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OUTCOME OF TYPE 1 TYMPANOPLASTY WITH CARTILAGE-PERICHONDRIUM GRAFT IN COMPARISON WITH TEMPORALIS FASCIA

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ABSTRACT

OBJECTIVE: To compared the outcome of Type 1 tympanoplasty with cartilage-perichondrium graft in comparison with temporalis fascia graft in terms of post-operative graft take-up and hearing results. **MATERIALS AND METHODS:** A prospective observational study among 80 patients between 15 and 60 years of age satisfying the inclusion criteria with complaints of ear discharge and hearing loss due to COM - mucosal type was conducted. Patients were grouped in two groups of 40 patients each. Group A patients underwent Type 1 tympanoplasty with temporalis fascia and Group B with cartilage-perichondrium graft. Patients were followed up for graft uptake, hearing improvement and rate of failure are compared for both the grafts. Graft uptake was assessed at the end of the 1st month, 3rd month, and 6th month, and hearing was assessed at the end of the 6th month with pure tone audiometry. **RESULTS:** Patients with temporalis fascia graft showed a take-up rate of 80% and cartilage-perichondrium graft of 92.5% by 6 months. Among the fascia group, graft failure was seen in 20% (8). One patient had failed take-up of graft and four patients showed reperforation. In cartilage group, three patients showed failure of take-up of graft during the 1st month. No patient had reperforation or retraction. Air-bone gap in fascia group showed a closure to 10 dB in 17.5% (7). In the cartilage group, 10 dB in 25% (10 patients). In our short-term follow-up of 6 months, we found that cartilage-perichondrial graft reduces the chance of reperforation and retraction even with variation in middle ear pressure due to eustachian tube catarrh. It gives good take-up rate and comparable hearing result as that of the fascia graft. It does not affect the sound conduction when thinned out to appropriate thickness. It is available from the same surgical field and in sufficient quantity for the closure of the TM defect. Cartilage-perichondrium graft for Type 1 tympanoplasty could be a successful replacement for temporalis fascia giving good result with neotympanum.

KEYWORDS

Cartilage Perichondrium, Neotympanum, Temporalis Fascia, Type 1 Tympanoplasty

INTRODUCTION

Chronic otitis media (COM) is a result of the previous episode of acute otitis media, otitis media with effusion, or trauma to the tympanic membrane (TM). This causes a permanent defect of the pars tensa which leads to recurrent infection and ear discharge. Eventually, these patients may develop hearing loss and further complications. These patients can be managed surgically by doing a tympanoplasty. Type I tympanoplasty or myringoplasty repairs the perforation of TM alone. The goal of Type I tympanoplasty includes the prevention of recurrent infection of middle ear from external pathogens and restoration of the vibratory area of TM which improves hearing. The closure of perforation is achieved using different autologous graft materials. The commonly used graft materials are temporalis fascia, perichondrium, cartilage, fascia lata, vein, and fat. Among the various options available otologists prefer to use temporalis fascia or perichondrium as it gives a good healing, sufficient quantity of graft, good tensile strength, and acoustic property similar to that of normal TM. Unfortunately, fascia grafts are found to succumb to infections and significant pressure gradient during the post-operative period. This can be avoided in certain cases using a cartilage-perichondrial graft.

Cartilage perichondrium is being successfully used in the reconstruction of TM in the past. The rigid nature of cartilage is thought to interfere with the sound transmission properties, even though it effectively prevents retraction and reperforation.

AIM

The aim of this study was as follows:

1. To study the take-up of cartilage perichondrium and temporalis fascia as graft material in Type 1 tympanoplasty.
2. To assess the post-operative retraction or reperforation of neotympanum in using cartilage perichondrium and temporalis fascia graft.

MATERIALS AND METHODS

During the study period from October 2018 to September 2020, 80 patients with complaints of ear discharge due to the mucosal type of COM with conductive hearing loss were recruited for the study at Department of ENT, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar. The patients of age 18–70 years were divided into two groups after a thorough clinical examination. The two groups are fascia group and cartilage group of 40 patients each. Fascia group underwent Type 1 tympanoplasty with temporalis fascia. Cartilage group underwent Type 1 tympanoplasty with tragal or conchal cartilage along with perichondrium. Grafts were placed using underlay technique in all patients.

