Section: Otorhinolaryngology

Original Research Article

HEARING IMPROVEMENT AND GRAFT UPTAKE IN TYMPANOPLASTY – TEMPORALIS FASCIA GRAFT VERSUS CARTILAGE REINFORCEMENT: A PROSPECTIVE STUDY

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Received *: 16/09/2026*
Received in revised form *: 14/10/2026*
Accepted *: 27/10/2026*

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DOI: 10.70034/ijmedph.2026.4.387

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (4); 2575-2584

ABSTRACT

Background: Different materials are used as grafts in tympanoplasty. They are temporalis fascia, cartilage, perichondrium, fat etc. Temporalis fascia graft is the most commonly used graft material in tympanoplasty. Cartilage graft technique which was commonly done in past has re-emerged as a popular technique with the advent of endoscopic middle ear surgeries. But the hearing outcome of primary cartilage tympanoplasty is considered inferior to temporalis fascia grafting alone, though the graft outcome is superior. Due to inconsistent results of previous studies, this prospective study is done to compare the outcomes of cartilage reinforcement and temporalis fascia tympanoplasty in terms of both graft uptake and hearing. The present study was conducted to find the effectiveness of cartilage reinforcement. tympanoplasty in providing good long term graft outcome and improvement in hearing when compared to temporalis fascia tympanoplasty.

Materials and Methods: The study was conducted in ENT department of Pushpagiri Institute of Medical Sciences and Research Centre, Kerala, India. Patients with chronic otitis media, mucosal disease, who underwent primary tympanoplasty were included in the study and were randomly allocated into two groups. In one group, tympanoplasty was be done using temporalis fascia alone as graft material. Graft was kept using underlay technique. In the other group, temporalis fascia was reinforced by keeping a piece of cartilage medial to it, either from concha or tragus. Graft uptake will be assessed using microscope/otoscope, during 3 months and 6 months follow up to know the short term and long-term outcomes. Hearing improvement will be assessed using pure tone audiogram. Values of pure tone average at 500, 1000 & 2000 Hz and air-bone gap will be obtained preoperatively and post operatively by 3 and 6 months follow up.

Results: Graft was intact in 77% of temporalis fascia tympanoplasties while graft was noted as intact in all cases of cartilage reinforcement tympanoplasty. While 58% of temporalis fascia tympanoplasty had good outcome when considering gain in ABG, it was 84% in cartilage reinforcement tympanoplasty.

Conclusion: Cartilage reinforcement tympanoplasty was significant in terms of both improvement in hearing outcome and graft uptake while temporalis fascia tympanoplasty was not significant in both categories. This study infers that thickness of cartilage do not hinder the hearing outcome of cartilage reinforcement tympanoplasties. Moreover, it provides better support to graft.

Keywords: Tympanoplasty; Pure tone audiometry; Fascia; Ear Cartilage; Hearing; Surgery.

INTRODUCTION

Chronic otitis media is a disease which is a major cause of morbidity in India. Large proportion of people have safe or mucosal disease. It leads to otorrhoea and hearing loss. One of the corrective procedures is tympanoplasty[1]. Tympanoplasty implies reconstruction of the tympanic membrane with eradication of disease in middle ear and reconstruction of hearing mechanism.

Approaches And Incisions Used In Tympanoplasty

1. Endomeatal or Transcanal Approach- It is used to raise a tympanomeatal flap to expose the middle ear. It requires the meatus and canal to be wide enough to work. Rosen's incision consists of two parts: (i) a small vertical incision at 12 o'clock position near the annulus and (ii) a curvilinear incision starting at 6 o'clock position to meet the first incision in the posterosuperior region of the canals, 5–7 mm away from the annulus. Posterior meatal canal skin is raised in continuity with tympanic membrane, after dislocating the annulus from the sulcus.
2. Endaural Approach - Endaural approach is made through Lempert's incision. It is used in tympanoplasties involving large tympanic membrane perforations.

It consists of two parts-

Lempert I: It is semicircular incision, made from 12 o'clock to 6 o'clock position in the posterior meatal wall at the bony–cartilaginous junction.

Lempert II: Starts from the first incision at 12 o'clock and then passes upwards in a curvilinear fashion between tragus and the crus of helix. It passes through the incisura terminalis and thus does not cut the cartilage.

Postaural (or Wilde's) Incision: It starts at the highest attachment of the pinna, follows the curve of retroauricular groove, lying 5 mm behind it, and ends at the mastoid tip. In infants and children up to 2 years of age, the mastoid process is not developed and the facial nerve lies exposed near its exit, and the incision, therefore, is slanting posteriorly, avoiding lower part of the mastoid. Some surgeons prefer to make the postaural incision in the sulcus (retroauricular groove).[2]

Various techniques are employed in tympanoplasty.

1. Underlay technique - It is the technique of placing grafting material medial to the annulus.
2. Overlay technique - In this, graft material is placed lateral to fibrous layer of tympanic membrane after removing all the squamous epithelium from lateral surface of tympanic membrane remnant.
3. Interlay technique - It is a combination of the techniques described before i.e. overlay and underlay. It is done in situations where malleus is present. In this the temporalis fascia graft was placed lateral to the long process of malleus and medial to the tympanic membrane remnant and anterior annulus.

