique was used in all cases. Postoperative follow-up examinations were performed at regular intervals up to 3 months after surgery. Graft uptake was assessed by otomicroscopic examination, while hearing outcome was evaluated using repeat pure tone audiometry.

Study Variables: Independent variables included age, sex, duration of disease, side of involvement, size of perforation, and graft material used (temporalis fascia or tragal cartilage-perichondrium graft). Dependent variables included graft uptake status (successful or failed graft uptake) and postoperative hearing improvement measured by change in air-bone gap on pure tone audiometry. Associations between graft material and surgical outcomes were analyzed.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 22.0. Continuous variables were summarized as mean ±standard deviation, whereas categorical variables were expressed as frequencies and percentages. Comparison of categorical variables between groups was performed using Chi-square test or Fisher's exact test wherever appropriate. Independent sample t-test was used for comparison of continuous variables. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations: Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity of patient information were maintained throughout the study. Participation was voluntary, and patients were free to withdraw at any stage without affecting their treatment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable institutional guidelines for biomedical research involving human participants.

RESULTS

A total of 46 patients with chronic suppurative otitis media (mucosal type) undergoing type I tympanoplasty were included in the study. The majority of patients belonged to the 18–30 years age group, and females slightly outnumbered males. Right ear involvement was marginally more common than left ear involvement (Table 1)

Table 1. Baseline demographic and clinical characteristics of study participants (N = 46)

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	18–30	18	39.1
	31–45	16	34.8
	46–60	12	26.1
Sex	Male	21	45.7
	Female	25	54.3
Side affected	Right ear	24	52.2
	Left ear	22	47.8
Duration of disease	<5 years	19	41.3
	5–10 years	17	37.0
	>10 years	10	21.7

Temporalis fascia was used in 24 patients, whereas tragal cartilage-perichondrium graft was used in 22 patients (Table 2).

Table 2. Distribution of patients according to graft material used (N = 46)

Graft material	Number of patients (n)	Percentage (%)
Temporalis fascia	24	52.2
Tragal cartilage-perichondrium	22	47.8
Total	46	100.0

Overall graft uptake was achieved in 42 of 46 patients, yielding a success rate of 91.3%. The graft uptake rate was higher in the tragal cartilage-perichondrium group (95.5%) than in the temporalis fascia group (87.5%); however, the difference was not statistically significant (p=0.339) (Table 3).

Table 3. Comparison of graft uptake rates according to graft material at 3-month follow-up

Graft material	Successful graft uptake n (%)	Graft failure n (%)	Total	p-value*
Temporalis fascia	21 (87.5)	3 (12.5)	24	
Tragal cartilage-perichondrium	21 (95.5)	1 (4.5)	22	0.339
Total	42 (91.3)	4 (8.7)	46	

*Chi-square/Fisher's exact test

Both graft groups demonstrated significant postoperative hearing improvement. Mean air-bone gap decreased substantially after surgery in both groups, with comparable hearing gains observed between graft materials (Table 4)

Table 4. Comparison of mean air-bone gap (dB) before and after surgery according to graft material

Graft material	Preoperative ABG (Mean ± SD), dB	Postoperative ABG (Mean ± SD), dB	Mean Improvement (dB)	p-value†
Temporalis fascia	29.8 ± 6.4	15.1 ± 4.8	14.7	<0.001
Tragal cartilage-perichondrium	30.6 ± 5.9	16.8 ± 5.1	13.8	<0.001

†Paired comparison within each graft group

Patients with smaller perforations exhibited higher graft uptake rates compared with those having larger perforations. Although graft failures were more frequently observed in large perforations, the association between perforation size and graft uptake did not reach statistical significance (p=0.214) (Table 5)

Table 5. Association between perforation size and graft uptake outcome (N = 46)

Perforation size	Successful uptake n (%)	Failure n (%)	Total	p-value*
Small (<25%)	12 (100.0)	0 (0.0)	12	
Medium (25–50%)	17 (94.4)	1 (5.6)	18	0.214
Large (>50%)	13 (81.3)	3 (18.7)	16	

*Chi-square/Fisher's exact test

DISCUSSION

The present prospective observational study evaluated the graft uptake rates and hearing outcomes associated with different graft materials used in type I tympanoplasty among patients with chronic suppurative otitis media at a tertiary care hospital in North India. Of the 46 patients studied, an overall graft uptake rate of 91.3% was achieved. Although the tragal cartilage-perichondrium graft demonstrated a higher graft uptake rate (95.5%) compared with temporalis fascia (87.5%), the difference was not statistically significant. Both graft materials resulted in significant postoperative hearing improvement, indicating satisfactory functional outcomes irrespective of graft selection. The overall graft success rate observed in the present study is consistent with published literature reporting tympanoplasty success rates ranging from 80% to 95% [4,6,7]. Sheehy and Anderson reported successful graft integration in a large proportion of tympanoplasty cases, establishing tympanoplasty as a reliable surgical intervention for chronic tympanic membrane perforations [4]. Similarly, Dornhoffer documented excellent anatomical outcomes with cartilage tympanoplasty, particularly in challenging middle ear conditions [6]. The high overall success rate observed in the present study supports the effectiveness of contemporary tympanoplasty techniques in achieving durable tympanic membrane closure.

