

Results of Tragal Perichondrium and Cartilage in Middle Ear Reconstructive Surgery

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ABSTRACT

Introduction: There will always be never ending quest to find ideal graft material in middle ear reconstructive surgery. Of all the graft materials used till date the temporalis fascia still enjoys the otologist's favour. This study was an attempt to find the results of the tragal perichondrium and cartilage in the middle ear reconstructive surgery in terms of the graft uptake and the hearing results in patients of the chronic suppurative otitis media.

Material and Methods: The present study was done in patients of chronic suppurative otitis media patients. The tragal perichondrium was used as a graft material for repair. The complete demographic and clinical data was collected. Following surgery, graft survival was studied and audiological assessment was carried out. The follow up of the patient was for atleast one year.

Result: 30 patients were included in the study with 31 ears operated. The overall graft uptake obtained in our study was 80.65% and the hearing improvement that is 10dB air bone closure was seen in 7 of the 12 ears (58.33%).

Conclusions: The results of this study emulate the earlier done tragal perichondrium and cartilage studies world over. The hearing results may not show the improvement as in other studies due to small number of patients studied. But overall, tragal perichondrium and cartilage serves as a good substitute available in adequate amounts in the vicinity of the surgical field.

Keywords: Tragal Perichondrium, Cartilage, Ear Reconstructive Surgery

INTRODUCTION

Chronic suppurative otitis media is a major cause of acquired hearing impairment in developing countries.¹ It leads to well established, intractable mucoperiosteal disease of the middle ear. These pathological changes result in ossicular destruction and/ or ankylosis which together with the tympanic perforation, contribute to the hearing loss.²

Cure of chronic infection, restoration of the integrity of the tympanic membrane, and reconstruction of hearing are the ultimate goals of the middle ear reconstructive surgery or tympanoplasty.³ The most common outcome measures to define success in tympanoplasty are graft incorporation, recreation of an aerated middle ear, disease control, and hearing results.

There has been continuous evolution in technique, material and method to obtain the most acceptable results to achieve the above listed goals, the temporalis fascia still enjoys the otologist's favour.⁴ The tragal perichondrium and cartilage is another graft material which is available in adequate

amounts and easily accessible in the operative site.⁵ It has excellent contour with excellent survival capacity. Besides this, the cartilage being stiffer material is preferred in the middle ear pathologies as a graft material.

This study was an attempt to find the results of the tragal perichondrium and cartilage in the middle ear reconstructive surgery in terms of the graft uptake and the hearing results in patients of the chronic suppurative otitis media.

MATERIAL AND METHODS

The present study was conducted after ethical committee clearance and taking adequate consent from the patients in the study. In this study, 30 patients of CSOM were selected from the ENT OPD of Dayanand Medical College and Hospital, Ludhiana after proper work up such as history, general and local examination, routine investigations, pure tone audiometry (with Arphi Model 700 Mk IV), Valsalva maneuver to confirm eustachian tube patency. All these patients fulfilled the standard criteria of tympanoplasty such as dry ear, good cochlear reserve, mild to moderate conductive deafness, no evidence of septic foci in nose, throat and external auditory canal.

Preoperative antibiotic therapy was administered to eliminate any septic foci in nose or throat. Dry ear of not less than 4 wks was a prerequisite prior to the tympanic membrane surgery. In all the patients, permeal, endaural or postaural approach was taken according to the site and size of the perforation. Tragal perichondrium with cartilage was used as a graft material. Following surgery, graft uptake and hearing assessment were recorded at 6 wks, 3 months and 1 year in all the patients. The graft uptake was considered as adequate if it had good vascularization and adequate mobility on sieglisation.

Technique of Surgery: Hair (1-1½ inch) surrounding the ear to be operated was shaved off and the surrounding areas was cleaned with povidone iodine 0.5% and spirit. Antiseptic dressing was done in all cases on the night before surgery

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in order to enhance local asepsis. Prior to the surgery the patients were premedicated with atropine 0.6mg, stemetil 12.5 mg and fortwin 30 mg before the surgery. During the surgery, 1% Xylocoine with 1: 100000 Adrenaline solution was infiltrated locally.