A thorough clinical examination of ear nose and throat was done. An otoscopic examination was done to record the site and size of perforation. Size of perforation was classified into small, medium, or large depending on the involvement of one quadrant, two quadrants, and three or more than three quadrants, respectively [Figure 1]. All findings were confirmed with examination of the ear under microscope. Hearing status was assessed with pure-tone average (PTA) and hearing threshold at 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz, and air- bone gap observed. Hearing loss was graded into mild (25–dB), mild-moderate (36–45 dB), and moderate-severe (45–60 dB) [Figure 2]. Patients with other comorbidities such as Type 2 diabetes mellitus and hypertension were managed medically. Diagnostic nasal endoscopy and indirect laryngoscopy were done to rule out any pathology and foci of infection. X-ray of paranasal sinuses was taken to rule out coexistent sinusitis. Those patients with foci of infection in the upper respiratory tract which influence the patency of eustachian tube were treated. Cortical mastoidectomy was done in patients with sclerotic mastoid and ensured a patent aditus to facilitate middle ear aeration. Wet ears were made dry by giving systemic antibiotics according to culture and sensitivity, local antibiotic ear drops, and asking the patient to observe.

Routine pre-operative investigations included examination under microscope, ear swab culture and sensitivity, pure-tone audiometry, X-ray mastoids, diagnostic nasal endoscopy, Video laryngoscopy, X-ray paranasal sinuses, chest X-ray and ECG, routine blood investigations, random blood sugar, and renal function tests.

All patients were operated under general anesthesia. Patients were nil per oral from 10 PM. Ear was prepared by shaving 2 cm above and behind the ear. After intubation, patient was put in reverse Trendelenburg position with a head ring. The head of the patient is turned to opposite side so that the operating ear is facing upward. A folded towel is placed below the face on the opposite side for support. Pinna preauricular area and postauricular area are painted with

betadine and draped.

Both postaural and transcanal approaches were used. Most of the ears were operated using Carl Zeiss operating microscope. Some cases were done using 0-degree endoscope for transcanal approach.

Graft Harvesting

Cartilage Perichondrium

The cartilage-perichondrium graft is harvested either from tragal cartilage or conchal cartilage. The tragus is injected with a local anesthesia. An incision along the free edge of tragus is made and the subcutaneous tissue is dissected to the lateral border of the cartilage and it is perichondrium. It is then harvested with it is attached perichondrium excess on one side. The donor site is then closed.

If the graft is from conchal cartilage, it is harvested by putting an anterior/posterior incision with preservation of it is associated perichondrium. The cartilage-perichondrium graft is prepared by elevating the perichondrium from one side of the cartilage while maintaining it is attachment on the other side of the cartilage.

The temporalis fascia graft is harvested through an extended postaural incision or through a separate 2 cm incision in the temporal region of scalp after infiltrating with 2% lignocaine and 1:100,000 adrenalin. The graft is then dried over a bowl of hot water [Figure 3].

Tympanoplasty procedure

The edges of the perforation are freshened. The tympanomeatal flap is elevated from 6 O'clock to 12 O'clock position. Ossicular intactness and mobility are confirmed. After putting antibiotic steroid soaked gel foam in the middle ear, the graft is placed medial to the handle of malleus and carefully tucked below the perforation. The tympanomeatal flap is repositioned. The final graft position is checked and readjusted if required. The external auditory canal is filled with antibiotic steroid soaked gel foam to stabilize the graft. A small ear pack soaked with antibiotic is kept in the ear canal. Incision is closed and mastoid dressing given [Figure 4].

When the graft is cartilage perichondrium, it is placed over the gel foam with the perichondrial side facing medially. Tympanomeatal flap is repositioned over it.

A cortical mastoidectomy is done in cases with a sclerotic mastoid and aditus patency is ensured. It facilitates aeration of middle ear and aids in the proper healing of graft.

All patients were given a mastoid dressing.

All patients were kept in post-operative intensive care unit for 24 h. Patients were kept nil per oral for 4 h postoperatively. IV fluids, IV antibiotics, and IV analgesics were given. Post-operative complications such as facial nerve weakness/palsy, soakage of mastoid dressing, vertigo, and nystagmus were observed. Mastoid dressing changed on the 1st post-operative day.

