

Audiological Outcomes of Type 1 Tympanoplasty Using Conchal Cartilage and Temporalis Fascia

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ABSTRACT

Objective: To compare the efficacy of conchal cartilage graft and temporalis fascia graft in Type 1 tympanoplasty in terms of graft uptake and hearing improvement.

Study Design: Descriptive study.

Place and Duration of the Study: Department of Otolaryngology, Khyber Teaching Hospital, Peshawar, Pakistan, from January 2020 till December 2022.

Methodology: Using quota sampling, 2 groups were made i.e. conchal cartilage group (Group A) and temporalis fascia group (Group B). Total of 124 records were selected with 62 records from each group. Graft uptake rate and audiological outcomes were compared between the groups. Moreover, postoperative complication rate was also noted for each group.

Results: The graft uptake rates between Group A and B at 3rd month were compared postoperatively (98.39%, 93.55%, $p=0.36$). The difference between preoperative mean air-bone gap (ABG, 28.05 ± 2.19 dB, 28.68 ± 2.38 dB, $p=0.12$) and postoperative mean ABG (13.35 ± 3.45 , 14.47 ± 3.29 , $p=0.69$) was also statistically not significant. However, the differences regarding audiological success rate between cartilage and fascia groups (96.77%, 82.25%, $p=0.01$) and average operating time (51.8 ± 2.1 vs. 43.5 ± 3.2 minutes, $p=0.009$) were significantly different.

Conclusion: In chronic otitis media (COM) patients with subtotal perforations, endoscopic tympanoplasty using conchal cartilage or temporalis fascia as graft yielded comparable outcomes in terms of graft uptake, hearing improvement, and postoperative complications. However, using conchal cartilage, the procedure showed better audiological success rate. With temporalis fascia as graft, the procedure was performed in a shorter time.

Key Words: Chronic otitis media, Tympanoplasty, Temporalis fascia, Conchal cartilage, Subtotal perforation.

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INTRODUCTION

Chronic otitis media (COM), a leading contributor of avoidable hearing loss, is defined as chronic inflammation and recurrent infections of tympanic cavity with recurrent or persistent mucopurulent otorrhea through a perforation in tympanic membrane (TM).¹ Patients often present with ear discharge, tympanic membrane perforation or attic retraction, and hearing loss.²

Tympanoplasty, a gold standard surgical technique to repair TM perforation, aims not only to close the anatomical defect in TM but also to improve the hearing ability of the patient.³ Since the debut of tympanoplasty in the 1950s by Wullstein,⁴ utilisation of numerous graft materials for TM perforation closure such as fat,⁵ temporal fascia,⁶ perichondrium,⁷ vein,⁸ duramater,⁹ and cartilage¹⁰ have been documented.

Cartilage, as a graft material, has been recommended for the reconstruction of TM defects.¹¹ It has structural stability that is tougher than fascia and contains no fibrous tissue.¹² It sustains by diffusion and adapts well to the tympanic membrane.¹²

The two most common cartilaginous materials used for this purpose are tragal and conchal cartilages. Due to its increased resistance properties to alteration in middle ear pressure, structural stability and pliability, conchal cartilage is the preferred graft material as compared to other cartilaginous grafts.¹³

The present study was designed to evaluate not only the graft uptake and hearing improvement of the individuals receiving tympanoplasty with either conchal cartilage or temporalis fascia grafts, but also to compare the operating time needed for these.

METHODOLOGY

This descriptive study was conducted retrospectively in the Department of Otolaryngology, Khyber Teaching Hospital, Peshawar, Pakistan after taking approval from the Ethical Review Board of Kyber Medical College, Peshawar. Patients' records were checked for recruitment. All available patients' records were checked from January 2020 till December 2022, irrespective of gender or ethnicity. The inclusion criteria were

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age 18-60 years, COM- inactive mucosal disease, with a dry ear for at least a month and subtotal perforation of TM, defined as a perforation involving all four quadrants of TM. The exclusion criteria were incomplete records, any previous middle ear surgery, presence of cholesteatoma, ossicular chain dysfunction, hearing loss of sensorineural type, any mental, psychiatric or cognitive disorder which hindered the proper assessment of patients. Informed consent was obtained from each participant during the follow-up before inclusion into the study.