A small incision was given through the skin on the medial side of tragus to harvest the tragal perichondrium along with the cartilage. The perichondrium was separated from the cartilage removed. The cartilage was put back in the tragal area if not required to maintain the shape, and the donor site approximated using small (3-0) interrupted mersilk sutures. The underlay technique was used to place the graft on the tympanic annulus. Wherever required, cartilage was used as ossicular replacement prosthesis. Also in cases of retracted tympanic membrane the perichondrium and cartilage was used to strengthen posterior quadrant. Following surgery, graft survival was studied and audiological assessment was carried out as per the plan.

STATISTICAL ANALYSIS

Prospective observational study was done. The hearing results were obtained using pair *t* test.

Results

The mean age was 33.77 year with the range between 12

and 58 year old. The females slightly outnumbered males. There were 16 (53.33%) females 14 (46.66%) males. Most of the patients presented with hearing impairment (90%) and otorrhea (83.33%) as shown in the figure 1. Majority of the patients had central perforation (80.64%). The two (06.66%) patients in the series had marginal perforation located in the posterior-superior quadrant. Four (12.90%) of the patients had adhesive tympanic membrane.

According to the site of the perforation 14(53.84%) were central type, 8(30.77%) were posteriorly located while only 4 patients were anterior. As per size, maximum were of medium size i.e. 12(48%), 5 (20%) had small size and 8(32%) were of large size. However, four of them had adhesive tympanic membrane.

Tympanosclerotic patch was present in six (19.35%) of the ears taken up in the study and none of them showed graft failure. The middle ear was healthy in 22 patients (70.97%) and 9 (29.03%) were unhealthy i.e. it showed congestion, granulations or was pale. 11.12% of the ears with unhealthy mucosa showed graft failure.

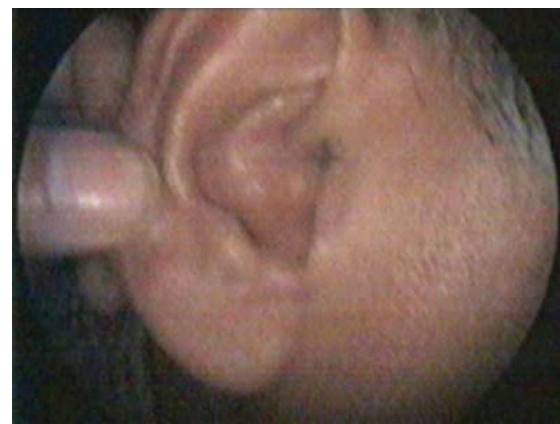
The tuning fork test were conducted using 256 Hz, 512Hz, 1028Hz frequency most had conductive ears. None of them had sensorineural loss. Two of them had mixed hearing loss. Primary repair of the tympanic membrane was done in all of the case except two cases in which revision surgery was undertaken. Type I tympanoplasty was done in 23 (83.87%) patients, Type II in 1 patient and Type III tympanoplasty

Site	N=26 ears		Graft intact(%)
	N	%	
Anterior	4	15.38	100%
Posterior	8	30.77	75%
ANT/Post (central)	14	53.84	85.71%
Total	26	100	

Table-1: Site of perforation

Age group (yrs)	N=ears	%
<18 yr	5	83.33
19-38 yr	11	91.67
39-58 yr	9	69.23
Total	25	

Table-2: reperforation cases



Post operative: Tragus Area

Paired differences		Mean	Standard deviation	Standard Error Mean	95% confidence interval of the difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Preop (R) Ear-Postop (R) Ear	7.06103	8.92543	1.65741	3.66598	10.45609	4.260	28	.000
Pair 2	Preop (L) Ear-Postop (L) Ear	6.6862	11.2258	2.0846	2.4161	10.9563	3.207	28	.003

Table-3a:

		Mean
Pair 1	Preoprightear	35.141
	Postopright	28.0803
Pair 2	Leftear	34.914
	Postopleftear	28.228

Table-3b:

