

COMPARISON BETWEEN TRAGAL CARTILAGE WITH PERICHONDRIUM AND TEMPORALIS FASCIA GRAFT BY UNDERLAY ENDOSCOPIC TYMPANOPLASTY

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ABSTRACT

Objective: To compare the results of tragal cartilage with perichondrium versus temporalis fascia graft in endoscopic tympanoplasty using underlay technique.

Study Design: Comparative prospective study.

Place and Duration of Study: Study conducted in Tertiary Care Hospital, Karachi, from Jul 2018 to Feb 2020.

Methodology: Overall, 34 patients having permanent unilateral tympanic membrane perforations were included in this study, in whom underlay endoscopic tympanoplasty was performed. Group A patients underwent temporalis fascia graft while group B received a tragal cartilage with perichondrium graft. The success rate between groups was compared in respect of reduction in postoperative air-bone gap and healing of perforation.

Results: The success rate of graft was 88% (30/34) in group A and 94% (32/34) in group B after 6 months follow-up, the difference was not found to be statistically significant ($p=0.368$).

Hearing improvement in the form of closure of air bone gap in group A was from 24.52 ± 1.73 dB (decibel) to 13.56 ± 5.67 s dB and in group B it was from 19.76 ± 3.47 dB to 11.94 ± 3.9 dB, the difference was not significant statistically ($p=0.333$).

Conclusion: Keeping in view the results of our study, we conclude that both tragal cartilage with perichondrium and temporalis fascia graft are considered equally successful in endoscopic tympanoplasty.

Keywords: Endoscopic tympanoplasty, Tragal Cartilage with perichondrium graft, Temporalis fascia graft, Underlay technique tympanoplasty.

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INTRODUCTION

Tympanic membrane (TM) perforations are serious health hazard. These, mostly result from acute otitis media which is second most commonly encountered infection in Pediatrics. Secondly, these are seen in chronic otitis media which may or may not be associated with cholesteatoma. About 3-5% cases of grommet insertion also result in permanent TM perforations. Other main cause is barotrauma to ears.¹

Chronic tympanic membrane perforations adversely affect patient's hearing mostly conductive but can also affect sensorineural in some cases. It increases their probability of developing acute as well as chronic otitis media and tympanosclerosis. Patient can have potential complications like balance disorders, meningitis, thrombosis in sigmoid sinus and brain abscesses. Current managements of chronic tympanic membrane perforations are either observation with precautions of water entry into ear or repair by surgery.²

Tympanoplasty is an operation carried out for repairing the eardrum perforation and the hearing

mechanism can also be reconstructed.³ Successful repair of these perforations is satisfying for both the operating surgeon as well as the patient. Hearing can improve up to 25dB. In most of cases, ear discharge as well as tinnitus is also improved.⁴ Conventional tympanoplasty, done with postauricular incision under microscope is very effective technique for patients having permanent TM perforation. This is especially useful in cases of anterior or large eardrum perforations or those having anterior bony overhang. This technique causes a surgical scar and substantial ache to the patient. In order to reduce operation time and pain levels, endoscopic tympanoplasty has gained more popularity as compared to microscopic tympanoplasty.⁵ Endoscopic tympanoplasty offers excellent middle ear structures visibility and has been found very useful for repairing large tympanic membrane perforations with fewer complications and less invasiveness.⁶

Since start of tympanoplasty, several different graft materials have been tried for closure of TM perforation e.g. conchal cartilage, temporalis fascia and veins. Other less popular choices include skin, dura mater, fascia lata, xenograft and pericardium.⁷

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Modern Otologists prefer temporalis fascia and tragal cartilage with perichondrium because they are translucent, supple and also, they are located anatomically close to surgical site.⁸ Our purpose of study is to check which method has better success rate in form of healing and hearing gain in ears operated for permanent tympanic membranes perforation by using cartilage with perichondrium from tragus or temporalis fascia by endoscopic underlay technique. Our hypothesis was that tragal perichondrium cartilage is easily available graft, with better results in terms of healing of perforation and improved hearing.

A lot of previous researches have compared both anatomical as well as functional results of different graft types. Healed perforation with discharge free ear is taken as anatomical success. A reduction in air bone gap to ≤ 20 dB is regarded as functional success. Temporalis fascia is the most popular graft material these days.⁹ However, in recent past, cartilage with perichondrium has also gained popularity in different otology setups for repair of tympanic membrane perforations. There are fewer chances of retraction and infection in cartilage graft, as it preserves its shape, and remains viable for a longer time.

