

Original Research Article

Comparative study of outcomes of type-1 tympanoplasty with temporalis fascia only and with cartilage slice reinforcement

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Received: 15 April 2020

Revised: 30 April 2020

Accepted: 01 May 2020

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ABSTRACT

Background: Tympanoplasty is a surgical procedure performed to eradicate infection and restore the function of middle ear. Cartilage slice support offers an extremely reliable method for reconstruction of tympanic membrane in cases of high-risk perforation. The purpose of this study was to evaluate the graft uptake and auditory outcomes of type I tympanoplasty using temporalis muscle fascia only and with cartilage slice reinforcement.

Methods: This prospective study was conducted at the Department of Otorhinolaryngology, Government Medical College, Jalaun, Uttar Pradesh, India from November 2016 to November 2019. There were total of 100 patients, divided in two groups, 50 patients in each group, tympanoplasty type-1 using only temporalis fascia (group-A) and tympanoplasty type-1 using temporalis fascia with cartilage slice reinforcement (group-B). The result was measured on graft uptake and hearing outcome at 6 months postoperatively.

Results: Overall graft uptake rate in group-A was 94%, whereas that in group-B was 100%. The age and sex had no significant effect on the success rate of surgery ($p > 0.05$) in group-A. The average air bone gap (ABG) decreased from 28.3 dB to 10 dB, in group-B, the average ABG was 28.3 dB preoperatively and reached 16.6 dB after surgery. The difference between the rates of ABG improvement in the two groups was significant ($p < 0.01$).

Conclusions: Hearing improvements is better in tympanoplasty type-1 with a temporalis graft only then with cartilage slice reinforcement. However, the graft uptake rate is higher in cartilage reinforcement compare with temporalis muscle fascia only.

Keywords: Tympanoplasty, Temporalis fascia, Cartilage slice reinforcement

INTRODUCTION

Tympanoplasty is a surgical procedure performed to eradicate infection and restore the function of middle ear.¹ Wullstein classified tympanoplasty into five different types, based on two things i.e. the remaining structures of middle ear and how sound is transferred to the oval window.² Temporalis fascia is most commonly used material for the repair of tympanic membrane perforation, other grafting materials have also been used to reconstruct the tympanic membrane like perichondrium, periosteum, vein, cartilage.^{3,4} Utech in

1959, cartilage was used first time for the repair of tympanic membrane perforation.⁵

In recent years especially advances in the fields of optics, microsurgical instrumentation, middle ear prostheses and surgical techniques to achieved the better results various techniques have been introduced like overlay tympanoplasty, the underlay tympanoplasty, over underlay tympanoplasty, gel film sandwich tympanoplasty, crown-cork tympanoplasty, swinging door tympanoplasty, laser-assisted spot welding technique and micro clip technique.⁶⁻¹¹

The cartilage graft is resistant to inflammation and infection and sustains its shape for a long time. Also, tighter than the fascia and does not contain fibrous tissue, so the result after surgery is better.¹²

Tek et al found that there was a statistically significant difference in the rate of graft uptake in the two groups compared the result of tympanoplasty with the anterior cartilage reinforcement technique and tympanoplasty with fascia only.¹³ Khan et al also found that fascia temporalis enhanced with sliced tragal cartilage the rate of closure was 100% and the mean air bone gap (ABG) after the operation was 9.64 dB.¹⁴ In the Indian scenario many patients of chronic otitis media have unhealthy middle ear mucosa and large perforation they require additional support for the graft material to increase the chances of graft uptake.

The purpose of this study was to find graft uptake and auditory outcomes in type I tympanoplasty using temporal fascia only and with cartilage reinforcement, in patients with chronic suppurative otitis media (CSOM).