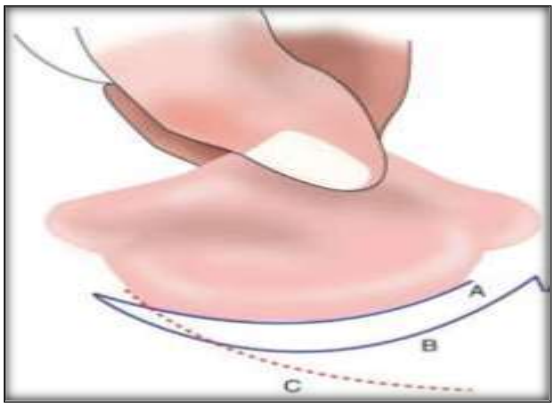

Figure 1: Postauricular (William Wilde's) incision A) Sulcus incision B) Postaural incision in adults C) Postural incision in infants.

Tympanoplasty was introduced by Wullstein in 19523. Different types of graft materials are used in this surgical technique. They are temporalis fascia, cartilage, fat, perichondrium etc.[4] Aims of grafting are to reproduce the natural characteristics of the tympanic membrane in terms of vibration, conduction of sound and resistance to negative middle ear pressure.[5] Temporalis fascia has been abundantly used worldwide owing to its ease of accessibility, abundant availability, low basal metabolic rate and similar thickness to tympanic membrane. But temporalis fascia has much poorer healing in cases of tubal dysfunction, tympanic fibrosis, total perforation and in revision surgical procedures. Moreover, long term outcomes are better in case of cartilage grafts.[6] Due to this, in the last decade, there has been renewed interest in the use of cartilage grafts as an alternative.[7]

Various factors like greater firmness, high resistance to resorption and retraction, long term survival owing to nourishment by diffusion makes cartilage a favourable material for tympanoplasties.[8,9] Even though temporalis fascia and perichondrium are the most commonly used graft materials, they can atrophy and lead to failure of tympanoplasty procedure especially in patients with eustachian tube dysfunction and other high risk ears with cholesteatoma, prior surgery and atelectasis.[10] Conchal and tragal cartilage are the two most commonly used cartilaginous grafts. Long term survival can be achieved since cartilage graft is nourished largely by diffusion and not by neovascularization. They can resist resorption and retraction in cases of eustachian tube dysfunction.[11] The cymba concha cartilage is within the operative field and has an average thickness of 0.8 mm. Its concave contour resembles the conical shape of the normal tympanic membrane. This cartilage has an average thickness similar to fossa triangularis cartilage (0.775 mm) and is thinner than tragal cartilage (1.016 mm). Different techniques are sort including stripping perichondrium from both sides of

cartilage, preserving perichondrium on one side or both sides or preserving perichondrium on one side and thinning cartilage on other side.[12] Although the thickness of the cartilage graft may decrease the middle ear space, this was not found to have any significant adverse effect on the hearing results post cartilage tympanoplasty.[11]

Chronic otitis media has a high prevalence rate in the population and its treatment continues to be a challenge for the surgeons. They are many factors that could interfere in the tympanoplasty success and the surgical results. In a study by Lee et al., i.e, a retrospective study of 423 myringoplasty-only operations showed that size does influence success; the success rate for small perforations was 74.1% compared with 56.0% for large perforations.[19] Merenda D et al. did a research to determine if preoperative tympanometric volumes have any predictive value in the success of pediatric tympanoplasty. It was concluded that a large tympanometric volume may be an important factor when considering tympanoplasty in children. In addition, disease of the contralateral ear may be a prognostic indicator.[20]

MATERIALS AND METHODS

This study received institutional ethical committee clearance with Ref no: PIMSRC/E1/388A/36/2018. This was a prospective study with control group constituting all chronic otitis media – mucosal disease patients who came to ENT OPD of Pushpagiri institute of medical sciences, Thiruvalla and subsequently underwent tympanoplasty with/without mastoidectomy over a period of 1 and ½ years, after receiving their informed consents. Those who underwent ossiculoplasty along with tympanoplasty and revision cases were excluded from the study. Parental consent was obtained in cases of paediatrics. Patients were consecutively recruited to each group. In one group, tympanoplasty was done using temporalis fascia alone as graft material. Graft was kept using underlay technique. In the other group, temporalis fascia was reinforced by keeping a piece of cartilage medial to it, either from concha or tragus. It was kept without thinning. Perichondrium was stripped from the cartilage. It was circular piece of cartilage with diameter around 0.8mm. Temporalis fascia tympanoplasties were done by two surgeons. Temporalis fascia reinforced with cartilage tympanoplasty was done exclusively by one of these surgeons. Graft uptake was assessed using microscope/otoscope at 3 months and 6 months follow up to know the short term and long-term outcomes. Hearing improvement was assessed using pure tone audiogram. Values of pure tone average at 500, 1000 & 2000 Hz and air-bone gap were obtained preoperatively and post operatively by 3 and 6 months follow up. Gain in pure tone average value of 15 dB HL was considered significant. Air-bone gap closure of 10 dB was also considered significant.

