

Prospective Interventional Assessment of the Anatomic and Functional Results of Endoscopic Composite Cartilage Tympanoplasty in Chronic Otitis Media Cases with Safe Central Perforation

Deepak Kumar Raman¹, Raj Kumar Choudhary², Rana Pratap Thakur³

¹Senior Resident, Department of ENT, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India.

²Associate professor, Department of ENT, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India.

³Associate professor and HOD, Department of ENT, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India.

Received: 15-06-2022 / Revised: 25-06-2022 / Accepted: 10-07-2022

Corresponding author: Dr. Raj Kumar Choudhary

Conflict of interest: Nil

Abstract

Aim: To determine the anatomic and functional results of endoscopic composite cartilage tympanoplasty in chronic otitis media cases with safe central perforation.

Material & Methods: This prospective interventional study included 60 patients of chronic otitis media with dry and safe central perforation (small/medium), who underwent endoscopic composite cartilage tympanoplasty (type I) in the Department of ENT, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India over a period of 4 months.

Results: The pre-operative ACT was 43.74 ± 8.62 dB whereas postoperatively it was 33.47 ± 7.38 dB and the difference between the pre-operative and post-operative values was found to be statistically significant ($p=0.001$).

Conclusions: This study concluded that endoscopic composite cartilage tympanoplasty in chronic otitis media cases with dry central perforations is an effective surgical modality with good audiological and morphological outcomes and negligible post-operative complications.

Keywords: Cartilage, Endoscopic ear surgery, Tympanoplasty type I

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Chronic mucosal diseases of middle ear cleft or chronic suppurative otitis media has been traditionally defined as a chronic inflammation of the middle ear and mastoid usually associated with perforation of the tympanic membrane and otorrhoea. [1]

Tympanoplasty is now an established surgery for tympanic membrane perforation. The principal aims of tympanoplasty are to create an intact tympanic membrane and to restore functional hearing. [2] Since the introduction of tympanoplasty, a wide variety of graft material has been used for

the closure of perforation: Skin, fascia lata, temporalis fascia, vein, perichondrium, and durameter. [3]

Persistent perforation of the tympanic membrane causes recurrent ear discharge and hearing loss of varying degrees. Cartilage supported myringoplasty with palisade technique has good result of graft uptake rate ranging from 86 to 100%. [4-5] This technique brings very good functional and better long-term results. [6]

Thus, we aim to determine the anatomic and functional results of endoscopic composite cartilage tympanoplasty in chronic otitis media cases with safe central perforation.

Material & Methods:

This prospective interventional study included 60 patients of chronic otitis media with dry and safe central perforation (small/medium), who underwent endoscopic composite cartilage tympanoplasty (type I) in the Department of ENT Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India over a period of 4 months.

This study was approved by the institutional ethics committee. The inclusion criteria were: (a) patients aging above 12 years; (b) with chronic otitis media with dry and safe central perforation (small or medium) for at least one and a half months; (c) having conductive hearing loss (air conduction threshold <45 dB in the affected ear); and (d) good tubal function and dry middle ear mucosa. The exclusion criteria were: (a) large subtotal/total perforation; (b) with active squamosal/adhesive disease (unsafe ear); (c) with persistently discharging ear not responding to medication; (d) pure sensorineural and mixed hearing loss in the affected ear; and (e) revision cases.

Informed consent was taken from all patients after proper counseling. All selected patients were subjected to a thorough history regarding presenting

complaints, any chronic illness, any long-duration medication, or any systemic disorder. Clinical examination, otoscopy, oto-endoscopy, tuning fork tests, and X-ray (bilateral) mastoid (Schuller's view) were done in all patients. Hearing assessment by pure tone audiometry (PTA) was performed on all patients. The air conduction (ACT) and bone conduction (BCT) pure-tone average were calculated by averaging the thresholds at 0.5, 1, 2, and 4 kHz.

All patients were followed up postoperatively at one month, three months, and six-month intervals and underwent audiometry and otoscopy. The final audiological and morphological outcome considered during this study was done at 6 months. Anatomical success was defined as the presence of an intact graft, as evaluated by a zero-degree endoscope, without perforation, atelectasis, or lateralization at the follow-up of 6 months. Functional results were evaluated by comparing the change in air conduction thresholds preoperatively and postoperatively. All data were collected and analyzed using appropriate statistical methods.

Data were described in terms of range, preoperative ACT, and postoperative ACT (mean±SD), frequencies (number of cases), and relative frequencies (percentages) as appropriate. The comparison of quantitative variables was done using paired t-test. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using (Statistical package for the social science) SPSS, version 21 (SPSS Inc., Chicago, IL, USA).

Surgical Technique:

All surgical procedures were performed by the same surgeon using 0 and 30-degree Karl Storz rigid endoscope (18 cm, 4 mm) with connected fiberoptic light transmission. The endoscope was

connected to Stryker 1588 Camera unit. All surgeries were done under general and hypotensive anesthesia. Trans-canal approach and over-underlay technique was employed in all the patients to maintain uniformity. The full-thickness tragal chondro-perichondrial graft was used in all cases.

