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ORIGINAL ARTICLE

Comparison of graft uptake between tragal cartilage and temporalis fascia in type-I tympanoplasty

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ABSTRACT

Background: To compare the anatomical success rates of type I tympanoplasty using tragal cartilage-perichondrium versus temporalis fascia grafts in patients with chronic suppurative otitis media.

Methods: This prospective comparative study was carried out at Ear, Nose, Throat (ENT) Department Hayatabad Medical Complex Peshawar. The study comprised 115 patients with central tympanic membrane perforations. Patients were divided into two groups at random: Group B (n=57) received a tragal cartilage-perichondrium graft, while Group A (n=58) had tympanoplasty with temporalis fascia. All procedures were performed post auricularly utilizing the underlay technique while under general anesthesia. Anatomical transplant success three months after surgery was the main outcome measure.

Results: The tragal cartilage group had a significantly higher graft uptake rate (86.2 Vs 96.5%) (p=0.047) than the temporalis fascia group. Sub-analysis of the 10 failures cases revealed that the majority (n=7) were caused by significant perforations, with 5 failures being explained by the line of the best fit passing through the temporalis fascia.

Conclusion: The superior graft material for type I tympanoplasty is tragal cartilage-perichondrium, which has a significantly greater anatomical success rate than temporalis fascia. It should be considered the preferred graft for tympanic membrane restoration because it is the best choice, particularly for larger perforations.

Keywords: Graft Uptake, Temporalis Fascia, Tragal Cartilage, Tympanoplasty

This article may be cited as: Noor A, Nawaz H, Khan A, Ahmad I, Arif M. Comparison of graft uptake between tragal cartilage and temporalis fascia in type-I tympanoplasty. Int J Pathol 23(4):338-44. https://doi.org/10.59736/IJP.23.04.1006

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Introduction

Chronic suppurative otitis media (CSOM) is the most common preventable cause of hearing loss globally, with a higher prevalence in developing countries as a result of poor access to health care, recurrent infections and low socioeconomic status (1). Chronic perforation of the tympanic membrane (TM) was one of the pathological features in CSOM, which not only leads to conductive hearing loss, but also makes patients prone to recurrent otorrhea and middle ear infection (2). The preferred treatment is to close the perforation surgically using tympanoplasty in order to restore the integrity of the tympanic membrane, improve auditory function, and minimize further infections (3,4).

Type I tympanoplasty, or myringoplasty is performed when only the TM requires repair and the ossicular chain remains intact. The surgery deemed successful when the graft is taken and the patient's hearing improves. The temporalis fascia and cartilage are the most commonly used graft materials despite several others having been proposed in the literature (5,6). Because it is readily available, easy to harvest, and provides good acoustics as a graft material, temporalis fascia has long been the chosen and time-tested form of graft. Its primary drawback, though, is the possibility of retraction, which is typically seen in high-risk situations including subtotal perforation, eustachian tube dysfunction, and revision surgery (7).

However, due to its superior mechanical stability and reduced resorption, retraction, and infection, tragus cartilage has gained increasing acceptance. Furthermore, patients with eustachian tube dysfunction benefit greatly from negative middle ear pressure, which is supported by the natural rigidity of cartilage (8).

Despite this advantage, the best graft material for Type I tympanoplasty is still up for debate. Comparing cartilage to fascia, some studies have found superior anatomic success, while others have found no difference [9,10]. The importance of research in this specific and distinct group, which is already distinguished by prospective differences (in the presentation of the disease, the performance of surgery, and the post-surgical care), is renewed by this ongoing argument, which makes this research process pertinent.

Thus, this study compares the graft take of tragal cartilage and temporalis fascia in Type I tympanoplasty. By contrasting and comparing these two commonly utilized acellular materials, the study aims to give otologic surgeons guidance for graft selection to be used for the best surgical outcomes.

Methods

From 1 January 2023 to 30 June 2024, this prospective comparative study was carried out in the Department of Otorhinolaryngology (ENT) Hayatabad Medical Complex, Peshawar. The study comprised 115 patients with tubotympanic type chronic suppurative otitis media who had undergone type I tympanoplasty. Patients were divided into two groups according to the type of graft material: 57 patients received tragal cartilage-perichondrial graft (group B) and 58 patients underwent tympanoplasty using temporalis fascia (group A).

