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Original Article

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Study the Comparison of Cartilage Tympanoplasty vs Temporalis Fascia Graft Techniques at a Tertiary Care Centre

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Abstract

Background: The study compares the post-operative restoration of hearing in patients undergoing Tympanoplasty for chronic otitis media, specifically between the use of Cartilage Graft and Temporalis Fascia Graft. Key objectives include assessing the success rate, post-operative failure, and hearing status after surgery with both graft techniques. ***Methods:*** A prospective study, to examine chronic otitis media, including various perforations and trauma. Patients excluded from the study included those with acute otitis media, otosclerosis, congenital hearing disorder, sensorineural hearing loss, active intracranial complications, diabetes mellitus, HIV, TB, radical mastoidectomy, and only hearing ear. ***Results:*** Total of 60 patients underwent tympanoplasty using either temporalis fascia or cartilage island. Both groups had similar age and gender distributions, with mean durations of graft uptake at 7.88±6.34 months for temporalis fascia and 9.68±5.80 months for cartilage island. Trauma was the cause in 16.67% of the temporalis fascia cases and 13.13% in the cartilage island cases. Graft uptake rates were 83.33% for temporalis fascia and 90.0% for cartilage island, showing no significant differences, with medialization in 16.67% of patients and no complications reported. ***Conclusions:*** The study indicated that cartilage island groups had higher uptake rates, while the temporalis fascia group did not experience significant pain. Additional research is necessary to assess long-term effects.

Keywords: ***Cartilage Tympanoplasty, Chronic otitis media, Temporalis Fascia Graft Techniques.***

Introduction

Chronic Suppurative Otitis Media (CSOM) presents symptoms such as ear pain, hearing loss, foul-smelling discharge, and fever. It significantly contributes to patient morbidity, with a global prevalence of 1 to 46%, exceeding 90% in regions like Southeast Asia, Africa, and Pacific coast countries [1,2]. Key symptoms include persistent tympanic membrane perforation, recurrent ear discharge, and impaired hearing, alongside risks of complications like mastoiditis and cholesteatoma. Effective surgical management, primarily through tympanoplasty, is crucial for eliminating the disease and restoring tympanic membrane integrity to improve hearing and ensure a dry, safe ear. Various graft materials and techniques have been utilized, with temporalis fascia and cartilage grafts being the most common [3,4].

Traditionally, the temporalis fascia graft is considered the "gold standard" for tympanoplasty due to its availability and similarity to the native tympanic membrane. It offers excellent acoustic properties and high success rates for small-to-moderate perforations. However, its effectiveness can diminish in certain cases such as large perforations, retraction pockets, recurrent CSOM, and Eustachian tube dysfunction. Additionally, the graft may undergo atrophy and retraction over time, potentially leading to recurrent perforation and decreased long-term stability [5,6].

Cartilage tympanoplasty is increasingly favored for its structural stability, especially for high-risk perforations and difficult conditions. Cartilage grafts, better than fascia in some respects, provide stiffness and durability while resisting negative middle-ear pressure. Concerns about sound conduction due to cartilage rigidity have been addressed with modern techniques, ensuring acoustic outcomes similar to those achieved with fascia grafts [7].

The comparison between cartilage and temporalis fascia grafts has therefore gained increasing relevance. While cartilage offers superior mechanical stability and resistance to retraction, fascia grafts provide better pliability and may yield slightly better audiometric outcomes in selected cases. Numerous studies have examined graft uptake rates, postoperative hearing improvement, complication profiles, and long-term success with both materials. However, variations in surgical technique, patient selection, perforation size, middle-ear conditions, and Eustachian tube function have led to differing results across studies [8,9].

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A systematic comparative evaluation is crucial for understanding the advantages of different graft types, especially in resource-limited settings with high prevalence of CSOM. The choice of graft material significantly affects long-term outcomes and may decrease the incidence of recurrent middle-ear disease [10].

