

A SERIES OF CARTILAGE TYMPANOPLASTY BY VARIOUS TECHNIQUES IN 208 PATIENTS

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ABSTRACT**BACKGROUND**

For repair of the tympanic membrane, temporalis fascia has been regarded as the ideal graft material. Post-operative negative pressure causes failure of the grafting and requires some rigid grafting material. The purpose of this study was to analyse the anatomical and audiologic results of cartilage tympanoplasty for the management of difficult conditions such as cholesteatoma, recurrent perforation, and atelectasis.

MATERIALS AND METHODS

The study design was a prospective case series. This study was carried out on 208 patients who underwent cartilage tympanoplasty with the various techniques at Department of ENT and Head and Neck surgery JLN Medical College & Hospital between September 2015 and January 2018, with over 6 months of follow-up with different types of tragal cartilage support for fascia graft, chondroperichondrial cartilage grafts with a boomerang-shaped cartilage island, butterfly and palisade cartilage tympanoplasty techniques.

Four-frequency (500, 1,000, 2,000, 3,000 Hz) pure-tone average air-bone gap (PTA-ABG) used for analysis of hearing results. Statistical results were compared using student t test.

RESULTS

In the present study, out of 208 patients 188 had sufficient data available for inclusion and outcomes analysis. In them 96 cases of high-risk perforation, 47 cholesteatoma, 29 cases of atelectasis and 16 cases posterosuperior granulations. There was a 11 decibel (dB) improvement in mean air conduction threshold post-operatively. Graft was taken up at 6 months by 89.90% patients. Results were statistically significant.

CONCLUSION

Cartilage tympanoplasty gives good anatomical and audiological results.

KEYWORDS

Cartilage Tympanoplasty; Chondroperichondrial Graft; Boomerang-Shaped; Butterfly Cartilage Graft; Palisade Cartilage Grafting.

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BACKGROUND

The term tympanoplasty was first used in 1953 by Wullstein.¹ In 1965, the American academy otolaryngology

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defined tympanoplasty as "a procedure to eradicate disease in the middle ear and to reconstruct the hearing mechanism, with or without tympanic membrane grafting." The aim in tympanoplasty is to achieve a healthy ear with reconstructed tympanic membrane.¹

Common graft materials used in tympanoplasties are temporal fascia, cartilage, perichondrium, periosteum, vein, and dura mater.

Utech, in 1959, first introduced cartilage in middle ear surgery.²

Microslice technique was used by Overbosch to improve the acoustic properties for an operated tympanic membrane.³

In situations of persistent middle ear pathology, large perforations, or retraction pockets, use of temporalis fascia cause higher failure rates due to the effect of negative pressure in middle ear. The post-operative dimensions of temporal fascia are unpredictable as it is composed of irregularly arranged elastic fibres and fibrous connective tissue and may shrink regardless of the surgical technique used.⁴

Cartilage tissue is mechanically resistant to retraction, residual perforation and failure of grafting. This is the characteristic and advantage of more rigid grafting material like cartilage. Post-operative dimensions remain the same because cartilage is thick material, has a constant shape, firmer than temporalis fascia and also lacks the fibrous tissue, so that it shows great adaptation with the tympanic membrane and improves anatomical and audiological outcomes.⁵

During healing of the tympanic membrane nourishment of the cartilage tissue is by diffusion of nutrients and it adapts better to focal nutritional disorders.⁶

Stiffness and bradytrophic metabolism, which make the reconstructed tympanic membrane particularly suitable for difficult conditions such as cholesteatoma, recurrent perforation, and atelectasis this is the major advantage of the cartilage.^{7,8}

Heerman used the cartilage palisade technique.⁹

Hearing results were comparable to normal tympanic membrane and have been achieved in the cases where cartilage is thinner than 0.5 mm.¹⁰

The present study was aimed to evaluate the results of using the autologous tragal cartilage graft in the surgical treatment of the various defects caused by chronic suppurative otitis media.