METHODOLOGY

The Ethical Review Board (23/2018/Trg/Adm) of the KIMS affiliated tertiary care hospital (Combined Military Hospital (CMH), Malir) reviewed and approved the research protocol. After getting informed consent from all patients, a prospective interventional randomized case series study was carried out from July 2018 to February 2020 in department of otolaryngology, CMH Malir.

Patient's aging 12 years and more, having permanent central TM perforation, no cholesteatoma and having intact middle ear ossicles, were included in study. Patients having ossicular chain disruption and actively inflamed middle ear were disqualified for the study. Pure-tone audiogram (PTA) was recorded before and 6-months after operation. PTA was carried out for the frequencies of 500, 1000, 2000 and 4000Hz. The air-bone gap (ABG) was calculated as the average difference between the air and bone conduction at 500, 1000, 2000 and 4000Hz. The patients with preoperative ABG >40 dB were assumed to have ossicular chain discontinuity, so were not included in study. Age, gender, size, location of perforation, and pre/post-operative hearing standards were documented for all the subjects. The marginal perforation was labeled when it involved the annulus; otherwise, it was termed as central. The TM

perforation was categorized as per size. It was defined as subtotal if it involved $>75\%$ tympanic membrane, large $>50\%$ and medium 25–50%. The small perforations were excluded from study because fat plug from ear lobule was usually utilized for their closure in our department. The sample was raised using convenience non-probability sampling technique. Informed consent was obtained from all the patients then they were divided into two equal groups. Temporalis fascia graft group taken as group-A and tragal cartilage with perichondrium group was taken as group B, using systemic random sampling method.

Endoscopic tympanoplasty was done using 0-degree angle, 18 cm long and 4 mm wide rigid endoscope (Richard Wolf Germany) with high definition monitor system (Richard Wolf GmbH). Edges of the perforation were freshened first and then graft was taken. Tympanic cavity was entered after elevating the tympano-meatal flap 5 mm lateral to the annulus. The ossicles were examined and their intactness confirmed in middle ear. In group A the temporalis fascia grafts were attained by supra-aural, 2-3 cm wide incision. The obtained grafts were placed properly using the underlay technique to repair the perforation. The tympano-meatal flap was placed back to its position. The supra aurial incision was closed. In group B the tragal cartilage was taken along with perichondrium and was preserved. The obtained grafts were positioned as per underlay technique after being trimmed properly, according to the size of tympanic membrane perforation. The tympano-meatal flap was then placed back. The gelatin sponge was placed medial and lateral to graft for support. The sutures were removed after 7 days. The cases in which, the gelatin sponge particles did not dissolve 3 weeks after surgery were aspirated. The patients were followed up after 1st week, 3rd week and at 6th months, post-surgery and status of the tympanic membrane was checked. The pure tone audiometry results at the 6th month post-surgery was recorded. The data of pre and postoperative ABG and the tympanic membrane healing status was compared between both the groups. The intact tympanic membrane without retraction or lateralization, and the Air-Bone Gap (ABG) below 15 dB were valued as criteria of success.

SPSS version 22 was used for statistical analysis. The data are expressed as means (standard deviation) and percentages (%). The chi-squared test was used to compare the categorical data. For parametric variables

independent and paired-samples t-tests were applied. p -value ≤ 0.05 was accepted as statistically significant.

RESULTS

A total of 34 patients, having 34 affected ears (24 males 70.58%, 10 females 29.41%) who met the above-mentioned inclusion criteria were included in this research. The mean age was found to be 31.4 ± 10.9 years. In 17 cases (50%) the left ear was affected, whereas in 17 (50%) patients, the right ear was involved. Out of 34 patients, 17 were placed in temporalis fascia graft group (group A) and 17 to the tragal perichondrium graft (group B), after randomization. Characteristics of patients are shown in Table-I. Age, gender, side, size and location of perforation were matched between the two groups (Table-I). In both groups no ossicular chain disruption was found during surgery. The tympano-meatal flap was elevated in all 34 patients in the both groups. All tragal as well as temporalis fascia incisions healed within 2 weeks postoperatively in both group. All patients were followed up for at least 6 months.

Hearing improvement: The pre/post-operative ABG are shown in Table-II. In group A, mean pre-surgery ABG was 24.52 ± 1.73 dB, and post-surgery at 6 months was 13.59 ± 5.67 dB; this difference was significant statistically (p -value < 0.001). The mean pre-surgery ABG in Group B was found to be 19.76 ± 3.47 dB, and post-surgery at 6 months was 11.94 ± 3.96 dB; again, the difference was significant statistically (p -value < 0.001). At 6 months after surgery there was no statistically significant difference in ABG values (p -value = 0.333) between group A and group B. At the same time, no significant difference in healing of TM perforation was seen at 6 months post operatively (p -value = 0.368) between the groups. ABG less than 15 is taken as success is 13 (76.4%) in group A and 15 (88.23%) group B (p -value = 0.368) Table-III.