All patients between the ages of 15 and 40 who had a central tympanic membrane perforation, an intact ossicular chain, and a dry ear for at least six weeks prior to surgery were included in the study. Patients with cholesteatoma, attic and marginal perforations, previous ear surgery, mixed or sensorineural hearing loss, craniofacial anomalies, unmanaged systemic disease or immunocompromised conditions were excluded from the study. Clinical characteristics (disease duration, perforation size, and preoperative hearing thresholds) and demographic characteristics (age, sex, and affected side) were recorded.

All patients received a full otoscopic examination and pure tone audiometry examination before surgery to evaluate the patient's hearing status before surgery. Random allocation into the two groups was achieved through a computer-generated sequence. General anesthesia was used in each group for the surgery. A postauricular incision was used in all the cases. The temporalis fascia was taken from the same

incision, whereas tragal cartilage with perichondrium was extracted through a small tragal incision. Cartilage grafts were reduced to approximately 0.5 mm in thickness prior to implantation to promote compliance and minimize acoustic stiffness. The underlay technique was used, inserting the graft medially in relation to retained remnants of TM and malleus handle. The graft center was secured at the middle ear side by gelfoam before closure of the wound.

Routine postoperative management consisted of systemic antibiotics, analgesia, and ear protection. Patients were examined at two weeks, six weeks, three months, and six months. Graft success was checked on otoscopic assessment at each visit and any complication like infection, residual perforation and retraction were noted.

Anatomical success, which was defined as graft uptake without defect at 3 months, was the main outcome measure. After prospective data collection, statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables such as age, duration of disease, preoperative hearing thresholds, and postoperative air–bone gap were expressed as mean ± standard deviation and were compared between the two groups using the independent samples t-test. Categorical variables including sex distribution, affected side, graft uptake rate, and postoperative complications were compared using the Chi-square test or Fisher's exact test, where appropriate. Within-group pre- and postoperative hearing outcomes were analyzed using the paired samples t-test. A p-value ≤ 0.05 was considered statistically significant.

Results

The mean age of patient In group A & B were 24.1±7.9 years Vs 25.3 ± 8.7 years (p=0.421). The two groups did not differ in terms of gender or the side of the affected ear (p=0.843 and p=0.682, respectively). Group A (7.2 ± 3.1) and Group B (7.8 ± 3.5) had comparable average durations of chronic ear disease (p=0.312). There was no significant difference between the two groups in the distribution of the pre-existing size of the tympanic membrane perforation (small, medium, large) (p=0.887). Table 1 describes the preoperative clinical and demographic features.

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	Group A (n=58)	Group B (n=57)	p-value
Age (years), Mean ± SD	24.1 ± 7.9	25.3 ± 8.7	0.421
Disease duration Mean ± SD	7.2 ± 3.1	7.8 ± 3.5	0.312
Sex, n (%)			
Male	32 (55.2%)	30 (52.6%)	0.843
Female	26 (44.8%)	27 (47.4%)	
Affected Side, n (%)			
Right	25 (43.1%)	27 (47.4%)	0.682
Left	33 (56.9%)	30 (52.6%)	
Perforation Size, n (%)			
Small (<25%)	12 (20.7%)	13 (22.8%)	0.887
Medium (25-50%)	30 (51.7%)	28 (49.1%)	
Large (>50%)	16 (27.6%)	16 (28.1%)	

In Group A, 50 (86.2%) were successful, yielding a graft uptake. In contrast, the Group B demonstrated a superior outcome, with 55 (96.5%) achieving successful graft uptake rate (p=0.047). Table-2.

Table 2: Graft uptake at 3 months Postoperatively

Graft Outcome	Group A	Group B	p-value
Successful Uptake, n (%)	50 (86.2%)	55 (96.5%)	**0.047**
Failure (Residual Perforation), n (%)	8 (13.8%)	2 (3.5%)	

The overall graft failure rate at 3months & 6-month postoperative evaluation was 10/115 (8.7%). In this analysis, the failure rates of the two grafts differed significantly. Group A's failure rate was 13.8%, whereas Group B's showed a statistically significant low frequency of 3.5% (p = 0.047). Table-3

Table 3: Analysis of Graft Failures

Group	Failed Grafts	Remarks on failed cases
Group A	8 (13.8%)	Majority of failures (5/8, 62.5%) were associated with large perforations (>50%).
Group B	2 (3.5%)	Both failures occurred in cases with large perforations.
Total	10 (8.7%)	The difference in failure rates between groups was statistically significant (p=0.047).