A pick or sharp needle was used to freshen the perforation margins. A lateral circumferential incision using Rosen's knife was made 4-6 mm laterally from the annulus of the tympanic membrane and integrated with radial incisions. The tympanomeatal flap was elevated and the manubrium of the malleus was skeletonized (Figure 1, a-f).

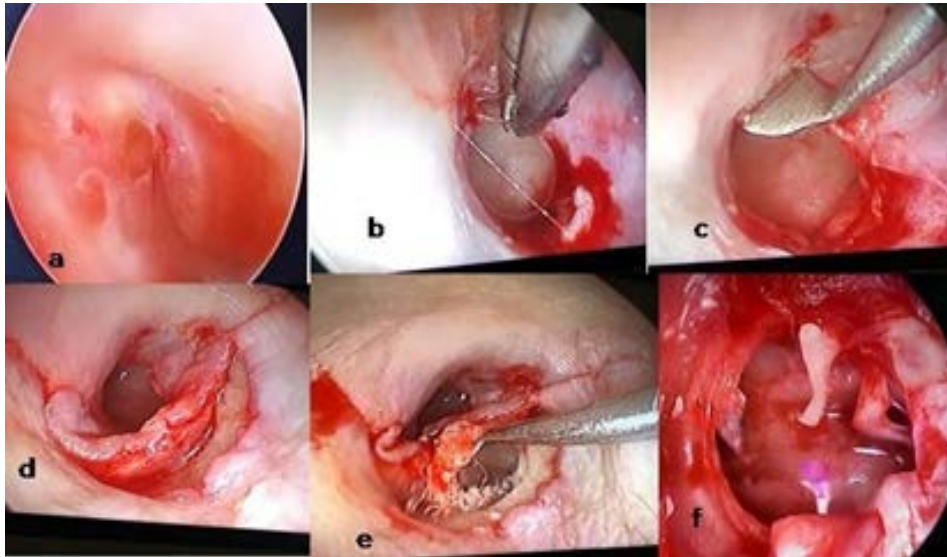


Figure 1: (a) Perforation; (b) freshening of margins; (c) creating raw surface under remnant; (d) a curvilinear incision in the canal; (e) elevation of the tympano-meatal flap; and (f) denuding the handle of malleus.

Middle-ear mucosa and ossicular chain mobility were assessed. The cartilage graft with mucoperichondrium (on one side) was then excised and a triangular part of it was removed at a site corresponding to the lateral process and handle of the malleus. The middle ear was then packed with Gel foam and the harvested graft was placed in position. The over-underlay technique was

performed by placing the chondro-perichondrial graft lateral to the handle of the malleus and medial to the tympanic membrane remnant and annulus (Figure 2, a-d). The tympanomeatal flap was repositioned back in the external ear canal. The external ear canal was then packed with Gelfoam and a sterile pack was placed in the external meatus.

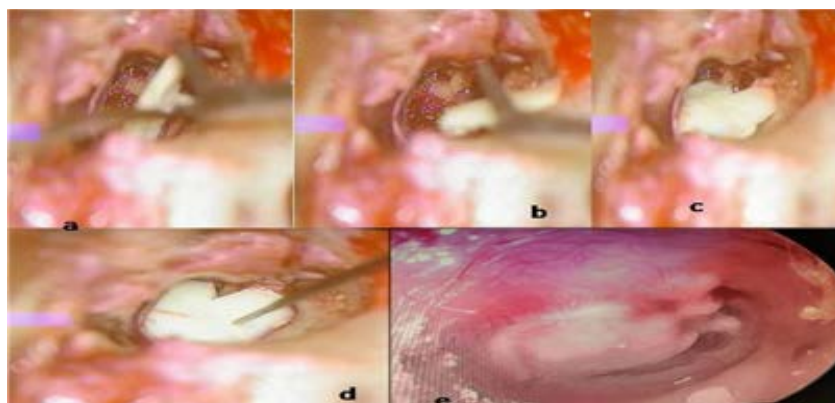


Figure 2:(a and b) Insertion of cartilage graft in the middle ear; (c and d) placement of cartilage graft over the handle of malleus; and (e) intact cartilage graft 8 months post-operatively.

All patients during their hospital stay were given intravenous antibiotics, analgesics, proton pump inhibitors, and also oral decongestants. Patients were discharged after 48-72 hrs and were called for follow-

Results:

The pre-operative ACT was 43.74 ± 8.62 dB whereas postoperatively it was 33.47 ± 7.38 dB and the difference between the

up visits. The follow-up protocol involved suture removal on postoperative day seven, followed by ear pack removal and antibiotic ear drop prescription on post-operative day 14.

pre-operative and post-operative values was found to be statistically significant ($p=0.001$). [Table 1]

Table 1: Comparison between pre-operative and post-operative air conduction thresholds at 6 months.

