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Original Research Article

COMPARATIVE EVALUATION OF TYMPANOPLASTY WITH AND WITHOUT CORTICAL MASTOIDECTOMY IN TUBOTYMPANIC CHRONIC OTITIS MEDIA

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ABSTRACT

Background: The role of cortical mastoidectomy as an adjunct to tympanoplasty in patients with chronic suppurative otitis media (CSOM) without cholesteatoma remains controversial. While some authors advocate cortical mastoidectomy for improving middle ear ventilation and graft uptake, others have reported no additional benefit over tympanoplasty alone. The objective is to compare hearing outcomes, graft uptake rates, and postoperative complications in patients undergoing tympanoplasty alone versus tympanoplasty combined with cortical mastoidectomy.

Materials and Methods: This comparative study included 70 patients diagnosed with CSOM who were divided into two groups of 35 patients each. Group 1 underwent tympanoplasty alone, while Group 2 underwent tympanoplasty with cortical mastoidectomy. Temporalis fascia was used as the graft material in all cases. All surgeries were performed through a postaural approach using the interlay technique. Preoperative and postoperative hearing assessments were conducted, and graft uptake and postoperative ear discharge were evaluated during follow-up. Statistical significance was set at $p < 0.05$.

Results: The mean age of patients was 29.60 ± 9.23 years in Group 1 and 31.57 ± 9.57 years in Group 2. Baseline demographic and clinical characteristics were comparable between the groups ($p > 0.05$). Significant postoperative hearing improvement was observed in both groups. In Group 1, the mean hearing threshold improved from 38.46 ± 7.92 dB to 30.02 ± 7.96 dB, while in Group 2 it improved from 39.33 ± 6.33 dB to 30.15 ± 6.75 dB (both $p < 0.001$). The mean hearing gain was 13.68 ± 4.24 dB in Group 1 and 12.06 ± 4.24 dB in Group 2, with no significant difference between the groups ($p = 0.11$). Graft failure occurred in 3 (8.57%) patients in Group 1 and 4 (11.43%) patients in Group 2 ($p = 0.69$). Postoperative ear discharge was significantly higher in Group 2 compared to Group 1 (31.43% vs. 8.57%; $p = 0.01$).

Conclusion: Both tympanoplasty alone and tympanoplasty with cortical mastoidectomy resulted in significant hearing improvement and high graft uptake rates. However, the addition of cortical mastoidectomy did not provide any significant advantage in terms of hearing gain or graft success. Routine cortical mastoidectomy may therefore be unnecessary in patients with non-cholesteatomatous CSOM and should be reserved for selected cases.

Keywords: Chronic suppurative otitis media; Tympanoplasty; Cortical mastoidectomy; Hearing improvement; Graft uptake; Chronic otitis media.

INTRODUCTION

Chronic suppurative otitis media (CSOM), also known as chronic otitis media (COM), is a persistent inflammatory condition of the middle ear and mastoid cavity characterized by recurrent or persistent ear discharge through a perforated tympanic membrane.[1] The prevalence of COM

varies considerably among different countries and populations. Importantly, otitis media remains one of the leading causes of preventable hearing loss worldwide and can significantly impair patients' quality of life.[2]

Persistent tympanic membrane perforations predispose patients to recurrent middle ear infections, which may result in progressive hearing impairment. Long-standing perforations with epithelialized margins often lead to recurrent ear discharge and consequently become an indication for tympanoplasty. The primary objectives of tympanoplasty are to eradicate disease from the middle ear cleft, close the existing perforation, and restore hearing function through reconstruction of the sound-conducting mechanism, with or without grafting of the tympanic membrane.[3]

In patients with persistent tympanic membrane perforations, Type I tympanoplasty (myringoplasty) is commonly performed to reduce the risk of recurrent infections and improve hearing. This procedure is widely practiced in both children and adults, with reported success rates of up to 86%.4 Several factors have been shown to influence the success of tympanic membrane closure following Type I tympanoplasty, including patient age, perforation size, and the type of graft material used.[4,5]