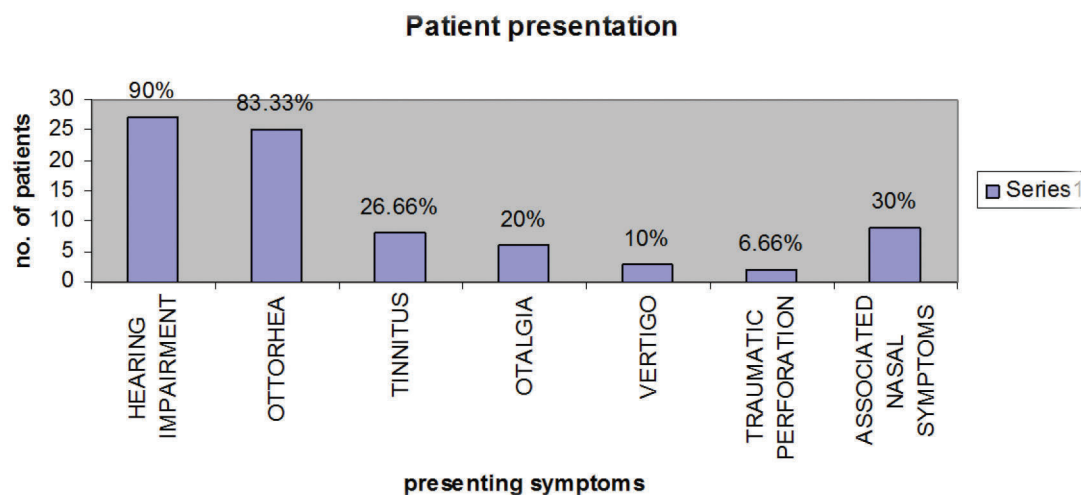


Figure-1: Presenting symptoms

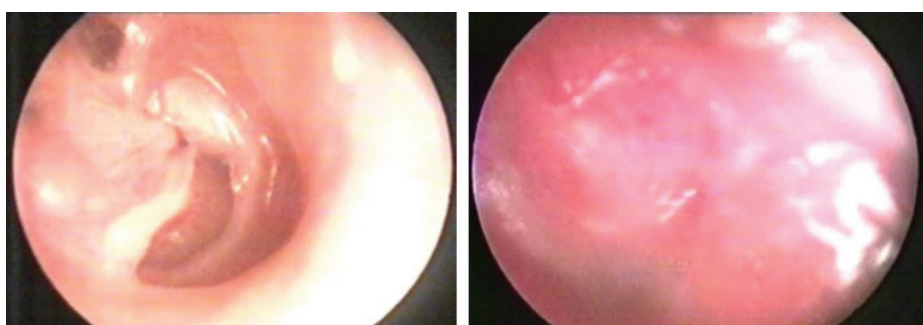


Figure-2: (a) Preoperative TM, (b) Postoperative status (3 months)

in 6(04.54%) cases. Mostly these were done under local anaesthesia except four patients which required general anaesthesia. The permeal approach was used in most of the cases 20(64.51%), endaural in 4(12.90%), and postaural in 7(22.58%) patients which required mastoid procedures. The underlay technique was used in almost all the patients expect in two where overlay and over-underlay was utilized.

In 7 cases where cartilage composite was used in atelectatic ear which required strengthening of the posterior superior quadrant. Island flap technique was used in five of them and butterfly inlay in two of them. Also, in four cases the tragal cartilage was used to maintain the ossicular continuity.

RESULTS

a) **Graft uptake rate:** In 25 ears (80.65%) and reperforation cases the uptake rate was 19.35%. The age wise graft uptake is shown in the Fig 2 a,b, table-2.

b) **Hearing results:** The post operative AB gap closure was ≤ 10 dB in 26.67%, 10-20dB in 56.67% and > 20 dB in 16.66%. Using pair test, the mean difference exist between the post operative and pre-operative at 1% level of significance for both the ears i.e. left ($P=.003$) and right ($P=.000$) and also there is a decrease in mean value post operation for both left as well as right ear, which shows there is an improvement (table-3a,b).