Patients were discharged on the 3rd post -operative day. Antibiotic, analgesic, decongestants, and antihistamines will be given for 1 week. Steroid nasal spray and mast cell stabilizers were continued in those patients with nasal allergy. Patients were advised not to cough, strain, or sneeze and keep ears dry. All patients were instructed to avoid air travel and swimming for 1 month.

Postaural suture removal was done on the 7th post-operative day. All patients were called for regular follow-up. The gel foam in the external auditory canal was not disturbed for 3 weeks. Antibiotic ear drops were started to facilitate dissolution of gel foam and to promote healing. On the 4th week, status of the graft was observed with otoscope. The same was done after 3 months and 6 months. PTA was done by the 6th month to assess the hearing.

All patients were followed up at regular intervals at the end of the 1st month, 3rd month, and 6th month after surgical procedure. By the end of 1 month, ear is observed for the status of the graft with otoscope alone. Any residual gel foam is cleared by gentle suctioning. By the end of the 3rd month, a healed neomembrane can be seen in case of a successful uptake of graft.

The graft take-up and gain in hearing are considered as the success of the surgery. The graft take-up was assessed by otoscopic examination. The surgery is considered as not successful in case of the failure of graft take-up, reperforation of the neomembrane, or graft retraction.

RESULTS

Among the 80 patients who underwent Type 1 tympanoplasty by disease eradication, 40 were repaired with temporalis fascia and 40 patients with cartilage perichondrium. These patients were followed up regularly for 6 months postoperatively.

The success of tympanoplasty was assessed by graft take-up and hearing improvement. Patients were followed up at 1 month, 3 months, and 6 months. The graft take-up was assessed by the end of 1 month, 3 months, and 6 months with otoscopic examination. A healed graft is considered to have a good take-up. Any residual perforation, retraction, or reperforation of graft are considered as a failure.

During the 1st month, graft take-up was seen in 97.5% (39) in fascia group and 92.5% (37) in cartilage group. The graft failure was seen only in one patient in fascia group due to upper respiratory tract infection which led to ear discharge and graft destruction. In cartilage group, three patients showed graft failure. Two of them had severe nasal allergy as they failed to use steroid nasal spray and antihistamine. One patient had infection during the 1st post-operative month, which led to graft rejection, [Table 1].

By the 3rd month, in fascia group, take-up rate came down to 92.5% (37). Three patients showed graft failure. Two of them had reperforation following allergic rhinitis and upper respiratory tract infection. In cartilage group, the take-up rate remained constant at the end of the 3rd month, [Table 2].

At the 6th month, follow-up was done to assess the neotympanum formation and hearing level. Graft was assessed using otoendoscopy and hearing assessment was done using pure-tone audiometry. In fascia group, by the end of the 6th month, success rate came down to 80% (32), which means graft failure has occurred in five patients and graft retraction in three patients. In the cartilage group, the success rate is remained same, i.e., 92.5%. Three patients showed graft failure in the 1st month and no patient had graft retraction, reperforation, or medialization, [Table 3].

Table – 1 : Percentage distribution of the post-operative result at 1 month

Follow up First	Teporalis Fascia		Cartilage Tympanoplasty		Total	
	n	%	n	%	n	%
Graft intact	39	97.5	37	92.5	76	95
Graft failure	1	2.5	3	7.5	4	5
Total	10	100	40	100	80	100

Table – 2 : Percentage distribution of the post-operative result at the 3 months

Follow up 3rd months	Teporalis Fascia		Cartilage Tympanoplasty		Total	
	n	%	n	%	n	%
Graft intact	37	92.5	37	92.5	74	92.5
Graft failure	3	7.5	3	7.5	6	7.5
Total	40	100	40	100	80	100

Table – 3 : Percentage distribution of the follow-up result at the 6th months

Follow up 6th months	Teporalis Fascia		Cartilage Tympanoplasty		Total	
	n	%	n	%	n	%
Graft intact	32	80	37	92.5	69	86.3
Graft failure	5	12.5	3	7.5	8	10
Graft retraction	3	7.5	0	0	3	3.8
Total	40	100	40	100	80	100