Table-I: Demographic characteristics of the groups.

	Temporalis Fascia (Group A)	Tragal Cartilage (Group B)	p -value
No. of Cases	17	17	
Gender (F:M)	6 (35.29%): 11 (64.70%)	4 (23.5%): 13 (76.4%)	0.452*
Age (years)	32 ± 10.81	30.82 ± 9.6	0.740**
Side of Ear (L:R)	8 (47.05%): 9 (52.94%)	9 (52.94%): 8 (47.05%)	0.732*
Perforation size (medium, large, subtotal)	8 (47.04%): 7 (41.17%): 2 (11.76%)	8 (47.04%): 6 (35.29%): 3 (17.64%)	0.871*

*Chi squares, **Independent samples t-test

Table-II: Hearing improvement (comparison of reduction in air-bone gap (dB) Mean \pm SD).

Group	Preoperative Air Bone Gap Mean	Postoperative Air Bone Gap Mean	p -value
Temporalis Fascia Group A	24.52 ± 1.73 dB	13.59 ± 5.67 dB	$< 0.001^*$
Tragal cartilage Group B	19.76 ± 3.47 dB	11.94 ± 3.96 dB	$< 0.001^*$

* p -value after paired t-test

Table-III: Efficacy of surgery and healing of perforation.

	Temporalis Fascia Group A	Tragal Cartilage Group B	p -value
Healing of Perforation (Yes: No)	13 (76.47%): 4 (23.53%)	15 (88.23%): 2 (11.76%)	0.368*
Efficacy (Mean Air bone gap after surgery)	13.56 ± 5.67 dB	11.94 ± 3.96 dB	0.333**
ABG < 15 as success post operatively after 6 months	13 (76.4%)	15 (88.23%)	0.368*

*Chi square test, **Independent sample t-test

DISCUSSION

Our results showed that tympanoplasty could be done using endoscope, both safely as well as successfully, in patients with permanent tympanic membrane perforation. The graft success rates in terms of healing and improvement of hearing, after the operation in the temporalis fascia and cartilage with perichondrium groups were found significant statistically. However, no statistically significant difference was observed between the two groups.

In our study, we used endoscope 00 with high definition monitors instead of microscope which provided us excellent view of surgical field. Tarabichi *et al* revealed that the ear surgery performed using microscope has defined and limited view because of narrow segment of the auditory tube.¹⁰⁻¹¹ On the other hand; using trans-canal endoscope we bypass the narrow segment of the auditory canal and it contributes to a wide and better clear view with 0 degree endoscopes.

Furukawa *et al*,⁵ Iade *et al*,¹² and Harugop *et al*,¹³ carried out researches to compare the microscopic versus endoscopic view tympanoplasties. They revealed that in the microscopic groups, the tympanic annulus was not visualized completely in 17-20% of cases, thus they required canaloplasty. On the other hand, in endoscopic groups, the tympanic annulus were completely visualized; therefore, no case needed canaloplasty.

In our study we used tragal perichondrium graft with good success rate of 94%, we found it very easy to obtain and harvest Prasad *et al*,¹⁴ in his study stated the same, cartilage graft is available locally, is tough and easily harvestable with just a small incision which is given on the inner surface of tragus and the scar is not even visible from outside. In his study, cartilage graft was successful in 96.7% cases.¹⁴ There is no significant difference between two groups in term of ABG in our study that is in accordance with study conducted by Ozdamer k and *et al*.¹⁵ In another study Wahid *et al*,¹⁶ concluded that The reduction in ABG and graft success between half-thickness tragal cartilage and temporalis fascia tympanoplasty groups was statistically non-significant that is in accordance with our study. Similar results were seen in study conducted by Gun *et al*,¹⁷ and Demirci *et al*,¹⁸ so both grafts can be used by otologists depending upon their experiences and preferences.

Despite getting very valuable data in this study, there were a few limitations. The small number of cases was the main limitation; secondly there is chance of development of cholesteatoma in long term, but we could follow the cases only for 6 months in this study. In future, we recommend more prospective randomized trials to be carried out, with higher number of patients and with very long term follow up.

CONCLUSION

Keeping in view the results of our study, we conclude that both tragal cartilages with perichondrium and temporalis fascia grafts are considered equally successful in endoscopic tympanoplasty.

Conflict of Interest: None.