DISCUSSION

Temporalis fascia is the most favoured graft material by the

otologist. The tragal perichondrium and cartilage is another graft material which is available in adequate amounts and easily accessible in the operative site. It has excellent contour with excellent survival capacity. Besides this, the cartilage being stiffer material is preferred in the middle ear pathologies as a graft material. This present prospective observational study is an attempt to find the results of the tragal perichondrium and cartilage in the middle ear reconstructive surgery in terms of the graft uptake and the hearing results in patients of the chronic suppurative otitis media.

The main outcome measures both anatomical and functional in form of graft incorporation and postoperative hearing function were calculated. The intact neotympanum was achieved in 25 ears (80.65%) of the 31 ears operated. In 6 ears (19.35%) residual perforation was seen at the end of the study period. These results are comparable to the study by Jyothi P.Dabholkar⁶ et al 2007. They reported 80% graft uptake with the tragal perichondrium in their 25 subjects. Earlier, Goodhill⁷ et al 1964 in their preliminary report of primary one-stage tympanoplasties in 19 cases obtained dry ear in every case in a short period of time.

In the present study the hearing gain ≤ 10 dB was achieved in 4 ears. Goodhill et al⁷ 1964 also reported improvement in hearing in their patients.

In the present series, age of the patients ranged from 12 -57 years, with a mean age of 33.77. The majority of the patients presented between 2nd and 4th decade. There were

6 cases (20%) in the paediatric age group. Twelve cases were between 39-59 age group. There was 1 graft failure in paediatric age group <18 years of the 6 patients in this group. In 19-38 group, 1 case of graft failure was there. Four cases of residual perforation were noted in the 39-58 age group. Raine and Singh⁸ 1983 in a retrospective analysis of 114 tympanoplasties in children in the age group of 7 to 16 demonstrated a significant higher rate of failure between 8 and 12 years. The probable explanation of high incidence of failure in younger children given by them was due to increased incidence of upper respiratory tract infection and immature Eustachian tube dysfunction. They advocated deferring surgery till 12 years. Ronald Strahan 1971⁹ documented that the incidence of graft failure and failure to restore hearing were higher in older age group. The same finding was seen in our study.

All patients in this series with graft failure had otorrhea as their chief complaint. Sheehy¹⁰ 1990 previews a dry ear for a better surgical result and Gersdodoff M 1995¹¹ emphasizes the ears which were operated and had otorrhea presented worse results than the dry ears. According to Sismanis 2003¹², the chronic middle otitis aggravation with purulent infection is a relative contra-indication for the myringoplasty. In a study, by Débora Bunzen, Alexandre Campos 2006¹³, 9 ears which were operated with otorrhea which had serous and odorless secretion, tympanic membrane closure was seen in 7 of them. This way, it was observed that the surgery can be performed if the ear was totally dry or not.

According to the site of the perforation, 14 patients had central perforation. Of these 8 were of subtotal perforation. Ten ears had posterior and 3 ears had anterior perforation. Of the 5 graft failures, 2 were subtotal, 2 were located in posterior quadrant and 1 in anterior quadrant. A higher incidence of graft failure in anterior perforations has been reported in various studies (Quinn and Ryan, personal communication, 2003).^{14,11} González FC 2002¹⁵ performed a retrospective study with 197 myringoplasties in which the only decisive factor for the surgical success was the place of the perforation, with better results in the posterior perforations and worse ones in the subtotal perforation. Similar findings were observed in our study.

Among the 5 graft failures noted, 1 was of small size, 2 of medium and other 2 of large size. The patient of small size perforation was of paediatric age group with history of recurrent episodes of upper respiratory tract perforation. There is a difference of opinion as to whether size influences the success rate in myringoplasty. The majority of studies may seem to suggest that size does not affect the outcome of surgery. The study by Lee, P.; Kelly, G.; Mills *et al* 2002¹⁶ in a retrospective study of 423 myringoplasty-only operations showed that size does influence success; the success rate for small perforations was 74.1% compared with 56% for large perforations ($p = 0.0003$).