A comparative study of cartilage tympanoplasty and temporalis fascia graft techniques is essential to identify which method offers better graft uptake, hearing improvement, and long-term stability. The study aims to compare the restoration of hearing post-operatively in patients who underwent Tympanoplasty for chronic otitis media using Cartilage Graft and Temporalis Fascia Graft in the Department of Otorhinolaryngology and Head and Neck Surgery at autonomous state medical college, Hardoi. The objectives include comparing the success rate, post-operative failure, and post-operative hearing status using both techniques.

Methods

The was a prospective study conducted at Autonomous state medical college, Hardoi, focusing on chronic otitis media, including small, medium, large, subtotal, total, and attic perforations, trauma perforations, and tympanosclerotic patches. Study excluded patients with acute otitis media, otosclerosis, congenital hearing disorder, chronic otitis media with predominant sensorineural hearing loss, active intracranial complication of chronic otitis media, patients with diabetes mellitus, HIV, TB, radical mastoidectomy, and only hearing ear. Total of 60 patients were included in the study after 30 out of 90 patients attending OPD/IPD did not provide consent. Patients admitted to the ENT department at the Autonomous State Medical College in Hardoi were assessed for middle ear illness and eustachian tube function pre-surgery. A clinical examination and preoperative hearing evaluation were conducted using three tuning forks and pure tone audiometry on two groups: those undergoing tympanoplasty with temporalis fascia graft and those with cartilage island graft.

The graft was harvested using either William Wilde's or Lempert's postauricular endaural approach, with gel foam filling the anterior mesotympanum and external auditory canal. A perichondrial/cartilaginous island flap was obtained from the tragal or conchal cartilage through a skin incision inside the tragus. A 15 x 10 mm piece of cartilage was excised from the side away from the ear canal, and a 2 mm piece was removed to accommodate the malleus handle. The cartilage was used as a full-thickness graft, usually under 1 mm thick, with a recommendation to thin it to 0.5 mm to enhance acoustics. A perichondrial flap was created and the graft was implanted via the underlay technique. The graft and eardrum's condition were evaluated, followed by a hearing test after 8 weeks. The study employed mean and standard deviation for presenting quantitative data and utilized an unpaired t-test for group comparisons. Qualitative data was tabulated, and correlation was evaluated using Fisher's test, Student's t-test, and chi-square test, with a significance level set at 0.05 or lower. Statistical analysis was conducted using Microsoft Excel and SPSS version 24th version to ensure accuracy.

Results

Total of 60 patients were included in a study, divided into two groups: one group (n=30) receiving tympanoplasty with temporalis fascia as graft material and the other group (n=30) using a cartilage island. Both groups were monitored for eight weeks in the ENT outpatient clinic. The mean ages were similar, 30.78±6.17 years for the temporalis fascia group and 29.43±6.44 years for the cartilage island group. Gender distribution was also comparable across groups, as was the duration of onset—7.88±6.34 months for the temporalis fascia group and 9.68±5.80 months for the cartilage island group. Most cases followed acute suppurative otitis media, with trauma accounting for 16.67% of cases in the temporalis fascia group and 13.13% in the cartilage island group. Overall, the type of occurrence was similar in both groups (**Table 1**).

Table 1: Comparison of the frequency of temporalis fascia and cartilage island across various age groups, durations of onset (measured in months), and modes of trigger between the two groups.

		Temporalis Fascia Group (n=30)		**Cartilage Island Group (n=30)**		**Chi Sq.**	**p-Value**
		n	%	n	%		
Gender	Male	20	66.67	18	60.0	0.58	0.87
	Female	10	33.33	12	40.0		
Age (years)	20-25 years	8	26.67	9	30.00	0.71	0.81
	26-30 years	11	36.67	8	26.67		
	31-35 years	4	13.33	5	16.67		
	36-40 years	7	23.33	8	26.67		
	mean±SD	30.78±6.17		29.43±6.44		p=0.39	
Duration of onset (month)	1-6 month	20	66.67	10	33.33	4.88	0.88
	7-12 month	7	23.33	7	23.33		
	13-18 month	2	6.67	7	23.33		
	19-24 month	2	6.67	3	10.00		
	>24 months	1	3.33	1	3.33		
	Mean±SD	7.88±6.34		9.68±5.80		p=0.81	

The study compared ear discharge frequency in two groups: temporalis fascia and cartilage island. The temporalis fascia group showed a higher percentage of both purulent and non-purulent discharge, while the cartilage island group had more abundant and scanty discharge. Both groups experienced higher rates of non-foul-smelling and foul-smelling discharge, with no blood staining observed. The temporalis fascia group reported 14.67% ear ache, versus the cartilage group, which had a higher frequency as well. Tinnitus was more common in the temporalis fascia group at 23.33%, with the cartilage group at 26.67%. No cases of vertigo were reported in either group (**Table 2**).