Data was analysed and presented as mean, standard deviation median and range for continuous variables such as age and hearing loss & for categorical variables such as mastoidectomy and graft uptake. Independent t test was used to compare quantitative parameters between categories. Chi-square test was used to find association between categorical variables. Mean differences in the hearing loss between baseline and postoperative values within each group & between groups were compared. Percentage of graft uptake between the two groups was also compared. For all statistical interpretations, $p<0.05$ was considered the threshold for statistical significance. Statistical analyses were performed by using a statistical software package SPSS, version 20.0. A p value of <0.05 was considered statistically significant.

RESULTS

Sixty-nine patients who underwent temporalis fascia or temporalis fascia with cartilage reinforcement tympanoplasties who had complete follow-up, were included in this study. Out of this, 31 patients underwent temporalis fascia tympanoplasty. Rest 38 patients have undergone cartilage reinforcement tympanoplasty. Data was analysed based on patient factors, surgical factors and results.

Background Characteristics of Patients: In our study, maximum number of people who underwent temporalis fascia tympanoplasty were in the middle age while a greater number of old age people have undergone cartilage tympanoplasty.

Background characteristics of patients

Table 1: Comparison of age based on type of tympanoplasty

Age	Temporalis fascia alone		Temporalis facia augmented with conchal cartilage	
	Count	Percent	Count	Percent
<30	8	25.8	7	18.4
31 - 40	5	16.1	6	15.8
41 - 50	13	41.9	7	18.4
51 - 60	5	16.1	6	15.8
>60	0	0.0	12	31.6
Mean ± SD	40.2 ± 11.4		48.2 ± 16	

t = 2.36*, p = 0.021

In this study, number of males and females who underwent each tympanoplasty were almost similar though slightly higher number of males underwent temporalis fascia reinforced with cartilage tympanoplasty while more of females underwent temporalis fascia tympanoplasty.

Table 2: Comparison of sex and types of tympanoplasty

Dry/wet	Temporalis fascia alone		Temporalis facia augmented with conchal cartilage		c2	p
	Count	Percent	Count	Percent		
Dry	26	83.9	20	52.6	7.5**	0.006
Wet	5	16.1	18	47.4		

**: - Significant at 0.01 level

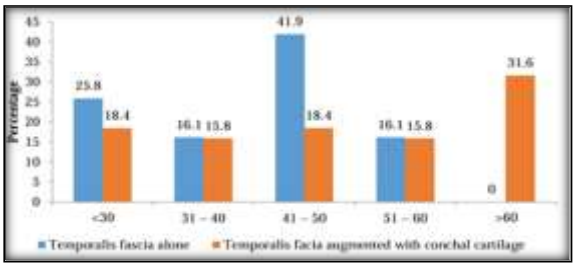

Figure 1: Comparison of age and types of tympanoplasty

Most number of cases who underwent temporalis fascia tympanoplasty was having large central perforation and larger number of cases with cartilage reinforcement tympanoplasty have had subtotal perforation.

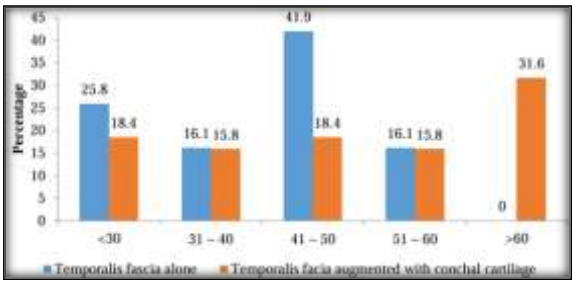

Figure 2: Comparison of sex and types of tympanoplasty.

Table 3: Distribution of perforation and types of tympanoplasty

Perforation	Temporalis fascia alone		Temporalis facia augmented with conchal cartilage	
	Count	Percent	Count	Percent
Sutotal perforation	5	16.1	12	31.6
Large central perforation	10	32.3	7	18.4
Central perforation-Anterior quadrant	0	0.0	1	2.6
Central perforation-Antero inferior	1	3.2	3	7.9
Central perforation-Anterosuperior quadrant	2	6.5	2	5.3
Central perforation-Posterior quadrant	3	9.7	1	2.6
Central perforation-Postero inferior	1	3.2	2	5.3
Central perforation-Postero superior quadrant	2	6.5	0	0.0
Central perforation-Anteroinferior & Posteroinferior	0	0.0	1	2.6
Medium sized central perforation-Anterior quadrant	3	9.7	4	10.5
Medium sized central perforation-Inferior quadrant	1	3.2	0	0.0
Medium sized central perforation-Posterior quadrant	3	9.7	5	13.2