METHODS

The present retrospective and prospective study was conducted at the department of otorhinolaryngology, Government Medical College and associated hospital Jalaun, U.P., India from November 2016 to November 2019. There were total of 100 patients. All patients were randomly divided into two groups i.e. patients undergoing type 1 tympanoplasty using fascia temporalis only; patients undergoing tympanoplasty type 1 using temporalis fascia with cartilage slice reinforcement. Temporalis fascia was placed as graft in tympanic perforation, supported by a slice of cartilage. Slice was placed anteriorly from hypo tympanum to anterior part of attic. It does not obstruct Eustachian tube opening, as it is curved with concavity facing towards medial wall. The results were measured on graft uptake rate and hearing outcome at 6 months postoperatively by performing pure tone audiometry.

Inclusion criteria

Dry central perforation for more than 3 months with remnant of the pars tensa, all around, intact and mobile ossicular chain, pure, conductive type of hearing loss were included.

Exclusion criteria

Exclusion criteria were patients of age less than 11 years, previous otological surgery, sensorineural hearing loss, ABG more than 35 dB, cholesteatoma.

All patients were operated by post aural route in 50 cases temporalis fascia was harvested and in other 50 cases temporalis fascia with concha cartilage was taken.

Both pre-operative and post-operative audiometry was done after 6 months in all the cases, also audiometric evaluation was on each visit. The results were recorded in a tabulated form and analyzed regularly.

Statistical comparisons were made using one-way analysis of variance, the chi-square test, and the t-test for independent samples. The results were assessed within 95% reliance, and at a significance level of $p < 0.05$.

RESULTS

Out of 100 patients, 65 (65%) were female and 45 (45%) were male patients (Figure 1). The age group of this study patients ranged from 11 to 50 years, more patients were noted in 21 to 30 years (45%), followed by 31 to 40 years (30%) (Figure 2).

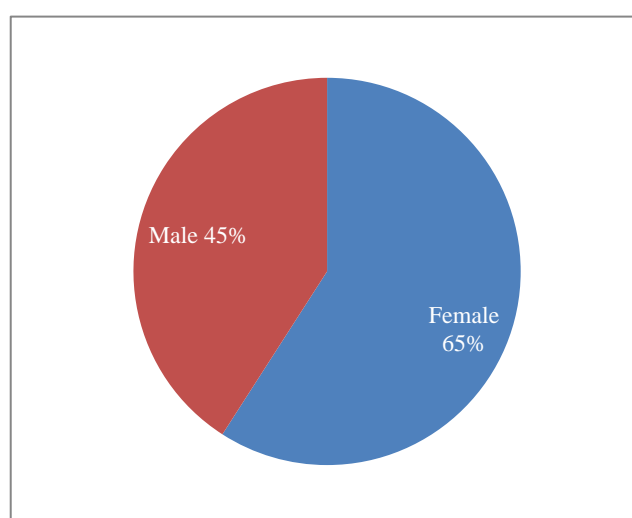


Figure 1: Distribution of gender.

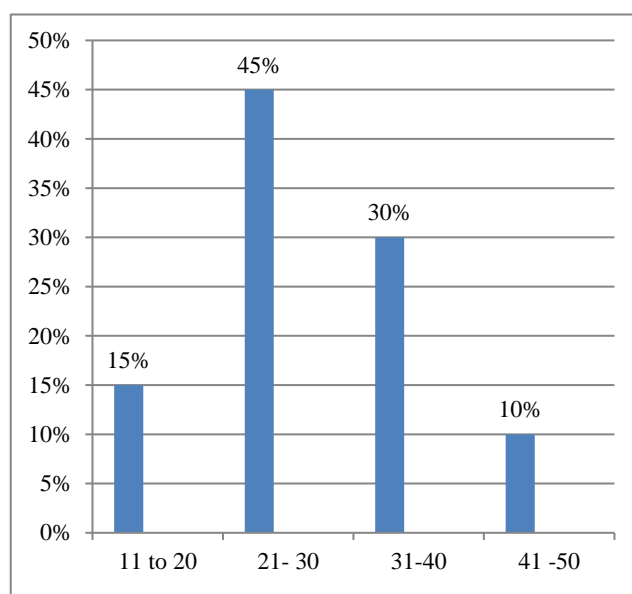


Figure 2: Age group distribution (in years).