Type I tympanoplasty is sometimes combined with cortical mastoidectomy. Although mastoidectomy was first described by Louis Petit in the eighteenth century, it gained widespread acceptance in the mid-twentieth century.[6] The procedure is generally indicated in cases of severe infection, extensive inflammation, or middle ear pathology associated with a sclerotic mastoid.[7] However, the role of mastoidectomy in improving outcomes of tympanoplasty for non-cholesteatomatous COM remains controversial and continues to be investigated.[8]

One proposed mechanism for improved surgical outcomes is that mastoidectomy creates a well-aerated mastoid cavity, thereby enhancing middle ear ventilation. This may be particularly beneficial in patients with poor Eustachian tube function or a poorly pneumatized mastoid air-cell system.[9] Despite these theoretical advantages, evidence regarding the routine addition of cortical mastoidectomy to Type I tympanoplasty remains inconclusive.

Therefore, the present study was undertaken to evaluate and compare the outcomes of Type I interlay tympanoplasty performed with and without cortical mastoidectomy in patients with large central tympanic membrane perforations. The comparison was based on graft uptake rates and postoperative hearing improvement.

MATERIALS AND METHODS

This prospective, comparative, randomized controlled trial was conducted in the Department of Otorhinolaryngology after obtaining approval from the Scientific Committee and the Institutional Ethics Committee. The study was carried out over a period of one year, from May 2018 to May 2019.

A total of 70 patients of either sex, aged more than 15 years, diagnosed with inactive mucosal-type chronic otitis media (COM) with a large central tympanic membrane perforation were included in the study. Patients with a history of previous ear surgery, unsafe (squamosal) COM, ossicular erosion, tympanosclerosis, evident disease involving the epitympanum or mastoid antrum detected during intraoperative exploration, mixed hearing loss with a sensorineural component, active infection of the ear, nose, throat, or paranasal sinuses, and those younger than 15 years or older than 55 years were excluded from the study.

All patients with chronic otitis media presenting with a large central perforation and conductive hearing loss were admitted to the Department of Otorhinolaryngology. A detailed history was obtained from each patient, including demographic characteristics such as age, sex, and socioeconomic status, as well as clinical details including symptoms and duration of ear complaints.

All patients underwent examination under microscopy (EUM) to confirm otoscopic findings, assess the condition of the middle ear mucosa, and evaluate the extent of middle ear epithelialization. Radiological assessment of the mastoid was performed using X-ray mastoid Schüller's view to determine the degree of mastoid pneumatization, and the findings were recorded. Diagnostic nasal endoscopy was also performed in all patients to exclude any associated sinonasal pathology.

Audiological evaluation was carried out using pure-tone audiometry (PTA) both preoperatively and at 12 weeks postoperatively. Pure-tone thresholds were measured using a GSI-61 two-channel diagnostic audiometer. Air-conduction and bone-conduction thresholds were assessed at octave frequencies ranging from 500 Hz to 8000 Hz. Hearing thresholds were determined using a duly calibrated double-channel clinical audiometer (American National Standards Institute [ANSI] S3.6-1996 standards), coupled with TDH-50P earphones and MX41R ear cushions for air-conduction testing. The modified Hughson–Westlake procedure was employed to estimate hearing thresholds with a resolution of 5 dB. Bone-conduction thresholds were obtained using a Radioear B-71 bone vibrator.

Routine preoperative investigations, including biochemical, hematological, and viral marker testing, were performed for all patients. Written informed consent was obtained from each participant before enrollment in the study.

All surgical procedures were performed by the same surgeon to eliminate inter-surgeon variability. Based on random allocation, patients were divided into two equal groups. Group I comprised 35 patients who underwent Type I tympanoplasty alone, whereas Group II consisted of 35 patients who underwent

Type I tympanoplasty combined with cortical mastoidectomy.

