

Original Article

Comparison of Reinforcement Cartilage Graft and Temporalis Fascia Graft in Type 1 Tympanoplasty

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Abstract:

Background: *Chronic otitis media (COM) is the long-standing infection of a part or whole of middle ear cleft characterized by ear discharge and perforation. It is the commonest ear problem in adult and children. Most common presenting symptoms are ear discharge, mild to severe hearing loss, sometimes tinnitus even vertigo. Treatment of COM is mainly operative. Inactive mucosal variety of COM presents with the perforation in tympanic membrane with non-inflamed middle ear mucosa. The treatment of inactive mucosal variety of COM is Type 1 tympanoplasty. It can be done by conventional temporalis fascia or cartilage graft. Both have some merits and demerits.*

Objective: *To compare the the outcomes between reinforcement cartilage graft and temporalis fascia graft in type -1 tympanoplasty.*

Methods: *86 (43 patients in each group) patients with COM (inactive mucosal) who were admitted in the department of Otolaryngology – Head and Neck Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka from January 2018 to June 2019, and had fulfilled the inclusion and exclusion criteria were selected for the study. History, examinations, investigations were done. All patients underwent type 1 tympanoplasty. Prior to surgery relevant investigations*

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were done and informed written consent was taken from all patients. In Group-A reinforcement cartilage tympanoplasty cases and in Group-B temporalis fascia tympanoplasty cases were placed. Post-operative graft uptake rate and hearing gain were compared in two groups

Results: The surgical outcomes between reinforcement cartilage tympanoplasty in comparison with temporalis fascia tympanoplasty showed no significant difference of graft uptake rate and hearing gain.

Conclusion: Cartilage tympanoplasty has been practised for reconstruction of perforated tympanic membrane in COM since long with variable results. Graft uptake rate in cartilage reinforcement is comparatively better than temporalis fascia graft. So, reinforcement cartilage graft can be adopted as an alternative to temporalis fascia graft in type- I tympanoplasty.

Keywords: Chronic otitis media, tympanoplasty, cartilage tympanoplasty, graft uptake, reinforcement, hearing gain.

Introduction:

Chronic otitis media is a chronic inflammatory disease of the middle ear and mastoid causing conductive hearing loss. The mainstay of therapy of COM is surgery. Tympanoplasty is the surgical choice with the main goals being eradication of disease, prevention of recurrent discharge, and preservation or improvement of hearing¹.

Tympanoplasty was introduced by Wullstein² in 1952 and Zollner³ in 1955. Since then numerous graft materials such as skin, fascia, vein, perichondrium and dura matter have been used to reconstruct the tympanic membrane (TM). Temporalis fascia and perichondrium remain the most employed materials for closure of TM perforation till date. In the last decade, it had shown a renewed interest an increasing use of cartilage graft as an alternative to more traditional grafting materials for TM reconstruction. Cartilage is like fascia in that it is mesenchymal tissue. Besides that, it has more rigid quality to resist resorption and retraction, even in the milieu of continuous eustachian tube dysfunction⁴.

Cartilage was first used as graft material for reconstruction of middle ear by Utech in 1959. Salen and Jansen in 1963 first reported the use of cartilage perichondrial composite graft for reconstruction of the TM. Heermann was the main advocate of cartilage tympanoplasty

who extensively used cartilage since 1962 for middle ear and mastoid reconstruction, and popularized palisade cartilage tympanoplasty^{5,6}.

Cartilage is pliable, can resist deformation due to its high elasticity and nourished by diffusion that may improve its graft uptake⁷.

Different graft materials have been used for repair of tympanic membrane perforation by different surgeons in their own choice with variable outcomes. To the best of our knowledge there is no protocol-based study conducted in our country regarding reinforcement cartilage tympanoplasty. This study had compared the graft uptake and hearing outcome of tympanoplasty by using reinforcement cartilage with temporalis fascia.