Aims and Objectives

The study planned to evaluate the anatomical and audiological results in cartilage tympanoplasty cases that utilized several techniques for the management of chronic otitis media and the difficult cases like large perforations, cholesteatoma, recurrent perforation, and atelectasis.

MATERIALS AND METHODS

a) Inclusion Criteria

- Tubotympanic type of COM not improving with conservative management.
- Tubotympanic type of COM in the quiescent stage.
- Retraction pocket present and conductive hearing loss.
- Atticoantral type of COM in whom ossicular chain was reconstructed using cartilage.

b) Exclusion Criteria

- COM present in the patients and having septic foci in throat or nose.
- Study design - prospective case series.

This study was carried out on 208 patients who underwent cartilage tympanoplasty with the various

techniques at Department of ENT and Head and Neck surgery JLN Medical College & Hospital between September 2015 and January 2018.

Out of 208 patients 188 had sufficient data available for inclusion and outcome analysis in them 99 were males and 89 females.

A detailed history including duration and nature of symptoms was taken. Detailed ENT examination was. Examination under microscope was done which has provided useful information i.e., perforation size, location according to quadrant.

Routine investigations were done in every case. X-ray Mastoids done. The pre-operative audiometry was done following standard protocol. Four frequencies of 500, 1000, 2000 and 3000 Hz were used for calculation of average of hearing loss. Written and informed consent taken.

The surgery was performed under local or general anaesthesia using a microscope. Local infiltration was done in post auricular area and tragus with 2% xylocaine with 1:200000 adrenalines. Wildes incision was used in majority of cases. Posterior tympanomeatal flap was elevated and status of the middle ear and ossicular chain was assessed to decide the type of tympanoplasty. Tragal cartilage was used, size and shape modified according to need and technique used by us.

Tragal cartilage harvested, was sliced to 0.5 mm thickness using cartilage slicer and then used for reconstruction.

We used a piece of cartilage and carved in semilunar shape and inserted medial to anterior remnant of tympanic membrane. Temporalis fascia graft was sandwiched between cartilage and anterior remnant of tympanic membrane. So it was a support of the cartilage for strengthening.

We used tympanoplasty with boomerang shaped chondroperichondrial graft technique-in which chondroperichondrial cartilage grafts with a boomerang-shaped cartilage island placed at the anterior and inferior parts of the tympanic membrane.

Butterfly tympanoplasty- The butterfly cartilage graft was slipped across the perforation, margins of the perforation went inside the groove to about 1 to 2 mm depth, one surface of the cartilage with its perichondrium lies inside the middle ear and the other on the lateral side.

Palisade cartilage tympanoplasty- cartilage graft were cut in an oblique manner. Cartilage strips made, following the perforation of edges, packing of middle ear cavity done with Gelfoam, the cartilage strips (usually 4-6 in number/0.5 mm thickness) were positioned in an over-underlay fashion from anterior to posterior direction, parallel to manubrium malleus and slightly overlapping each other.

These techniques utilized, with decision making and modification of the basic surgical techniques based on the specific situation, surgical approach and type of TM pathology.

Cartilage is thin, flat, and in sufficient quantities to allow reconstruction of the complete tympanic membrane so it is ideal material for reconstruction.

In cholesteatoma cases cavity was also covered by cartilage with attached its perichondrium.

Pre and post-operative hearing evaluation in 6 months was done by audiometry recording air conduction and bone conduction of all these patients for 0.5, 1, 2 and 3 kHz.

Pre and post-operative air conduction, bone conduction and AB gap calculated and assessed statistically.

At each follow up the complaints of the patients were noted. Microscopic examination was done to see the condition of the canal and graft.

Graft uptake was considered successful if there was no residual perforation on follow up at 6 months. Hearing results were compared using the guidelines recommended by Committee on Hearing and Equilibrium of the American academy of otolaryngology- head and neck surgery for the evaluation of results for the conductive hearing loss.

The Student t test was used for statistical comparison.

RESULTS

In the study, out of 208 patients 188 had sufficient data available for inclusion and outcome analysis in them 99 were males and 89 females.