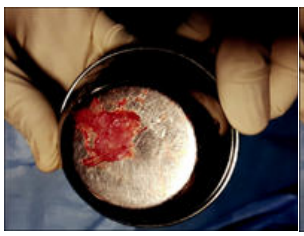

Figure 1: Temporalis fascia harvested

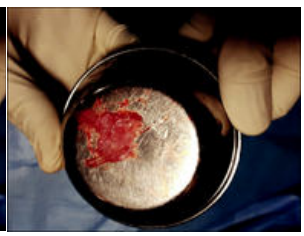

Figure 2: Graft placed using underlay technique

DISCUSSION

COM is an inflammatory process in the middle ear space that results in long term, or more often, permanent changes in the TM including atelectasis, dimeric membrane, perforation, tympanosclerosis, retraction pocket development, or cholesteatoma. Ossicular involvement is variable. COM results from long-term eustachian tube dysfunction with poorly aerated middle ear space, recurrent episodes of acute otitis media, persistent middle ear infection, or other chronic inflammations. COM is classified as active, inactive, and inactive with frequent reactivation.

Inactive COM with perforation is a permanent defect of the TM without any ongoing inflammatory process or infection in the middle ear or mastoid. The TM has been ruptured in the past as part of the previous acute or chronic inflammation. The site of perforation can be the pars flaccida or pars tensa of the TM and can be marginal, central, subtotal, or total. Pathologically, there will be no inflammation of the mucosa of the middle ear space or mucosa, but the TM is perforated. The perforation can be surrounded by healthy residual TM, tympanosclerosis, a dimeric membrane, or thick scar. Sometimes, the perforation may extend onto the fibrous annulus. The lamina propria of the TM thickens at the periphery of the perforation due to fibrous tissue proliferation. The mucocutaneous junction is at the edge of the perforation and the epithelial cells migrate medially through the perforation or may stop at the edge. The presence of an epithelial lining within the middle ear space, if not removed before closure of the membrane perforation results in iatrogenic cholesteatoma.

Perforation can be in pars tensa or pars flaccida. Perforation in the pars tensa is called as central perforation. Perforation can involve different quadrants of the TM. Anterior and posterior perforations are seen anterior and posterior to the handle of malleus, respectively. Inferior perforation is seen inferior to the handle of malleus. Subtotal perforations are very large perforation of pars tensa reaching up to the annulus of pars tensa. Marginal perforations are perforations which destroy the annulus and reach the sulcus tympanicus. It may be posterosuperior, anterior, inferior, and total perforation.

Frequent flare-ups can occur in an inactive ear. Each episode of reactivation or flare-ups can occur even without any triggering factor such as water entry or any upper respiratory tract infection in the presence of subclinical inflammation. Treatment of this subclinical infection is essential before undergoing TM closure. Without the treatment of this subclinical inflammatory process, failure of the surgical procedure can occur.

The two goals of tympanoplasty are to achieve a dry ear after eradicating middle ear disease and improve hearing mechanism by the closure of TM with graft and ossicular reconstruction. The success of the surgery is determined by the graft take-up and hearing improvement. For the success of surgery, it should be planned according to the condition of each ear. Benign central perforations, with or without cholesteatoma, previous tympanoplasty failure, mucosal diseases, poor eustachian tube function, and erosions of ossicular chain are the different entities to be considered. Benign perforation with minimal ossicular changes is expected to obtain 93–97% chance for graft take-up and an 85–90% gain in hearing is within 20 dB of bone level.

The success of tympanoplasty was assessed by graft take-up and hearing improvement. Patients were followed up at 1 month, 3 months, and 6 months. The graft take-up was assessed by the end of 1 month, 3 months, and 6 months with otoscopic examination. A healed graft is considered to have a good take-up. Any residual perforation, retraction, or reperforation of graft are considered as a failure.

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Several literatures are available regarding the study of different graft material. In a study conducted by Gibb and Chang *et al*. in 365 patients who underwent Type 1 tympanoplasty using temporalis fascia showed a take-up of 87.5%. Another study conducted by Dabholkar *et al*. in 50 patients showed 84% of take-up by temporalis fascia and 80% with tragal perichondrium. In a study conducted by Onal *et al.* in 2011, among 80 patients showed a success rate of 65.9% in fascia group and 92.3% in cartilage group. Our study showed almost similar result with the cartilage group. A study with palisade cartilage graft by Kazikdas *et al.* found a 95.7% graft take-up when compared with a 75% take-up with temporalis fascia graft.

CONCLUSION

Cartilage-perichondrium graft for Type 1 tympanoplasty could be a successful replacement for temporalis fascia giving good result with neotympanum.

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