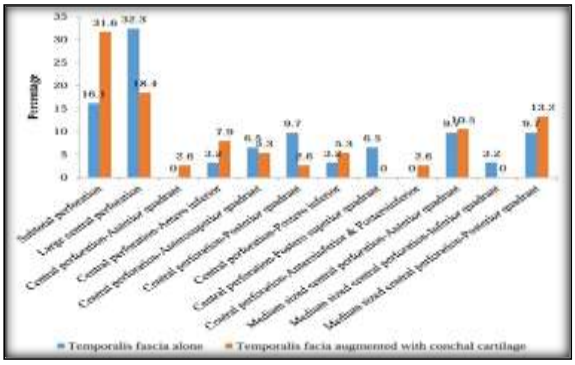

Figure 3: Distribution of perforation and types of tympanoplasty

As per analysis of data, more of dry ears underwent temporalis fascia tympanoplasty while higher number of wet ears have undergone cartilage reinforcement tympanoplasty.

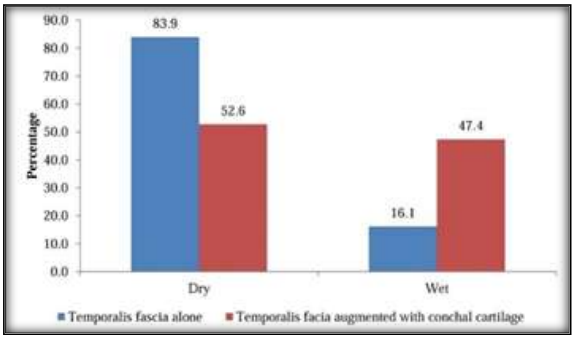

Figure 4: Comparison of Dry/wet and types of tympanoplasty

While 93 percent of temporalis fascia tympanoplasties had conductive hearing loss alone and rest had mixed hearing loss, 73 percent of cartilage reinforcement tympanoplasty had conductive hearing loss alone.

Table 5: Comparison of type of hearing loss and types of tympanoplasty

Type of hearing loos	Temporalis fascia alone		Temporalis facia augmented with conchal cartilage		c2	p
	Count	Percent	Count	Percent		
Conductive hearing loss	29	93.5	28	73.7	4.69*	0.030
Mixed hearing loss	2	6.5	10	26.3		

*: - Significant at 0.05 level.

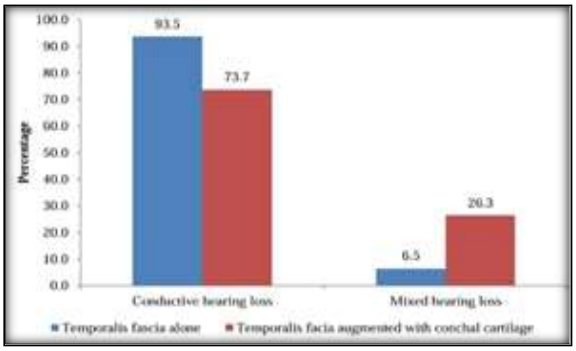

Figure 5: Comparison of type of hearing loss and types of tympanoplasty Background Characteristics Based on Surgical Factors

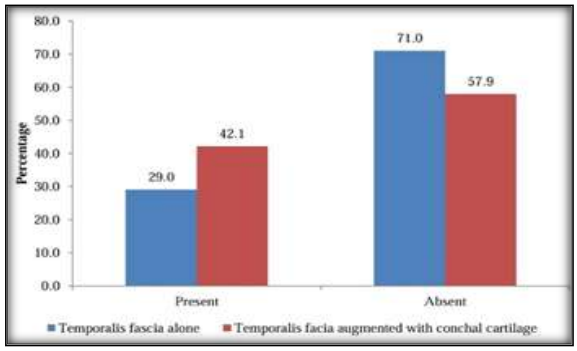

Figure 6: Comparison of mastoidectomy and types of tympanoplasty

Analysis of data indicated that mastoidectomy was done in a lesser number of patients. Out of 69 patients, only 25 cases underwent cortical mastoidectomy along with tympanoplasty. Among these, a greater number of mastoidectomies were done in cartilage reinforcement tympanoplasty.

1. Comparison of hearing improvement in tympanoplasty by temporalis fascia and cartilage

Out of 69 cases of tympanoplasties, betterment in PTA was higher in cartilage reinforcement tympanoplasty, both 3 months and 6 months postoperatively.

Table 6: Comparison of mastoidectomy and types of tympanoplasty

Mastoidectomy	Temporalis fascia alone		Temporalis facia augmented with conchal cartilage		c2	p
	Count	Percent	Count	Percent		
Present	9	29.0	16	42.1	1.26	0.261
Absent	22	71.0	22	57.9		

Table 7: Comparison of PTA in tympanoplasty at different stage by temporalis fascia and cartilage reinforcement

PTA	Temporalis fascia alone		Temporalis facia augmented with conchal cartilage	
	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)
Pre Op	38.2 ± 14.2	35 (30 - 48.3)	42.5 ± 12.1	41.6 (31.75 - 53.3)
3 month	29.3 ± 14.1	25 (18.3 - 33.3)	26.8 ± 8.2	25 (21.6 - 31)
6 month	26.5 ± 14.9	25 (15 - 31.6)	21.6 ± 8.3	21.8 (15 - 25.5)