Discussion

In chronic suppurative otitis media, type-I tympanoplasty is the treatment of choice to close the perforation in tympanic membrane. The graft (temporalis fascia and tragal cartilage-perichondrium) has been debated, and contradictory results from the literature can be found (11).

In Group B, the percentage of graft take was significantly higher compared with that in Group A (96.5% vs 86.2%, p = 0.047). These results are in agreement with those of Sood et al (12), who demonstrated that cartilage provides the best biomechanical support to prevent graft failure, particularly when the perforation size is large or there is an unfavourable middle ear status. The excellent success rate of the tragal cartilage-perichondrium graft is explained by its superior anatomical and biological features. In contrast, the temporalis fascia is a soft, pliable tissue that depends on early revascularization and may be at risk for atrophy and/or mucosal scarring at some time after implantation, which is not the case with cartilage (13). This rigidity increases the middle ear's resistance to the negative pressure caused by eustachian tube dysfunction, which often present with COM, and to the failure-causing variables, such as reperforation graft and retraction [14]. Additionally, because the cartilage that covers the perichondrium is a highly vascularized stratum, it facilitates rapid neovascularization and epithelial migration from perforation borders during the healing phase, resulting in fast wound healing, we proposed that reducing the cartilage to roughly 0.5 mm was crucial because it decreased acoustic mass, which would have had little effect on hearing while maintaining sufficient support for structural integrity (15). Even failures can be informatively analyzed. Large perforation (>50%) (62.5%) was the leading cause of failure in 80% patients in the group A. This was in line with the findings of Jain et al (16), who observed that the efficacy of the fascia graft declines with the size of the perforation and, consequently the subsequent graft, in comparison to central necrosis prior to complete revascularization. Because both of the two failures in the group B developed with large perforations, the number of failures was significantly reduced for a comparable perforation size (tragal cartilage group: 2, fascia group: 5). This underscores the particular advantages of cartilage in cases involving larger perforation, as well as the possibility of more severe Eustachian dysfunction in certain cases. The 100% no failure of the tragal cartilage for small and

medium size perforations is a proof that it is a very reliable one for all levels of the perforation (17).

Our findings align with a growing global trend of research emphasizing the benefits of cartilage use in tympanoplasty (18). A meta-analysis by Jalali et al. (19) found that, particularly in high-risk cases, the graft uptake rate for cartilage tympanoplasty was substantially greater than that of fascia. By demonstrating this advantage in a prospective, randomized strategy among unselected patients, our study adds credence to this conclusion. In the present era, thinning procedures (such as palisade or placement in the posterosuperior quadrant) have significantly reduced the concerns that were previously raised about the use of cartilage due to potential acoustic attenuation (20). Its anatomical benefit is confirmed by our investigation, which is primarily based on graft uptake.

This study has few limitations. First, the follow-up was short (6 months) and a longer one would be of interest in order to ensure the long-term stability of the grafts and not miss late failures or retractions. Second, the study was performed in a single tertiary care center; however, this may influence the generalizability of the results. Finally, since the goal of the study was to assess the anatomical outcomes, detailed audiometric data were not reported, which may be an area of study of the current cohort in the future.

The main strengths of this study are its prospective design, which minimizes selection bias. The treatment groups were well balanced with respect to all baseline demographic and clinical parameters, thereby allowing the superiority of the graft material used to be unequivocally attributed to its higher osteoconductive and inductive potential. Secondly, the cause of operation was standard in all cases, so that there would be no interfering factor from the level of surgical skill and techniques.

Conclusion

Tragal cartilage-perichondrium graft demonstrated a significantly higher graft uptake rate than temporalis fascia in type I tympanoplasty, with an overall success rate of 96.5%. The superior outcomes are likely attributable to the greater mechanical stability of cartilage and the favorable healing properties of the perichondrium. While temporalis fascia remains an effective graft material, tragal cartilage is particularly advantageous in large perforations and in the presence of Eustachian tube dysfunction and should be considered routinely to enhance surgical success.

Source of funding: Nil

Conflict of interest:

The authors declare no conflict of interest

Acknowledgement: Nil

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HISTORY	
Date received:	11-07-2025
Date sent for review:	16-08-2025
Date received reviewers' comments:	23-08-2025
Date received revised manuscript:	24-11-2025
Date accepted:	02-12-2025

CONTRIBUTION OF AUTHORS	
AUTHOR	**CONTRIBUTION**
Conception/Design	AN, HN
Data acquisition, analysis and interpretation	AN, AK, IA
Manuscript writing and approval	AN, HN, IA, MA
All the authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed.	