Mean Air conduction threshold (ACT)	Pre-operative	Post-operative		T	P value
	Mean SD	Mean	SD		
		43.74 ± 8.62	33.47 ± 7.38	7.65	15.017

Discussion:

Composite cartilage tympanoplasty is a well-established technique. When performed endoscopically, functional and anatomical outcomes are comparable to microscopic surgical techniques. However, advantages in the visualization and access via the EES method have been observed. Cartilage is robust enough to resist middle ear negative pressure and no significant difference has been demonstrated in sound conduction when compared to temporalis fascia. [7-10] Factors that resulted in good graft uptake, involve the exploitation of the natural characteristics of the tragal cartilage, through a specific grafting design that diminishes the possibility of dislodgement and easier one-handed placement. Furthermore, this method reduces the need for middle ear packing, which reduces the likelihood of adhesion formation. [11]

A study by Cicek MM et al. [12] reported that average hearing threshold at pre-operative and post-operative was obtained as 34.3 ± 13.31 and 26.2 ± 14 dB, respectively. Another study conducted by Albirmawy OA. [13] Where the mean pre-

operative ABG was 26.62 ± 1.73 dB and the mean post-operative ABG was 10.95 ± 2.12 dB. Thus, in their study, mean ABG was decreased by 14.67 ± 2.10 dB. Shishegar M, Faramarzi A, Tarashi A [14] performed palisade cartilage tympanoplasty in 27 patients and found Graft uptake rate 100%. [15]

Conclusion:

This study concluded that endoscopic composite cartilage tympanoplasty in chronic otitis media cases with dry central perforations is an effective surgical modality with good audiological and morphological outcomes and negligible post-operative complications.

References:

1. Jahn AF. Chronic otitis media: diagnosis and treatment. *Med Clin North Am.* 1991; 75:1277–91.
2. Ozbek C, Cifti O, Tuna EE, Yazkan O, Ozdem C. A comparison of cartilage palisades and fascia in type 1 tympanoplasty in children: Anatomic and functional results. *Otol Neurol.* 2008; 29:679-83.

3. Cavaliere M, Mottola G, Rondinelli M, Iemma M. Tragal cartilage in tympanoplasty: Anatomic and functional results in 306 cases. *Acta Otorhinolaryngol Ital.* 2009; 29:27-32.
4. Yung M. Cartilage tympanoplasty: literature review. *J Laryngol Otol.* 2008 July;122(7):663-72.
5. Cabra J, Monux A. Efficacy of cartilage palisade tympanoplasty: randomized controlled trial. *OtolNeurotol.* 2010 June;31(4):589-95.
6. Heermann J Jr, Heermann H, Kopstein E. Fascia and cartilage palisade tympanoplasty: Nine years' experience. *Arch Otolaryngol.* 1970 March;91(3):228-41.
7. Dornhoffer J. Cartilage tympanoplasty: indications, techniques, and outcomes in a 1,000-patient series. *Laryngoscope.* 2003;113 (11):1844-56.
8. Gerber MJ, Mason JC, Lambert PR. Hearing results after primary cartilage tympanoplasty. *Laryngoscope.* 2000;110(12):1994-9.
9. Bahadir O, Aydin S, Caylan R. The effect on the middle-ear cavity of an absorbable gelatine sponge alone and with corticosteroids. *Eur Arch Otorhinolaryngol.* 2003;260(1):19-23.
10. Monasta L, Ronfani L, Marchetti F, Montico M, Vecchi BL, Bavcar A, et al. Burden of disease caused by otitis media: systematic review and global estimates. *PLoS One.* 2012;7(4): e36226.
11. Gokgoz MC, Tasli H, Helvacioğlu B. Results of endoscopic transcanal tympanoplasty performed by a young surgeon in a secondary hospital. *Braz J Otorhinolaryngol.* 2020;86(3):364-9.
12. Cicek MM, Avci H, Sahn B, Acar S, Polat B, Celik M et al. Surgical success of tympanoplasty using composite tragal cartilage in chronic otitis media. *J Craniofac Surg.* 2017; 25:2042-4.
13. Albirmawy AO. Comparison between cartilage perichondrium composite ring graft and temporalis fascia in type one tympanoplasty in children. *J Laryngol Otol.* 2010; 124:967-74
14. Shishegar M, Faramarzi A, Taraghi A. A Short-term Comparison Between Result of Palisade Cartilage Tympanoplasty and Temporalis Fascia Technique. *Iran J Otorhinolaryngol.* 2012;24(68):105-12
15. M S., Ibrahima, C., Nouhoum, G., Gounon S., Brainima, C., Adama G., Abdoulaye, N. & Fatoumata, S. La rétinopathie de Valsalva et le travail d'accouchement au CHU-IOTA. *Journal of Medical Research and Health Sciences,* 2021:4(8), 1428-1431.