Table 8: Comparison of improvement in PTA tympanoplasty by temporalis fascia and cartilage reinforcement

Type of tympanoplasty	Mean	SD	N	t	p
Temporalis fascia alone	11.9	11.3	31	3.39**	0.001
Temporalis facia augmented with conchal cartilage	20.1	8.8	38		

**: - Significant at 0.01 level

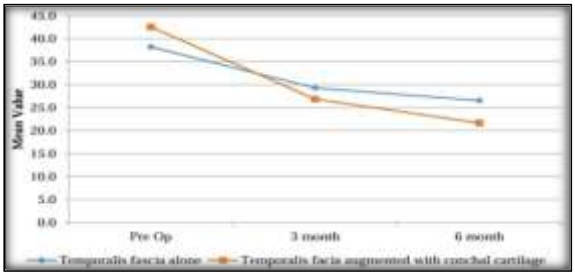

Figure 7: Comparison of PTA in tympanoplasty at different stage by temporalis fascia and cartilage reinforcement

Mean gain in PTA was 11.9 for temporalis fascia tympanoplasty while it was 20.1 in cartilage reinforcement tympanoplasty. Hence, significant improvement is noted in cartilage reinforcement tympanoplasty.

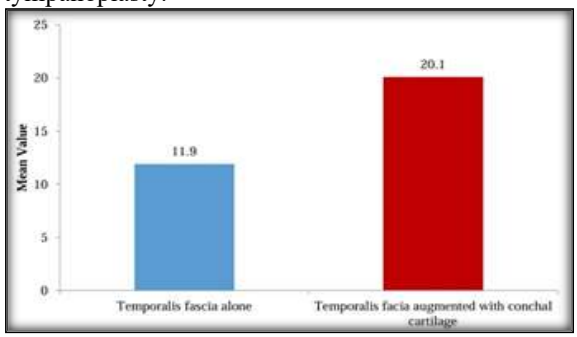

Figure 8: Comparison of improvement in PTA tympanoplasty by temporalis fascia and cartilage reinforcement.

Table 9: Comparison of outcome of tympanoplasties via either technique and gain in PTA

ABG	Temporalis fascia alone		Temporalis facia augmented with conchal cartilage	
	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)
Pre Op	26.2 ± 10.4	25 (20 - 28.3)	26.7 ± 7.7	25 (21.6 - 32.03)
3 month	18.9 ± 10.9	16.8 (10.8 - 23.3)	16.1 ± 5.2	16.6 (13.3 - 18.73)
6 month	16.2 ± 11.6	13.3 (6.6 - 20)	12.6 ± 5.1	11.6 (8.3 - 16.6)

**: - Significant at 0.01 level

Table 10: Comparison of ABG in tympanoplasty at different stage by temporalis fascia and cartilage reinforcement

Type of tympanoplasty	Mean	SD	N	t	p
Temporalis fascia alone	9.7	9.2	31	2.21*	0.031
Temporalis facia augmented with conchal cartilage	14.1	7.6	38		

*: - Significant at 0.05 level

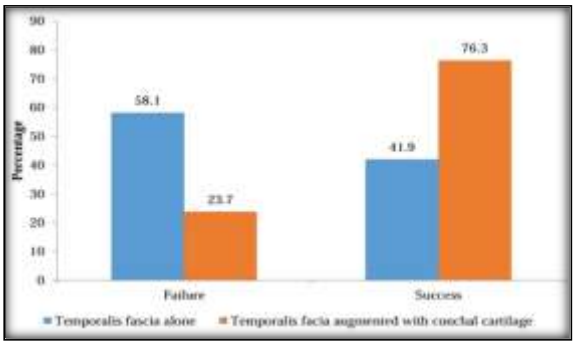

Figure 9: Comparison of outcome of tympanoplasties via either technique and gain in PTA

In this series, cartilage reinforcement tympanoplasty has better outcome in terms of improvement in hearing assessed through gain in PTA. Gain in PTA > 15 dbHL was taken as significant in this study. So, cartilage reinforcement tympanoplasty was identified as statistically significant.

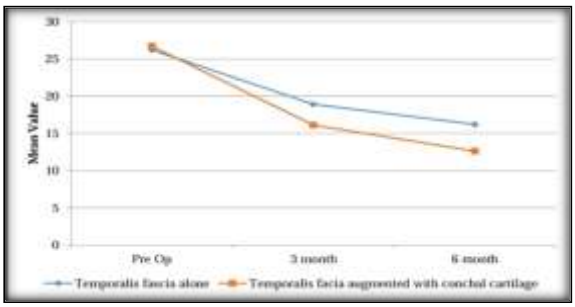

Figure 10: Comparison of ABG in tympanoplasty at different stage by temporalis fascia and cartilage reinforcement

On analysing 31 cases of temporalis fascia tympanoplasty and 38 cases of cartilage reinforcement tympanoplasty, more air borne gap closure was detected in cartilage reinforcement tympanoplasty.