Methods:

This is an observational type of cross-sectional comparative study conducted in the Department Otolaryngology – Head & Neck surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka from January 2018 to June 2019. After obtaining clearance and approval from Institutional Review Board, 86 (43 patients in each group) patients with COM (inactive mucosal), fulfilled the inclusion and exclusion criteria, were selected for the study. Inclusion criteria were a) Only inactive mucosal variety of COM cases b) Age-11 to

50 years of age and Exclusion criteria were : a) Sensorineural type of hearing loss, b) Patients with squamous disease/active mucosal disease c) COM with ossicular fixation or disconnection d) Patients were not fit for general anesthesia. All patients with a clinical diagnosis of inactive variety of mucosal COM underwent a detailed clinical examination including otoscopic and microscopic examination, and all findings were recorded. Audiological evaluation was done by pure tone audiogram.

All cases were operated under general anesthesia through post auricular approach. Tragal cartilage was used as graft material in case group (Group-A) and temporalis fascia in the control group (Group-B). Temporalis fascia graft was harvested by a standard postauricular incision in both groups. Transcanal incision was given. Margin of perforation was freshened. Tympanomeatal flap was elevated. For harvesting a tragal cartilage a horizontal incision was given at 2-3 mm below and behind the tip of tragus to maintain the cosmesis of tragus. The tragal cartilage was harvested by keeping the perichondrium attached to medial wall and perichondrium free lateral wall. Then the perichondrium was separated from the harvested cartilage. Then it was sliced and reshaped with the scalpel. A wedge-shaped piece of cartilage was excised from superior border to accommodate the malleus handle. In cartilage group, the cartilage was placed underneath the remnant tympanic membrane or fibrous annulus and over handle of malleus to accommodate within the notch. The previously harvested temporalis fascia was placed over the cartilage and medial to margin of perforation. In temporalis fascia group, the harvested temporalis fascia was placed in underlay technique (under the remnant tympanic membrane or fibrous annulus, and or under or over the handle of malleus). The

patients were kept under regular follow up. Graft uptakes were evaluated by otoendoscopic examination. PTA and Impedance were done at the end of 3 months. Postoperative air conduction and bone conduction threshold and Air-Bone Gap (ABG) were calculated at 500, 1000, 2000 Hz.

Successful surgical result was considered when patient had intact new tympanic membrane without any perforation and postoperative hearing gain than preoperatively. Those patients who failed the criteria was considered as failure

Data collection technique:

Relevant data were collected in a predesigned data collection sheet for each of the patient with chronic otitis media.

Presentation of data: After compiling data were arranged and presented in simple ways.

Statistical Analysis: Data were processed and analyzed by using Microsoft Office Excel, 2007 software. Data were presented as mean± standard deviation (SD) or percentages. Finally, the result was evaluated by using proper statistical test of significance. To compare between intervention groups, a CHI-SQUARE ($\div 2$) was used and data of each parameter before and after operation were compared using a paired t-test. A *P* value less than 0.05 was considered statistically significant.

Result:

Results was tabulated and analyzed as shown below

Table I :
Operated Ear involvement

Operated ear	Group A (n=43) No.(%)	Group B (n=43) No.(%)
Right	15(34.88%)	16(37.2%)
Left	28(65.12%)	27(62.79%)

Table II :
Comparison of graft uptake between intervention groups

Intervention	Graft Uptake		Total	χ^2	p-value
	Success	Failed			
Group A (Reinforcement cartilage)	41	2	43	1.3996	>0.05
Group B (Temporalis fascia)	38	5	43		
Total	79	07	86		

Chi-square (χ^2) = 1.3996; P- value >0.05.

Table III :
Comparison of graft uptake between intervention groups

Intervention	Audiological result		Total	χ^2	p-value
	Success	Failed			
Group A (Reinforcement cartilage)	20	23	43	.211	>0.05
Group B (Temporalis fascia)	28	15	43		
Total	48	38	86		

Chi-square (χ^2) = .2118; P- value >0.05.

Table IV :
Comparison of graft uptake between intervention groups

	Group A (Reinforcement cartilage) (n=43)	Group B (Temporalis fascia) (n=43)	
Audiological success	20(46.51%)	28(65.11%)	48(55.81%)
Audiological fail		15(34.88%)	38(44.18%)
Total	43	43	86(100%)

Table-V :
Complications between two intervention groups

Complications	In Reinforcement cartilage group (Group-A)	In Temporalis fascia group (Group-B)
Wound infection	No	No
Sensory neural hearing loss	No	No
Facial nerve palsy	No	No
Tinnitus	No	No
Myringitis	No	No

Discussion:

Various graft materials including temporalis fascia, perichondrium, skin, vein, cartilage etc. have been using to repair the tympanic membrane perforation for long time. There are variable results having merits and demerits of each graft material used in tympanoplasty. In this study tragal cartilage and temporalis fascia were used as graft materials. Total numbers of subjects in this study were 86 where 43 were selected in each group. Among them in group –A, 25 male, 18 female patients underwent type-1 tympanoplasty which was reinforced with tragal cartilage, while in group-B, 19 male, 24 female underwent temporalis fascia tympanoplasty in group-B.