Table 2: Compare the frequency of ear discharges, earaches, tinnitus, and vertigo between the temporalis fascia group and the cartilage island group, highlighting the occurrence rates of these symptoms.

		Temporalis Fascia Group (n=30)		Cartilage Island Group (n=30)	
		n	%	n	%
Type	Purulent	25	83.33	26	86.67
	Non- purulent	5	16.67	4	13.33
Quantity	Copious discharge	27	90.00	26	86.67
	Scanty discharge	3	10.00	4	13.33
Odor	non foul smelling	4	13.33	3	10.00
	foul smelling	26	86.67	27	90.00
Blood Stained	Yes	0	0.00	0	0.00
	No	30	100.00	30	100.00
Ear Ache	Yes	14	46.67	10	33.33
	No	16	53.33	20	66.67
Tinnitus	Yes	10	33.33	8	26.67
	No	20	66.67	22	73.33
Vertigo	Yes	0	0.00	0	0.00
	No	30	100.0	30	100.0

In a comparison of ear disease frequency, 16.67% of the temporalis fascia group had bilateral ear disease, while this was true for 26.67% of the cartilage island group. Surgical procedures revealed a distribution of 53.3% for the right ear and 47.7% for the left in the temporalis fascia group, whereas the cartilage island group showed equal distribution at 50.0% for both ears. Regarding perforation grades, the cartilage island group had 3.33% with grade I, 46.67% with grade II, 30% with grade III, and 20% with grade IV. The temporalis fascia group had 6.67% with grade I, along with a similar distribution as the cartilage group across the other grades (**Table 3**).

Table 3: comparison of the frequency of unilateral or bilateral perforation between the temporalis fascia group and the cartilage island group, as well as the frequency of different grades of perforation between the two groups.

		Temporalis Fascia Group (n=30)		Cartilage Island Group (n=30)		Chi Sq.	p-Value
		n	**%**	**n**	**%**		
Unilateral or Bilateral	Unilateral	25	83.33	22	73.33	0.39	0.531
	Bilateral	5	16.67	8	26.67		
Side of Operation	**Right**	16	53.33	15	50.00	0.07	0.796
	Left	14	46.67	15	50.00		
Grade of perforation	I	2	6.67	1	3.33	0.51	0.916
	II	13	43.33	14	46.67		
	III	9	30.00	10	33.33		
	IV	6	20.00	5	16.67		
	V	0	0.00	0	0.00		

The study compares the frequency of different AB gap (dB) between the temporalis fascia group and the cartilage island group. The majority of patients (53.33% in the temporalis fascia group and 50% in the cartilage island group) had an AB gap between 21-30 dB before surgery. The temporalis fascia group had a greater gap than the cartilage island group (**Table 4**).

Table 4: Comparison of the frequency of the AB gap (dB) between the temporalis fascia group and the cartilage island group, focusing on the gain in AB gap.

AB gap (dB)		Temporalis Fascia Group (n=30)		Cartilage Island Group (n=30)		Chi Sq.	p-Value
		n	%	n	%		
Pre-Operative	1-10	1	3.33	1	3.33	0.37	0.946
	11-20	7	23.33	9	30.00		
	21-30	16	53.33	15	50.00		
	31-40	6	20.00	5	16.67		
Post-operative at 8 week	0-10	15	50.00	11	36.67	3.82	0.350
	11-20	13	43.33	13	43.33		
	21-30	1	3.33	5	16.67		
	31-40	1	3.33	1	3.33		

In a study comparing the temporalis fascia group and cartilage island group, the uptake rates were 83.33% and 90.0% respectively, with no significant difference (p-value > 0.05). Medialization of the graft occurred in 10% of patients in the temporalis fascia group, but none in the cartilage island group (**Table 5**).