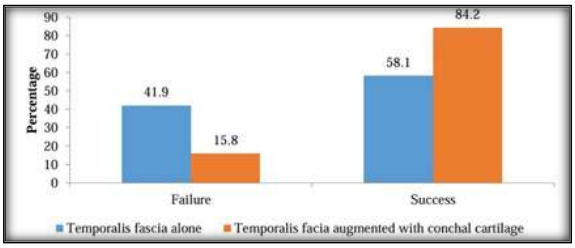

Figure 11: Comparison of outcome of tympanoplasties via either technique and gain in ABG

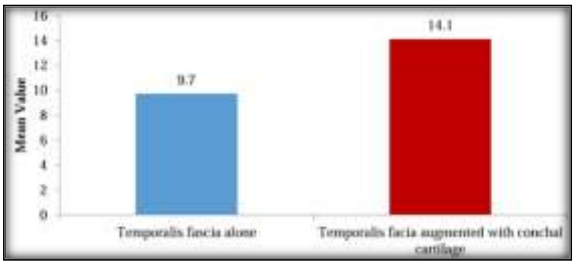

Figure 12: Comparison of improvement in ABG and tympanoplasty by temporalis fascia and cartilage reinforcement

While 58% of temporalis fascia tympanoplasty had good outcome when considering gain in ABG, it was 84% in cartilage reinforcement tympanoplasty. From the analysis, it was inferred that significant improvement in hearing was present when temporalis fascia was augmented with cartilage.

2. Comparison of graft uptake in tympanoplasty by temporalis fascia andcartilage reinforcement.

Table 11: Outcome (failure / success) by type of tympanoplasty

	Temporalis fascia alone		Temporalis fascia augmented with conchal cartilage		χ2c	p
	Count	Percent	Count	Percent		
Failure	13	41.9	6	15.8	5.85*	0.016
Success	18	58.1	32	84.2		

* significant at $p < 0.05$

Table 12: Comparison of graft uptake and types of tympanoplasty

Graft intact	Temporalis fascia alone		Temporalis facia augmented with conchal cartilage		c2	p
	Count	Percent	Count	Percent		
Yes	24	77.4	38	100.0	9.55**	0.002
No	7	22.6	0	0.0		

**: - Significant at 0.01 level

Table 13: Association of patient factors with significant gain in pure tone average (PTA), by type of tympanoplasty

Type of tympanoplasty			No significant gain in PTA		Significant gain in PTA		p#
			Count	Percent	Count	Percent	
Temporalis fascia alone	Age	≤50	16.0	61.5	10	38.5	0.341
		>50	2.0	40.0	3	60.0	

	Sex	Male	5	71.4	2	28.6	0.282
		Female	13	54.2	11	45.8	
	Dry/wet perforation	Dry	15	57.7	11	42.3	0.358
		Wet	3	60.0	2	40.0	
	Mastoidectomy	Present	4	44.4	5	55.6	0.440
		Absent	14	63.6	8	36.4	
Temporalis fascia augmented with conchal cartilage	Age	≤50	6	30.0	14	70.0	0.659
		>50	3	16.7	15	83.3	
	Sex	Male	3	30.0	7	70.0	0.573
		Female	6	21.4	22	78.6	
	Dry/wet perforation	Dry	5	25.0	15	75.0	0.279
		Wet	4	22.2	14	77.8	
	Mastoidectomy	Present	2	12.5	14	87.5	0.160
		Absent	7	31.8	15	68.2	

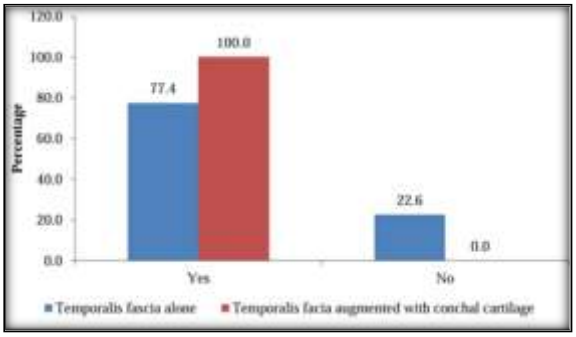

Figure 13: Comparison of graft uptake and types of tympanoplasty

In our study, graft was intact in 77% of temporalis fascia tympanoplasties while graft was noted as intact in all cases of cartilage reinforcement tympanoplasty. Hence, statistical significance is noted in cartilage reinforcement tympanoplasty in terms of graft uptake too.

Here, we analysed whether variables like age, sex, dry/wet perforation, associated with mastoidectomy or not, are deciding factors in hearing outcome of tympanoplasty by either temporalis fascia alone or temporalis fascia augmented with cartilage techniques, assessed using gain in PTA. It was found that they did not affect the outcome of tympanoplasty by either technique.