Table 1: Comparison with regards to graft uptake (n=50).

Graft uptake	Tympanoplasty with temporalis fascia only	Tympanoplasty with temporalis fascia and cartilage slice reinforcement
	N (%)	N (%)
Successful	47 (94)	50 (100)
Failure	3 (6)	0 (0)

Table 2: Hearing results in term of frequency.

Frequency [Hz]	Tympanoplasty with temporalis fascia only		Tympanoplasty with temporalis fascia and cartilage slice reinforcement	
	Preoperative	Postoperative after 6 months	Preoperative	Postoperative after 6 months
500	30 dB	10 dB	30 dB	15 dB
1000	30 dB	10 dB	30 dB	20 dB
2000	25 dB	10 dB	25 dB	15 dB
Average ABG	28.3 dB	10 dB	28.3 dB	16.6 dB

Graft uptake

In our study, at 6-month follow-up, 47 (94%) patients out of 50 in group-A have shown successful uptake of graft and 3 patients were failures seen. While 50 patients (100%) out of 50, were successful graft uptake in group-B. Graft uptake was good in group-B 100% when compared to group A (94%) (Table 1). In general, the causes of failure in group A were residual perforation in 2%, infection or gaping of wound in 3% and severe retraction 1%. Age and sex had no significant effect on the success rate of surgery ($p>0.05$).

Hearing results in term of frequency

Hearing results are evaluated in terms of air bone gap in standard 500 kHz, 1000 kHz and 2000 kHz. at pre-operatively and 6 months post-operatively (Table 2). Group A, the average ABG decreased from 28.3 dB to 10 dB. In group B, the average ABG was 28.3 dB preoperatively and reached 16.6 dB after surgery. The difference between the rates of ABG improvement in the two groups was significant ($p<0.01$).

It is evident that hearing outcome is better in temporalis fascia graft only group A post operatively after 6 months in compare to group B tympanoplasty with temporalis fascia and cartilage slice reinforcement postoperatively after 6 months.

DISCUSSION

Cartilage tympanoplasty is a safe and a reliable technique in tympanic membrane reconstruction, and achieves good anatomical and audiologic results.^{15,16} Cartilage graft resists negative middle ear pressure and infection, it has low reperforation rates.^{17,18} As it has very low metabolic rates, it is nourished by diffusion, and incorporated into the tympanic membrane easily.^{19,20}

Intact temporalis fascia was placed as graft in tympanic perforation, supported by a slice of cartilage; slice was placed anteriorly from hypotympanum to anterior part of attic. It does not obstruct eustachian tube opening, as it is curved with concavity facing towards medial wall.

In our study, there were 100 patients with 50 each in group A and group B. The age group of patients ranged 11 to 50 years, the most common age group was 21 to 30 years, is similar to more patients were noted in 21 to 30 years 44%, followed by 31 to 40 years 30% by Gangadar et al.²¹ Female gender was predominance, line to Mundra et al.²² In addition, cartilage reinforcement in the anterior part of the graft prevents medialization of fascia temporalis.²³

In this study, the success rate in the cartilage group was higher than in the fascia-only group (100% vs. 94%), and age and sex had no significant effect on the success rate of the surgery. Khan et al published the results of 28 patients with large perforation (>50%) tympanic membrane. In this prospective study, fascia temporalis was enhanced with sliced tragal cartilage, and the rate of closure was 100%. The mean air bone gap (ABG) after the operation was 9.64 dB.¹⁴ This finding is in line with results of type I tympanoplasty using fascia with or without cartilage reinforcement 10 years' experience Kouhi et al.²⁴