Using quota sampling, two groups were made i.e. conchal cartilage group (Group A) and temporalis fascia group (Group B). Total of 124 records were selected with 62 records from each group. Records were checked for a thorough assessment including history, clinical examinations, and examinations under a microscope. Preoperative and postoperative air-bone gap ABG in records were measured for each patient using pure tone audiometry at frequencies of 500, 1000, 2000, and 4000 Hz. Graft uptake was defined as complete closure of tympanic membrane perforation, while audiological success rate was defined as postoperative ABG ≤ 20 dB.

All the surgical procedures were performed under general anaesthesia with strict aseptic measures. All the surgeries were performed per-meatally using endoscope. Tympanomeatal flaps were raised. Graft margins were refreshed along with

removal of tympanosclerosis, wherever needed. In Group A, the patients received conchal cartilage graft with perichondrium on lateral aspect, while Group B received temporalis muscle fascia graft. The graft was implanted using the underlay method. In both the groups, the gel foam pledgets were used to pack the middle ear cavity. After graft implantation, the tympanomeatal flap was replaced and gel foam was used, once again, to support the flap and graft in place. The incisions for grafts were sutured using 3-0 prolene and surgical dressings were done.

All the data were collected and analysed using IBM SPSS v22.0. Quantitative variables were expressed as mean (\pm) standard deviation, while qualitative variables were expressed as numbers and/or percentages. Independent sample t-test was applied to compare means of the groups. Chi-square test was used for the comparison of categorical variables between both the groups. A p-value of less than 0.05 was considered to be statistically significant.

RESULTS

The research included 124 medical records with patients having COM mucosal disease with subtotal perforation. Two groups of 62 patients each were made. Group A had cartilage graft while Group B had fascia graft. Descriptive statistics of both groups are shown in Table I.

Table I: Descriptive details of participants in both the groups, with comparison of graft uptake and audiological success rate.

Variable	Group A	Group B	p-value
Sample size (n)	62	62	
Age in years (Mean \pm SD)	29.55 \pm 11.52	29.61 \pm 10.31	0.99 ^b
Gender (Male:Female)	38:24	31:31	0.27 ^a
Side of ear (Right:Left)	37:25	28:34	0.15 ^a
History of allergy (Yes:No)	11:51	9:53	0.80 ^a
Diabetes status (Yes:No)	3:59	1:61	0.61 ^a
Deviated nasal septum (Yes:No)	25:37	19:43	0.34 ^a
Tympanosclerosis (Yes:No)	16:46	22:40	0.33 ^a
Average operating time in minutes (mean \pm SD)	51.8 \pm 2.1	43.5 \pm 3.2	0.009 ^b
Graft success n (%)	61 (98.39)	58 (93.55)	0.36 ^a
Graft failure n (%)	1 (1.61)	4 (6.45)	
Audiological success n (%)	60 (96.77)	51 (82.25)	0.01 ^a
Audiological failure n (%)	2 (3.22)	11 (17.74)	

^a Chi-square test, ^b Independent sample t-test.

Table II: Comparison of preoperative and postoperative mean air-bone gap (ABG) in both the groups.

Variable	Group A	Group B	T value	p-value ^a
Preoperative ABG (Mean \pm SD)	28.05 \pm 2.19 dB	28.68 \pm 2.38 dB	-1.52	0.12
Postoperative ABG (At 3 rd month) (Mean \pm SD)	13.35 \pm 3.45 dB	14.47 \pm 3.29 dB	-1.83	0.69
T value	28.30	27.48		
p-value ^a	<0.00	<0.00		

^a Independent sample t-test.

The operating time taken by the surgical procedures was measured in minutes. In Group A, the mean time taken was 51.8 ± 2.1 minutes, while it was 43.5 ± 3.2 minutes in Group B. The operating time taken by tympanoplasty using fascia as graft was significantly less than that by using conchal cartilage as graft ($p=0.009$).

Postoperatively, graft uptake was observed in 98.39% (61) of Group A and 93.55% (58) of Group B in the third month. Graft failure was seen in just one patient of Group A and 4 patients of Group B ($p>0.05$, Table I).