Tympanosclerotic patch was noted in 6 ears (19.35%). None of them showed graft failure. With regard to the postoperative results, the study showed an average gain of 6dB when plaques exceeding one third of the tympanic membrane

surface area were removed as part of the myringoplasty procedure. In a study by Eize W.J. Wielinga, *et al* 1995¹⁷ depicted no significant difference in the graft take up rate between tympanosclerotic and non tympanosclerotic group. Not only in the primary cases tragal perichondrium was used as a graft material but in 2 revision cases also it was utilized. One of the revision cases had discharging ear 6 months after the primary procedure and in other case, patient had pin point residual perforation 8 month following previous procedure. In both the revision cases there was graft uptake with hearing improvement, suggesting that perichondrium is good option in revision cases. Boone, Ryan T, Gardner, Edward K, Dornhoffer, John L 2004¹⁸ conducted a retrospective case review of 95 patients who had undergone revision tympanoplasty without mastoidectomy. An underlay tympanoplasty technique using either a tragal cartilage-perichondrium island graft or palisaded concha cymba cartilage was used. Successful closure without reperforation was obtained in 90 of 95 patients (94.7%). Average postoperative pure-tone average air-bone gap was 12.2+/- 13.8 dB preoperatively ($p < 0.001$).

In 4 ears (12.90%) where there was adhesive tympanic membrane cartilage-perichondrial graft was used to strengthen the posterior superior quadrant. Only in one case graft failure was noted in this category. This justifies the use of cartilage and perichondrium in adhesive otitis media with good results. John Dornhoffer 2003 presented the surgical management of the atelectatic ear. It was concluded that the management of type III and IV retractions via cartilage tympanoplasty with or without ossicular reconstruction is a proven modality.

In 3 ears (9.67%) the tragal cartilage was used for ossicular reconstruction. In 2 of these 3 ears there was 10 dB closure of air-bone gap, suggesting that cartilage is a good ossicular graft material. The tragal cartilage makes an excellent prosthesis for ossicular reconstruction because it is readily available in the operative field, is easy to use and is viable Shea MC, Glasscock ME 1967.²⁰ Yamamoto E *et al* 1988²¹ found in the human and animal studies that although some softening occurs with time, the matrix of the cartilage remains intact, but with empty lacunae.

Most of the ears had healthy middle ear mucosa i.e. 22 (70.97%) of the 31 ears. Dry ear pre-requisite was fulfilled by most of them. In 9 ears (29.03%) the middle ear mucosa was unhealthy. The mucosa was hypertrophied, in some of them granulations were noted. Only 1 ear (11.12%) with unhealthy mucosa showed graft failure. This suggests that status of middle ear mucosa is an important indicator of underlying pathology. Albu S 1998²² in their study concluded that the mucosal situation is the most important predictive factor for post operative success. Débora Bunzen *et al* 2006²³ in their evaluation of mucosal state observed that it did not influence the surgical results. The degree of affection of the mucosa of the middle ear indicates the magnitude of the disease for the mastoid, once its hyperplasia indicates important bad aeration.

In our study, 6 cases of residual perforation were present. The

reason of which could be cited were age, site and size of the perforation, state of mucosa noted intraoperatively. Besides this one failure case had associated medical condition which could play role in graft uptake.

CONCLUSION

Thus, to accomplish the surgical success in tympanoplasty procedures besides the nature of graft material, a host of other factors interplay their role as listed above. This study was a small effort to establish tragal perichondrium and cartilage as an alternative graft material.

The results in this study are comparable to the studies already done on the tragal perichondrium and cartilage. Also, after comparing with the results obtained with temporalis fascia, the tragal perichondrium offers a good substitute particularly in adhesive otitis media, open cavity procedures and revision cases. The limitations recognised during the study period were 1) Non uniformity of the patient selection 2) Interrelationships between the different prognostic factors themselves 3) Less number of cases 4) Slight deformity observed at the tragal area. However, long term results using tragal cartilage and perichondrium can favour its use as a first choice. More studies are required on this subject.

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