Table 5: Comparison of the graft uptake frequency between the temporalis fascia group and the cartilage island group, along with the frequency of medialization, is presented.

		Temporalis Fascia Group (n=30)		Cartilage Island Group (n=30)		Chi Sq.	p-Value
		n	%	n	%		
Graft taken up	Yes	25	83.33	27	90.0	0.35	0.554
	No	5	16.67	3	10.0		
Medialization	Yes	5	16.67	0	0.00	1.40	0.236
	No	25	83.33	30	100.00		

Discussion

Chronic suppurative otitis media (CSOM) is a common condition marked by a perforated tympanic membrane, resulting in hearing loss and ear discharge. This leads to social challenges for patients, prompting them to seek assistance from ENT specialists. Tympanoplasty, a frequent procedure in otology, repairs tympanic membrane defects, with autologous cartilage grafts being preferred over temporalis fascia for large or subtotal perforations, due to easier harvesting and better success rates.

The study found that the majority of patients in the temporalis fascia group and 56.67% in the cartilage island group were between 20 and 30 years old. There was no significant difference in mean age between the two groups. Previous studies have found that the mean age of patients in the cartilage group was 31.3±4.9 years, while in the fascia group it was 30.2±4.2 years [11]. The average age in the temporalis fascia graft group was 28 years, while in the cartilage palisade graft group it was 30 years [12]. A separate study by Ferlito *et al.,* found the average age of patients in the fascia group was 52.5 ± 18.9 years [13].

The study found that the proportion of males and females in the temporalis fascia group was 53.33% and 46.67%, respectively, while in the cartilage island group it was 56.67% and 43.33%. Both groups were comparable in terms of gender, with males being more frequently affected. Another studies found a male-to-female ratio of 1:2.21 in the cartilage group and 1:1.77 in the fascia group [11,13].

The study highlights that acute suppurative otitis media (ASOM) is a bacterial infection of the middle ear, marked by inflammation and pus behind the eardrum, potentially causing damage to the ear and adjacent structures. The onset duration was similar for both the temporalis fascia and cartilage island groups. In the temporalis fascia group, 83.33% had ASOM, with trauma triggering 16.67% of cases. In the cartilage island group, 86.67% experienced ASOM, with only 13.13% due to trauma. The two groups were similar in event type, with a study by Singh *et al.,* noting 30 cases of perforation due to post-traumatic factors and observing twenty cases linked to post-traumatic, post-acute otitis media [14].

The choice of graft material in cartilage tympanoplasty and temporalis fascia grafting affects patient outcomes. Poor graft integration can cause permanent tympanic membrane perforation. Temporalis fascia grafts, being thinner and more flexible, facilitate quicker healing. A study revealed an 83.33% incidence of purulent discharge in the temporalis fascia group compared to 86.67% in the cartilage island group, while non-purulent discharge was 16.67% for temporalis fascia and 13.33% for cartilage island. In the temporalis fascia group, abundant discharge was found in 90% of cases, compared to 86.67% in the cartilaginous island group [25].

Tinnitus, a frequently observed symptom in chronic suppurative otitis media (CSOM), involves hearing ringing or buzzing sounds due to persistent inflammation and infection in the middle ear, impacting the eardrum and ossicles. A study by Aslam *et al.,* emphasized the importance of comprehensive evaluations and customized treatment strategies [16]. This finding suggests that surgeons should take graft material into account to lessen tinnitus incidence and enhance patient outcomes.

The study indicates that 6.67% of patients experience grade I perforations, 43.33% grade II, 30% grade III, and 20% grade IV. Among those in the temporalis fascia group, the distribution is 3.33% for grade I, 46.67% for grade II, 33.33% for grade III, and 16.7% for grade IV perforations. Research has shown that successful graft integration is 100% for small and medium-sized holes, 91% for big perforations, and 50% for subtotal perforations [17]. The success rate of graft acceptance is 95% for small perforations, 92% for moderate perforations, and 87% for big perforations. Harkare *et al.,*[18] found 100% success rate for moderate perforations, 67% for big perforations, and 75% for subtotal perforations.