Overall graft uptake rate in group I was 85%, whereas that in group II was 95% ($p<0.01$). To study the effect of site and size of tympanic membrane perforation on graft uptake rates and hearing improvement in type I tympanoplasty using sliced conchal cartilage reinforced with temporalis muscle fascia and temporalis muscle fascia alone.²⁵

A study by Mundra et al, graft uptake rate is 98.94%. Only 1 out of 94 cases had residual perforation of

tympanic membrane. That patient has not come for follow-up for initial 1 month, during which he had develop URI and otomycosis. This has resulted in small residual perforation that gets healed on conservative treatment. So, taken this in consideration our results were almost 100%. 95.74% has closed air bone gap within 0-30 dB (social hearing), 21.28% within 10 dB and 56.38% within 20 dB in this series was obtained. 4.26% cases have >30 dB hearing, they are cases of unsafe variety.²²

Overall, our study shows hearing improvement in both groups. Group-A, the average ABG decreased from 28.3 dB to 10 dB. In group-B, the average ABG was 28.3 dB preoperatively and reached 16.6 dB after surgery. The difference between the rates of ABG improvement in the two groups was significant ($p < 0.01$). This finding is consistent with the study of Gerber et al which showed that reconstruction of the tympanic membrane with cartilage can impair auditory function.²⁶ A study showed that postoperative ABG in the fascia group was 15 dB, in contrast with the cartilage tympanoplasty group in which it was found to be 11 dB. In both the groups 100 percent of patients showed significant improvement in hearing. The average ABG improvement for both Groups I and II was $14.85 \text{ dB} \pm 5.62 \text{ SD}$.²⁷ A study by Singh et al showed that there were small differences in the hearing improvements at different frequencies between anterior and posterior perforations (1-5 dB) but were statistically insignificant.²⁵

CONCLUSION

In conclusion, the results of our study show that hearing improvement is better in tympanoplasty type-I with a temporalis graft only then with cartilage slice reinforcement. However, the graft uptake rate is higher in cartilage reinforcement compare with temporalis muscle fascia only.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Flint PW, Haughey B, Lund V, Niparko JK, Robbins J, Thomas R, et al. Cummings Otolaryngology E-Book: Head and Neck Surgery, 6th ed., Saunders; 2014.
2. Wullstein H. Theory and practice of tympanoplasty. Laryngoscope. 1956;66:1076-93.
3. Storrs L. Myringoplasty with use of fascia graft. Arch Otolaryngol Head Neck Surg. 1961;74:45-9.
4. Shea JJ. Vein graft closure of eardrum perforations. Arch Otolaryngol. 1960;74:358-62.
5. Utech H. Tympanotomy in disorders of sound conduction; its diagnostic and therapeutic possibilities. Laryngol Rhinol Otol 1959;38:212-21.
6. Shea JJ. Vein graft closure of eardrum perforations. Arch Otolaryngol. 1960;74:358-62.
7. Karlan MS. Gelatin film sandwich in tympanoplasty. Otolaryngol Head Neck Surg. 1979;87(1):84-6.
8. Hartwein J, Leuwer RM, Kehrl W. The total reconstruction of the tympanic membrane by the - crown cork technique. Am J Otolaryngol. 1992;13(3):172-5.
9. Schwaber MK. Post auricular undersurface tympanic membrane grafting: some modifications of the swinging door technique. Otolaryngol Head Neck Surg. 1986;95(2):182-7.
10. Escudero LH, Castro AO, Drumond M, Porto SP, Bozinis DG, Penna AF, Gallego Lluésma E. Argon laser in human tympanoplasty. Arch Otolaryngol. 1979;105(5):252-3.
11. Williams JD. Microclip application in tympanoplasty. Ann Otol Rhinol Laryngol. 1977;86(2):223-6.
12. Cabra J, Monux A. Efficacy of cartilage palisade tympanoplasty: randomized controlled trial. Otol Neurotol. 2010;31:589-95.
13. Tek A, Karaman M, Uslu C, Habesoglu T, Kilicarslan Y, Durmus R, et al. Audiological and graft take results of cartilage reinforcement tympanoplasty (a new technique) versus fascia. Eur Arch Otorhinolaryngol. 2012;669:1117-26.
14. Khan MK, Parab SR. Reinforcement of Sliced Tragal Cartilage Perichondrium Composite Graft with Temporalis Fascia in Type I Tympanoplasty: Our Techniques and Results. J Rhinolaryngo Otol. 2013;1:1-6.
15. Prasad S, Ahlawat B, Kumar A, Agrawal A, Nalksulaha M, Chaudhury N. Cartilage island tympanoplasty: the prespective study of anatomical and audiological results. Indian J Sci Res. 2010;7:103-7.
16. Dornhoffer J. Cartilage tympanoplasty: indications, techniques, and outcomes in a 1,000-patient series. Laryngoscope. 2003;113:1844-56.
17. Vashishth A, Mathur NM, Verma D. Cartilage palisades in type 3 tympanoplasty: functional and hearing results. Indian J Otolaryngol Head Neck Surg. 2014;66:309-13.
18. Demirpehlivan IA, Onal K, Arslanogulu S, Songu M, Ciger E, Can N. Comparison of different tympanic membrane reconstruction techniques in type I tympanoplasty. Eur Arch Otorhinolaryngol. 2011;268:471-4.
19. Shrestha BL, Amatya RC, Shrestha I, Pokharel M. Comparison of pre and post-operative hearing results in patients undergone modified inlay butterfly cartilage perichondrium myringoplasty. J Rhinol-Otologies. 2013;1:82-6.
20. Mendes Neto JA, Neiva FC, Brodskyn F, Palumbo MD, Bittar CV, et al. Plug cartilage tympanoplasty in children. Braz J Otorhinolaryngol. 2008;74:890-5.