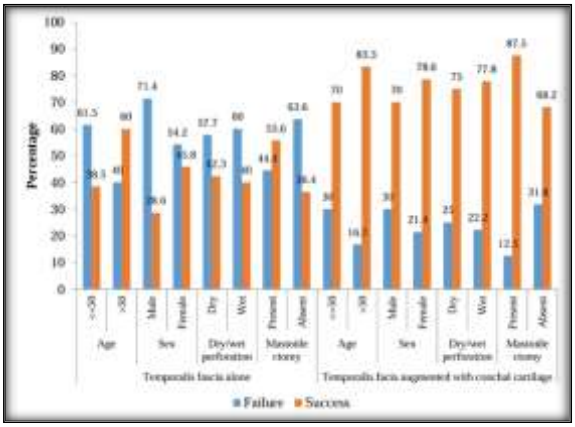

Figure 14: Comparison of hearing outcome of tympanoplasty via both techniques (using gain in PTA) with selected variables

Table 14: Association of patient factors with significant gain in air-bone gap (ABG), by type of tympanoplasty

Type of tympanoplasty			No significant gain in ABG		Significant gain in ABG		p#
			Count	Percent	Count	Percent	
Temporalis fascia alone	Age	≤50	11.0	42.3	15	57.7	0.659
		>50	2.0	40.0	3	60.0	
	Sex	Male	3.0	42.9	4	57.1	0.069
		Female	10.0	41.7	14	58.3	
	Dry/wet perforation	Dry	12.0	46.2	14	53.8	0.642
		Wet	1.0	20.0	4	80.0	
	Mastoidectomy	Present	3.0	33.3	6	66.7	0.031
		Absent	10.0	45.5	12	54.5	
Temporalis fascia augmented with conchal cartilage	Age	≤50	1.0	5.0	19	95.0	0.285
		>50	5.0	27.8	13	72.2	
	Sex	Male	4.0	40.0	6	60.0	0.384
		Female	2.0	7.1	26	92.9	
	Dry/wet perforation	Dry	4.0	20.0	16	80.0	0.417
		Wet	2.0	11.1	16	88.9	
	Mastoidectomy	Present	2.0	12.5	14	87.5	0.498
		Absent	4.0	18.2	18	81.8	

Table 15: Association of patient factors with graft status, by type of tympanoplasty

Type of tympanoplasty			Graft intact: Yes		Graft intact: No		p#
			Count	Percent	Count	Percent	
Temporalis fascia alone	Age	≤50	21.0	80.8	5	19.2	0.312
		>50	3.0	60.0	2	40.0	
	Sex	Male	6.0	85.7	1	14.3	0.490
		Female	18.0	75.0	6	25.0	
	Dry/wet perforation	Dry	20.0	76.9	6	23.1	0.688
		Wet	4.0	80.0	1	20.0	
	Mastoidectomy	Present	6.0	66.7	3	33.3	0.319
		Absent	18.0	81.8	4	18.2	
Temporalis fascia augmented with conchal cartilage	Age	≤50	20.0	100.0	0	0.0	-
		>50	18.0	100.0	0	0.0	
	Sex	Male	10.0	100.0	0	0.0	-
		Female	28.0	100.0	0	0.0	
	Dry/wet perforation	Dry	20.0	100.0	0	0.0	-
		Wet	18.0	100.0	0	0.0	
	Mastoidectomy	Present	16.0	100.0	0	0.0	-
		Absent	22.0	100.0	0	0.0	

p-value as given in the source tables.

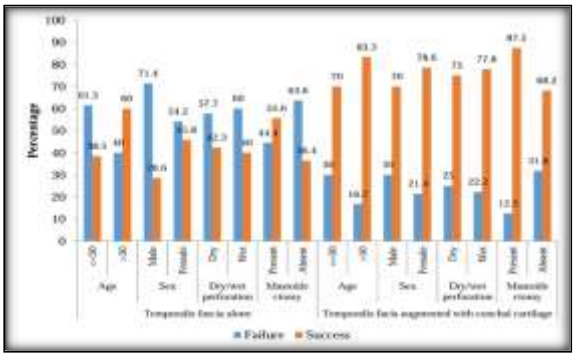

Figure 15: Comparison of hearing outcome of tympanoplasty via both techniques (using gain in ABG) with selected variables

It was analysed whether variables like age, sex, dry/wet perforation, associated with mastoidectomy or not, are deciding factors in hearing outcome of tympanoplasty by either temporalis fascia alone or temporalis fascia augmented with cartilage techniques, assessed using gain in ABG. It was found that these variables do not have any effect on the outcome of tympanoplasty by either technique.

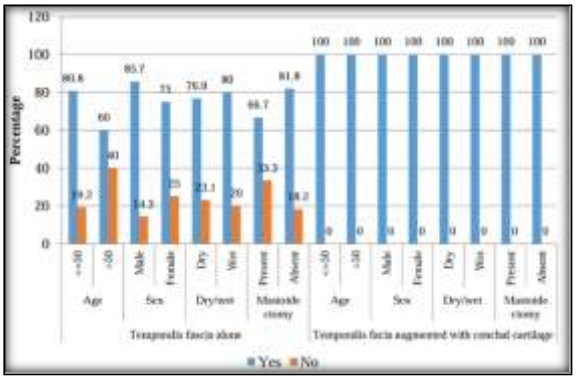

Figure 16: Comparison of graft uptake of tympanoplasty via both techniques with selected variables

It was analysed whether variables like age, sex, dry/wet perforation, associated with mastoidectomy or not, are deciding factors in graft uptake of tympanoplasty by either temporalis fascia alone or temporalis fascia augmented with cartilage techniques, assessed using microscopic/otoscopic analysis of graft, 3 months and 6 months postoperatively. It was found that these variables did not have any effect on graft uptake of tympanoplasty by either technique.