Almost 96.77% (60) of Group A showed audiological success, while only 3.22% (2) showed audiological failure. Meanwhile, in Group B, 82.25% (51) showed success while 17.74% (11) showed failure in this regard. The difference was statistically significant ($p=0.01$), favouring cartilage graft over fascia graft (Table I).

In the third postoperative month, both the procedures showed significant improvement in mean ABG ($p<0.05$). The pre and postoperative mean ABG between the groups were comparable ($p>0.05$). Table II depicts the pre and postoperative mean ABG in both the groups.

Patients were closely followed for postoperative complications. The difference between the groups was statistically insignificant in this regard ($p>0.05$, Table III).

Table III: Comparison of rate of postoperative complications between the groups.

Complications	Group A % (n/N)	Group B % (n/N)	p-value ^a
Tinnitus	1.61 (1/62)	3.22 (2/62)	>0.99
Ear discharge	4.83 (3/62)	4.83 (3/62)	0.67
Retraction	1.61 (1/62)	3.22 (2/62)	>0.99
Otitis media with effusion	4.83 (3/62)	3.22 (2/62)	>0.99
Myringitis	0.0 (0/62)	0.0 (0/62)	-

^a Chi-square test.

DISCUSSION

Currently, the endoscopic underlay technique using temporalis fascia as graft material is a preferred surgical procedure wherever primary tympanoplasty is indicated.¹⁴ However, worldwide research is still on-going to provide a surgical technique with the best outcomes and little-to-no complications.

Outcomes of tympanoplasty are judged not only in regard to anatomical uptake of graft by tympanic membrane but also in areas of audiological improvement. In this study, the graft take-up was observed in 98.39% of patients in Group A and 93.55% of patients in Group B at third month. In the study of Odat *et al.* it was found that there was successful graft uptake in 97.1% of patients with cartilage graft, while in the temporalis fascia group, the uptake rate was 95.7%, which was statistically insignificant in accordance with the findings of the present study.¹⁵ Hu *et al.* compared 42 cartilage grafts

with 42 fascia grafts and found no significant difference in terms of graft uptake between the two techniques.¹⁶ The postoperative complications between the two surgical techniques in the study's clinical trial were comparable, which coincided with findings of the previous study.¹⁵

In this study, significant hearing improvement was observed in both groups following surgery. Couloigner *et al.* compared 59 patients with cartilage tympanoplasty to 29 patients with temporalis fascia tympanoplasty and observed no significant difference in hearing improvement between the two methods.¹⁷ Similarly, Kazikdas *et al.* compared 23 cartilage tympanoplasty patients and 28 fascia tympanoplasty cases, and found no significant difference in hearing improvement between the two surgical techniques.¹⁸

However, the current research sheds light on two statistically significant differences between the two techniques. Conchal cartilage as graft yielded a significantly better audiological success rate as compared to temporalis fascia tympanoplasty, 96.77% vs. 82.25%, respectively. This was in accordance with studies conducted by Hu *et al.* and Vashishth *et al.* who observed the same results in paediatric population.^{16,19} On the other hand, temporalis fascia as graft provided with a quicker operating procedure as compared to conchal cartilage tympanoplasty, 43.5 ± 3.2 vs. 51.8 ± 2.1 minutes, respectively.

This study was performed retrospectively due to which randomisation of patients among groups could not be ensured.

CONCLUSION

In COM patients with subtotal perforations, endoscopic tympanoplasty using conchal cartilage or temporalis fascia as graft, yielded comparable outcomes regarding graft uptake, hearing improvement, and postoperative complications. However, the procedure showed better audiological outcome with the use of conchal cartilage. While, the procedure was performed in a shorter time with temporalis fascia as graft.

ETHICAL APPROVAL:

The study was approved by the Institutional Researched and Ethical Review Board of Khyber Medical College, Peshawar, Pakistan (No. 922/DME/KMC).

PATIENTS' CONSENT:

Informed consent was obtained from each participant included in this study.

COMPETING INTEREST:

The authors declared no competing interest.

AUTHORS' CONTRIBUTION:

IUH: Study conception and design, manuscript drafting.
NL: Manuscript drafting, statistical analysis.

IUD: Interpretation of results, critical analysis of final manuscript.

IK: Interpretation of results, drafting of manuscript.

SU: Statistical analysis, interpretation of results.

All authors approved the final version of the manuscript to be published.

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