In them 96 cases of high-risk perforation, 47 cholesteatoma, 29 cases of atelectasis and 16 cases poster superior granulations.

Sl. No.	Symptoms	No. of Patients	Percentage
1.	Ear Discharge	174	93
2.	Decreased Hearing	141	75
3.	Earache	28	15

Table 1. Clinical Presentation of Study Population

Age Group (Years)	Number of Patients
0-10	2
10-20	66
21-30	72
31-40	34
41-50	7
51-60	7

Table 2. Age Distribution of Study Population

Air Bone Gap (dB)	Pre-operative No. of Patients (%)	Post-operative No. of Patients (%)
≤15	6(3.19)	25(13.29)
16-25	30(15.95)	65(34.57)
26-40	59(31.38)	71(37.76)
>40	93(49.46)	27(14.36)

Table 3. Comparison of Air Bone Gap

	Hearing Threshold Pre-operatively (mean ± SD)	Hearing Threshold Post-operatively (mean ± SD)
Air Conduction (dB)	40±14	29±13
Bone Conduction (dB)	13±7	13±7
Air bone gap (dB)	27±11	16±9

Table 4. Comparison of Pre and Post-Operative Hearing Results

Findings	No. of Patients	Percentage
Graft taken up	169	89.90
Not taken up with perforation	8	4.25
Not taken up with discharge	11	5.85

Table 5. Otosopic Finding During Follow-up at 6 Months

DISCUSSION

The present study was conducted on the patients with Chronic Suppurative Otitis Media, in the Department of ENT and Head and Neck surgery JLN Medical College & Hospital between September 2015 and January 2018, with over 6 months of follow-up.

Clinical and demographic data were collected by the age and sex of the patient. Diagnosis was confirmed. Past surgical history was taken. Surgical technique, use of the cartilage and intra operative findings were analysed and kept in mind. The main outcome measures were to evaluate the graft uptake, postoperative hearing results and complications.

The age of the patients included in the study ranged from 9 years to 63 years. The commonest age group was 21-30 years. Sirena E et al. Conducted a case series of 50 cases to assess the surgical results and audiometric outcomes of

tympanoplasty in which the age ranged from 7 to 64 years, which is comparable to the present study.¹¹ In the present study, there were 99 males (52.65%) and 89 females (47.35%).

In our study there was a 11 decibel (dB) improvement in mean air conduction threshold post-operatively and graft was taken up at 6 months by 89.90% patients. Gerber et al. compared the cartilage and fascia in a frequency-specific manner and found in their study that there was an average improvement of 10 dB in air conduction threshold.¹² Using shield-sliced tragal cartilage –perichondrium composite graft, Khan et al. reported 97.7% success rate.¹³ In the study by Sapci T. et al 92% successful closure of tympanic membrane was achieved using tragal cartilage graft.¹⁴ Tympanoplasty with boomerang shaped chondroperichondrial graft technique was a new technique used in our study. In study of Riza Dundar et al, (2013) performed Tympanoplasty with boomerang shaped chondroperichondrial graft the success rate was 95 % in 99 cases.¹⁵ In the series reported by Kazikdas et al. (2007) the graft success rate was 95.7% (22 cases) using palisade cartilage tympanoplasty, and 75% using temporal fascia (21 cases).¹⁶ Our results are also similar to Ulku et al who had found graft uptake rate of 91.3% with perichondrium cartilage in his retrospective study.¹⁷ No residual

cholesteatoma or granulations found during follow-up. There was not retraction pocket formed post-operatively. Post-operatively there were no complications like wound infection, haematoma formation and facial nerve injury.

CONCLUSION

Cartilage tympanoplasty achieves good anatomical and audiological results. No change in bone conduction noted. On analysing the pre and postoperative audiometric results, it was found that there was a statistically significant improvement in air conduction threshold following cartilage tympanoplasty. In view of these benefits, we suggest that cartilage tympanoplasty would be a good alternative for grafting.

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