DISCUSSION

In the present study, 69 of chronic mucosal disease were prospectively analysed for postoperative improvement in hearing and graft uptake following temporalis fascia/cartilage reinforcement tympanoplasty. Postoperative hearing was assessed based on improvement in PTA and ABG closure, 3 months and 6 months postoperatively. There were 31 cases in temporalis fascia tympanoplasty group and 38 cases in cartilage reinforcement tympanoplasty group. Patients were consecutively recruited to each group. Various host and surgical factors which could affect the surgical results were considered and analysed. The age distribution of patients who underwent tympanoplasty by either temporalis fascia or fascia + cartilage grafts, was analysed. Minimum age of patient who underwent tympanoplasty was 17 and maximum age was 73. In temporalis fascia group, a greater number of cases were between 41 and 50 years of age while in cartilage reinforcement group, maximum number of people was observed in the elder age group. i.e., above 60 years of age. In middle aged and elderly people, hearing loss was one major problem that made them to proceed with surgery. Second most important cause was discharge from ear. Age did not show any effect on the outcome of tympanoplasties by either technique.

In this series of 69 patients, 70 percent of subjects were females. It infers that higher incidence of chronic otitis media-mucosal disease is in females. This trend was seen in both temporalis fascia tympanoplasty group and cartilage reinforcement group though gender did not show any association with the outcome of tympanoplasty. It was in accordance with similar studies done worldwide.[13]
In this study, size of central perforations in subjects was analysed. It was found that maximum number of patients have undergone surgery in large perforations. It could be due to higher magnitude of hard of hearing in large perforations.[15] Maximum number of patients with large central perforations underwent fascia tympanoplasty. Similarly, a greater number of subjects with subtotal perforations have undergone cartilage reinforcement tympanoplasty. Least number of patients underwent tympanoplasty in small perforations in both groups.
Following data analysis, it was found that majority of cases with dry ear underwent fascia tympanoplasty while number of cases with dry/wet ears was almost similar in cartilage reinforcement groups though number of dry ears was slightly higher when compared to cartilage reinforcement group. Whether dry/wet ear, it did not show any implication on success of tympanoplasty by either of the techniques. In a study by Shreyesh et al to know the outcomes of tympanoplasty, it was concluded that whether the ear is dry/wet was not statistically significant in terms of outcome of tympanoplasty.[14]
Majority of cases did not undergo cortical mastoidectomy. Only 25 out of 69 patients underwent mastoidectomy. A few of the indications of mastoidectomy is when middle ear mucosa is unhealthy with soft tissue proliferation and active discharge. Data analysis showed that majority of wet ears have undergone mastoidectomy. As per this study, no association was seen between mastoidectomy and outcome of tympanoplasty by either technique. In a similar study, it was concluded that the addition of cortical mastoidectomy to type I tympanoplasty did not improve the graft uptake rate or the hearing improvement in cases of chronic suppurative otitis media, mucosal disease.[16]
Cartilage reinforcement tympanoplasty had significant improvement in terms of both hearing outcome and graft uptake. Hearing outcome was analysed here with the help of gain in PTA and gain in ABG, 3 months and 6 months postoperatively. In both these characteristics, there was significant improvement in cartilage reinforcement tympanoplasty when compared to temporalis fascia alone. The inference is in accordance with the studies done by Jalali et al and Yang et al.[17,18] In this study, Temporalis fascia tympanoplasties were done by more than one surgeon, it could have had its own implications in the outcome of study. Though grafts were kept by underlay technique by all surgeons, minor individual variations can affect the results. Very long-term outcomes of graft uptake could not be studied due to the short duration of study.
Results of temporalis fascia tympanoplasty turned insignificant probably because a subset of patients in temporalis fascia group was excluded from the study secondary to inadequate/improper follow up, though minimum sample size was met.
A number of cases with intact graft postoperatively in the temporalis fascia group, did not have 6 months follow up PTA and hence was not included in the study group. Though a few patients were lost for follow up in temporalis fascia augmented with cartilage group too, the numbers were less and hence, did not affect the study outcome in that group.

CONCLUSION

Cartilage reinforcement tympanoplasty is significant in terms of both improvement in hearing outcome and graft uptake while fascia tympanoplasty was not significant in both categories. Insignificance noted in temporalis fascia group could be secondary to inadequate or improper follow up of a subset of patients who were not included in the study. This study infers that thickness of cartilage do not hinder the hearing outcome of cartilage reinforcement tympanoplasties. Moreover, it provides better support to graft.

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