The mean \pm standard deviation (SD) age was 28.2 ± 8.65 years (range, 11 to 50 years) in the reinforcement cartilage group and 30.39 ± 9.6 years (range, 11 to 50 years) in the temporalis fascia group; the difference in mean age was not statistically significant ($p=0.2669$). This finding was quite similar to Kulkarni et al⁸.

In reinforcement cartilage group (Group-A) right ear was operated in 15 (34.88%) cases and left ear was operated in 28(65.12%) cases and in temporalis fascia group (Group-B) right ear was operated in 16 (37.2%) cases and left ear was operated in 27 (62.79%) cases. (Table I). These findings coincided with the findings of Yung et al⁹.

All patients were followed up for at least 03 months. Overall graft uptake rate was 91.8% (79/86). In reinforcement cartilage group graft uptake was achieved in 41(95.34 %) out of 43 patients and 88.34% (38/43) in the temporalis fascia group. The difference was statistically not significant. ($p=0.2367$). This finding correlated with the results of Ozdamar et al¹⁰. The graft uptake results in cartilage group was near to similar in some other studies- Onal et al 92.3%¹¹, Pradeep et al 96.7%¹² Yakup et al 92.1%¹³ and Gun et al

96.7%¹⁴. But there are variable results 65-84% in temporal fascia graft uptake rate in same study group.

New graft was rejected in 02 cases (4.6 %) in reinforcement cartilage group and 05 cases (11.62 %) in temporalis fascia group. This finding was not statistically significant.

Pure tone audiometry was done after 03 months of operation. The mean preoperative and post-operative air conduction threshold in the reinforcement cartilage group (Group-A) was found to be 23.16 ± 5.75 dB and 13.98 ± 4.9 dB, respectively with 9.82 ± 4.5 dB closure of the air bone gap (ABG). Air bone gap was calculated in frequency level in both Group-A and Group –B in 500, 1000 and 2000 Hz. In temporalis fascia tympanoplasty patients (Group-B) mean preoperative and postoperative air conduction threshold were found to be 23.53 ± 3.7 dB and 12.36 ± 3.49 dB, respectively with 11.26 ± 7.32 dB closure of the ABG. The mean gain was 9.82 dB and 11.26 dB in the reinforcement cartilage group and temporalis fascia group respectively.

Air bone gap closure in PTA e'' 10 dB were considered as audiological success¹². In our study, overall audiological success was 55.81% (48/86). In the reinforcement cartilage group 46.5% (20/43) and temporalis fascia group 65.11 per cent (28/43), (Table -V). In this study showed audio logical improvement in temporalis fascia group (Group-B) was better than reinforcement cartilage group (Group-A) but the difference was statistically not significant ($p=0.082$). This result was almost similar to Ozdamar et al¹⁰, Onal et al¹¹ and Yakup et al¹³ and Tan et al¹⁵.

No major intraoperative and immediate postoperative complications like wound infection, sensory neural hearing loss and facial nerve palsy were found in any patient of either group in the procedures. No cosmetic deformity of tragus was observed in reinforcement cartilage group.

These encouraging anatomical and functional results may be due to the nature of the cartilage. As cartilage is nourished by simple diffusion from surrounding tissue, it can survive in a relatively avascular condition thus reinforcement cartilage may be a valid alternative to conventional temporalis fascia graft for the reconstruction of tympanic membrane.

Conclusion:

Cartilage tympanoplasty has been practised for reconstruction of perforated tympanic membrane in COM since long with variable results. Graft uptake rate in cartilage reinforcement is comparatively better than temporalis fascia graft. So, reinforcement cartilage graft can be adopted as an alternative to temporalis fascia graft in type- I tympanoplasty.

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