Authors' Contribution

MT: Manuscript drafting literature survey bibliography and data interpretation, AA: Conceived the main idea and developed the study design, developed study tool, FHN: Data collection and analysis tabulation, final proof reading, SAS: Helped in data collection, data entry and analysis, AR: research supervisor, critical checking and analysis of results, Final Approval of Manuscript.

REFERENCES

1. Kuo CY, Wilson E, Fuson A, Gandhi N, Monfaredi R, Jenkins A, et al. Repair of tympanic membrane perforations with customized bioprinted ear grafts using chinchilla models. *Tissue Eng Part A* 2018; 24(5-6): 527-535.
2. Santos F, Shu E, Lee DJ, Jung DH, Quesnel AM, Stankovic KM, et al. Topical fibroblast growth factor-2 for treatment of chronic

tympanic membrane perforations. *Laryngoscope Investig Otolaryngol* 2020; 5(4): 657-664.

3. Çayir S, Kayabaşı S. Type 1 tympanoplasty in pediatric patients: Comparison of fascia and perichondrium grafts. *Int J Pediatr Otorhinolaryngol* 2019; 121(1): 95-98.
4. Wright WK. Repair of chronic central perforations of the tympanic membrane: by repeated acid cautery; by skin grafting. *Laryngos* 1956; 66(11): 1464-1487.
5. Choi N, Noh Y, Park W, Lee JJ, Yook S, Choi JE, Chung WH, et al. Comparison of endoscopic tympanoplasty to microscopic tympanoplasty. *Clin Exp Otorhinolaryngol* 2017; 10(1): 44-48.
6. Plodpai Y. Endoscopic vs microscopic overlay tympanoplasty for correcting large tympanic membrane perforations: A randomized clinical trial. *Ind J Otolaryngol Head Neck Surg* 2018; 159(5): 879-886.
7. Guler I, Baklaci D, Kuzucu I, Kum RO, Ozcan M. Comparison of temporalis fascia and tragal cartilage grafts in type 1 tympanoplasty in elderly patients. *Auris Nasus Larynx* 2019; 46(3): 319-323.
8. Dabholkar JP, Vora K, Sikdar A. Comparative study of underlay tympanoplasty with temporalis fascia and tragal perichondrium. *Ind J Otolaryngol Head Neck Surg* 2007; 59(2): 116-119.
9. Yegin Y, Çelik M, Koç AK, Küfeciler L, Elbistanlı MS, Kayhan FT. Comparison of temporalis fascia muscle and full-thickness cartilage grafts in type 1 pediatric tympanoplasties. *Braz J Otorhinolaryngol* 2016; 82(6): 695-701.
10. Tarabichi M. Endoscopic middle ear surgery. *Ann Otol Rhinol Laryngol Suppl* 1999; 108(1): 39-46.
11. Tarabichi M, Ayache S, Nogueira JF, Al Qahtani M, Pothier DD. Endoscopic management of chronic otitis media and tympanoplasty. *Otolaryngol Clin North Am* 2013; 46(2): 155-163.
12. Lade H, Choudhary SR, Vashishth A. Endoscopic vs microscopic myringoplasty: a different perspective. *Eur Arch Otorhinolaryngol Suppl* 2014; 271(7): 1897-1902.
13. Harugop AS, Mudhol RS, Godhi RA. A comparative study of endoscope assisted myringoplasty and microscope assisted myringoplasty. *Indian J Otolaryngol Head Neck Surg* 2008; 60(4): 298-302.
14. Prasad S, Gupta V, Kumar A, Naik SM. Cartilage Tympanoplasty: Is it more effective than temporalis fascia grafting for tympanoplasty? *Otolaryngology Online* 2015; 5(4): 1-5.
15. Özdamar K, Sen A. Comparison of temporal muscle fascia and tragal cartilage perichondrium in endoscopic type 1 tympanoplasty with limited elevation of tympanomeatal flap. *Braz J Otorhinolaryngo*, 2020; 86(4): pp.483-489.
16. Wahid FI, Nagra SR. Comparison of half-thickness tragal cartilage graft to temporalis fascia graft Tympanoplasty Type I: A randomized control trial. *JPMA. J Pak Med Assoc* 2020; 70(4): 602-606.
17. Gün T, Boztepe OF, Atan D, İkinçioğulları A, Dere H. A comparison of cartilage palisades and temporal fascia in type 1 tympanoplasty for bilateral tympanic membrane perforations in children. *J Int Adv Otol* 2017; 13(1): 36-38.
18. Demirci S, Tuzuner A, Karadas H, Acıkgöz C, Caylan R, Samim EE. Comparison of temporal muscle fascia and cartilage grafts in pediatric tympanoplasties. *Am J Otolaryngo* 2014; 35(6): 796-799.