21. Kiran Gangadar S, Priyadarshini G. Comparative study of outcomes of type-1 tympanoplasty with and without anterior tucking, *Int J Otorhinolaryngol Head Neck Surg.* 2020;6(4):657-60.
22. Mundra RK, Sinha R, Agrawal R. Tympanoplasty in subtotal perforation with graft supported by a slice of cartilage: A study with near 100% results. *Indian J Otolaryngol Head Neck Surg.* 2013;65:631-9.
23. Uslu C, Tek A, Tatlipinar A, Kiliçarslan Y, Durmuş R, Ayöğredik E, et al. Cartilage reinforcement tympanoplasty: otological and audiological results. *Acta Otolaryngol.* 2010;130:375-83.
24. Kouhi A, Ashthiani MTK, Jalali MM. Results of Type I Tympanoplasty Using Fascia with or without Cartilage Reinforcement: 10 Years' Experience, *Iranian J Otorhinolaryngol.* 2018;30(2):103-6.
25. Singh SP, Nagi RS, Singh J. To study the effect of site and size of tympanic membrane perforation on graft uptake rates and hearing improvement in type I tympanoplasty using sliced conchal cartilage reinforced with temporalis muscle fascia and temporalis muscle fascia alone. *Indian J Otol.* 2019;25:121-6.
26. Gerber MJ, Mason JC, Lampert PR. Hearing results after primary cartilage tympanoplasty. *Laryngoscope.* 2000;110:1994-9.
27. Sheikh S, Bajaj A, Vaze V. Is cartilage shield tympanoplasty better than fascia tympanoplasty. *Int J Otorhinolaryngol Head Neck Surg.* 2020;6(1):70-3.

Cite this article as: Rathaur SK. Comparative study of outcomes of type-1 tympanoplasty with temporalis fascia only and with cartilage slice reinforcement. *Int J Otorhinolaryngol Head Neck Surg* 2020;6:1162-6.