The study revealed that a notable percentage of patients, especially in the temporalis fascia and cartilage island groups, exhibited an auditory brainstem gap of 21 to 30 decibels prior to surgery. In the temporalis fascia group, the average air conduction hearing thresholds were 30.23 ± 7.77 dB before surgery and 14.60 ± 4.6 dB post-surgery, demonstrating a reduction in the AB gap by 15.63 dB [13]. Eighteen patients, representing sixty percent of the total, achieved an air-bone gap (ABG) closure of at least fifteen decibels. Thirty percent of patients achieved AB gap closure of 10 to 15 dB, while 10% had minimal improvement in hearing with an AB gap of less than 10 dB.

The average increase in AB gap and the ratio of AB gap closure are more accurate indicators of hearing improvement after tympanoplasty. A closure ratio of more than 50% is considered a successful outcome in type 1 tympanoplasty [35]. In a study by Mohanty *et al.,* the average improvement in AB gap was 17.52 ±3.84 dB in the cartilage group and 15.26 ±5.56 dB in the fascia group [11].

In this study, the AB gap closure rates of the cartilage and fascia groups were 62.84 ±11.87% and 53.6 ±19.6%, respectively. The cartilage showed a higher and statistically significant closure rate [7,8]. A study by Soezen *et al.,* investigated the use of cartilage grafts in patients who were more likely to fail, comparing the morphologic and functional outcomes of these grafts with those of temporalis fascia grafts [19].

The study by Lee *et al.,*[20] found that the mean reduction in the AB gap was 10.7 dB in the temporalis fascia group and 11.9 dB in the cartilage island group, supporting the idea that both graft procedures are similar in minimizing the AB gap in patients with chronic suppurative otitis media (CSOM). However, the choice of graft material for best hearing restoration should be based on specific patient variables and surgical considerations. In a study, the uptake rate was 83.33% in the temporalis fascia group and 90.0% in the cartilage island group [21]. The cartilage group had a higher rate of morphologic success after 24 months than the fascia group.

Lee *et al.,*[20] demonstrated a graft uptake rate of 91% in the temporalis fascia group and 92% in the cartilage island group, indicating high success rates in graft integration. Both temporalis fascia and cartilage island grafts have high uptake rates in patients

with CSOM undergoing tympanoplasty, suggesting successful integration and encouraging results in middle ear reconstruction. Surgeons should consider individual patient characteristics and surgical preferences when selecting the appropriate graft material.

The study found that pain only occurred in the temporalis fascia group, and no pain was noted at the donor site in any cases in the cartilage island group. No further complications were observed in either group. Kumar *et al.,* found that the cartilage island group had lower pain scores at the donor site compared to the temporalis fascia group [22].

The study demonstrates strengths such as a large patient sample, diverse outcome measures, a 6-month to 1-year follow-up period, and direct comparison of two techniques, enhancing result reliability. However, it has limitations including a retrospective design, potential biases from selection and data accuracy, surgeon variability, subjective measures, and short follow-up periods, which could impact generalizability and the understanding of long-term outcomes.

Conclusions

The study assessed hearing recovery post-tympanoplasty for chronic otitis media using cartilage and temporalis fascia grafts. Most patients were aged 20-30, with temporalis fascia showing higher disease onset within 1-12 months. Pre-surgery, AB gaps ranged from 21-30 dB. Although uptake rates were higher for cartilage grafts, this difference was not statistically significant. Pain was reported in the temporalis fascia group, while no pain was noted in the cartilage group's donor site. Further research is required to evaluate the long-term efficacy of both methods.

Declaration

Ethical Clearance

Aapproved by Institutional ethics committee

Contributorship

All author contributor equally.

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Conflict of interest

There is no conflict of interest among authors.

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Contributors

VS: Concept design, Supervision, Patients enrollment, Patients treatment, Supervision, Case management, Radiological investigations

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