A higher graft uptake rate was observed in the cartilage-perichondrium group compared with the temporalis fascia group, although statistical significance was not demonstrated. This finding is in agreement with previous reports suggesting superior structural stability of cartilage grafts. Cartilage is known to be more resistant to resorption, retraction, and the effects of negative middle ear pressure, thereby enhancing long-term graft integrity [6,7]. Gerber et al. reported favorable graft survival with cartilage tympanoplasty and highlighted its usefulness in patients with larger perforations and

compromised Eustachian tube function [7]. Likewise, Yung's review emphasized the durability and reliability of cartilage grafts in middle ear reconstruction [9].

The absence of a statistically significant difference between graft materials in the present study may be attributed to the relatively small sample size and the generally high success rates achieved in both groups. Similar findings have been reported by systematic reviews demonstrating that while cartilage grafts often show a trend toward improved graft uptake, the differences may not always reach statistical significance in smaller clinical studies [8]. Therefore, both temporalis fascia and cartilage-perichondrium grafts remain acceptable options for routine tympanoplasty.

Postoperative hearing improvement was significant in both graft groups. The mean reduction in air-bone gap observed following surgery indicates successful restoration of middle ear sound conduction. These findings are comparable to those reported by Mohamad et al., who found that cartilage tympanoplasty can achieve hearing outcomes similar to fascia tympanoplasty despite concerns regarding the relative stiffness of cartilage grafts [8]. Preservation of satisfactory hearing outcomes in the cartilage group suggests that the structural advantages of cartilage do not necessarily compromise auditory function when appropriate surgical techniques are employed.
Perforation size appeared to influence surgical outcomes, with smaller perforations demonstrating higher graft uptake rates than larger perforations. Although the association was not statistically significant, a gradual decline in success rates with increasing perforation size was evident. Similar observations have been reported in previous studies, where larger perforations were associated with reduced vascular support, increased technical difficulty, and greater susceptibility to graft displacement or reperforation [5,10]. The lack of statistical significance in the present study likely reflects the limited sample size rather than the absence of a true clinical relationship.

From a clinical perspective, the findings suggest that both temporalis fascia and tragal cartilage-perichondrium grafts can be used effectively in type I tympanoplasty with high probabilities of successful graft uptake and hearing restoration. Cartilage-based grafts may offer an additional advantage in patients considered at higher risk for graft failure, such as those with large perforations or unfavorable middle ear conditions. These observations may assist otologic surgeons in tailoring graft selection according to individual patient characteristics.

The strengths of this study include its prospective design, uniform surgical indication, standardized postoperative assessment, and direct comparison of commonly used graft materials within a single tertiary care center. However, certain limitations should be acknowledged. The study involved a relatively small sample size, which may have limited the ability to detect statistically significant differences between groups. The follow-up period was limited to three months and therefore does not provide information regarding long-term graft integrity or delayed failures. In addition, allocation of graft material was not randomized, introducing the possibility of selection bias.

Overall, the present study demonstrates that both temporalis fascia and tragal cartilage-perichondrium grafts provide favorable anatomical and functional outcomes in type I tympanoplasty. While cartilage-perichondrium grafts showed a tendency toward higher graft uptake rates, larger multicentric studies with longer follow-up are required to establish whether this advantage translates into statistically and clinically significant long-term benefits.

CONCLUSION

This prospective observational study demonstrated that both temporalis fascia and tragal cartilage-perichondrium grafts are effective graft materials for type I tympanoplasty in patients with chronic suppurative otitis media. An overall graft uptake rate exceeding 90% was achieved, reflecting favorable anatomical outcomes in the study population. Although the cartilage-perichondrium graft

showed a higher graft uptake rate compared with temporalis fascia, the difference was not statistically significant. Both graft materials resulted in significant postoperative improvement in hearing, indicating satisfactory functional outcomes.The findings suggest that graft selection may be individualized based on perforation characteristics, middle ear status, and surgeon preference, as both materials provide reliable results. Cartilage-perichondrium grafts may offer additional structural advantages in selected cases without compromising hearing improvement. Further studies with larger sample sizes, longer follow-up periods, and multicenter participation are recommended to better define the long-term comparative effectiveness of different graft materials in tympanoplasty. The study supports the continued use of both temporalis fascia and cartilage-perichondrium grafts in routine otologic surgical practice.

DECLARATIONS

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Conflict of Interest: The authors declare that there are no conflicts of interest related to this study.
Informed Consent: Written informed consent was obtained from all participants prior to enrollment and data collection.
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