The postoperative outcomes were evaluated in terms of graft uptake rate and hearing improvement at 12 weeks following surgery.

RESULTS

A total number of 70 patients were included in the study and were divided into two groups. The first study group consisted of 35 patients who had undergone tympanoplasty and the other group of 35 patients, underwent tympanoplasty with cortical mastoidectomy. Temporalis fascia was used as graft in all the cases. All the surgeries were done by post aural route and underlay technique was used in all cases.

The two study groups were comparable with respect to baseline demographic and clinical characteristics. No statistically significant differences were observed between Group 1 (tympanoplasty alone) and Group 2 (tympanoplasty with cortical mastoidectomy) in terms of age, gender distribution, side of lesion, duration of ear discharge, or duration of hearing loss (all $p > 0.05$).

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population

Parameters	Group 1(n=35)	Group 2 (n=35)	p value
Age in years (Mean±SD)	29.60 ±9.23	31.57± 9.57	0.38
Gender M (%): F (%)	17(48.57%): 18(51.43%)	25(71.43%): 10(28.57%)	0.08
Side of lesion left: right	18(51.43%):17(48.57%)	16(45.71%):(54.29%)	0.07
Duration of discharge in years (Mean±SD)	3.80± 3.59	3.53 ±2.83	0.72
Duration of hearing loss in years (Mean±SD)	2.44± 2.49	2.24 ±2.14	0.72

Values are expressed as mean ± SD or n (%). Group 1: Tympanoplasty alone (n = 35); Group 2: Tympanoplasty with cortical mastoidectomy (n = 35). A p-value < 0.05 was considered statistically significant

Table 2: Comparison of Auditory Improvement Between the Two Study Groups

Auditory assessment	Group 1(n=35) (Mean±SD)	Group 2 (n=35) (Mean±SD)	p value
Preoperative(dB)	38.46± 7.92	39.33±6.33	0.61
After 3 months(dB)	30.02±7.96	30.15±6.75	0.94
p value	<0.001	<0.001	

Values are expressed as mean ± SD in decibels (dB). Group 1: Tympanoplasty alone (n = 35); Group 2: Tympanoplasty with cortical mastoidectomy (n = 35). Within-group comparisons were performed between preoperative and 3-month postoperative hearing thresholds. A p-value < 0.05 was considered statistically significant.

Both groups demonstrated significant improvement in hearing thresholds at 3 months postoperatively compared with preoperative values ($p < 0.001$ for both groups). The mean preoperative and postoperative hearing thresholds were comparable between Group 1 and Group 2, with no statistically significant intergroup differences observed at either time point ($p > 0.05$).

Table 3: Comparison of Hearing Benefit and Surgical Outcomes between the Two Study Groups

Parameters	Group 1(n=35)	Group 2 (n=35)	p value
Hearing benefit(dB) (Mean±SD)	13.68±4.24	12.06±4.24	0.11
Ear discharge after follow up Yes (%): No (%)	3(8.57%):32(9.43%)	11(31.43%):24(68.57%)	0.01
Graft failure Yes (%): No (%)	3(8.57%):32(9.43%)	4(11.43%): 31(88.57%)	0.69

Values are expressed as mean ± SD or n (%). Group 1: Tympanoplasty alone (n = 35); Group 2: Tympanoplasty with cortical mastoidectomy (n = 35). A p-value < 0.05 was considered statistically significant.

The mean hearing benefit was higher in Group 1 than in Group 2 (13.68 ± 4.24 dB vs. 12.06 ± 4.24 dB); however, the difference was not statistically significant ($p = 0.11$). Postoperative ear discharge was significantly more frequent in Group 2 compared to Group 1 (31.43% vs. 8.57%; $p = 0.01$). Graft failure rates were comparable between the groups, with no statistically significant difference observed ($p = 0.69$).

DISCUSSION

Chronic otitis media (COM) is a major cause of preventable hearing loss, particularly in developing countries. India is among the countries with the highest burden of COM, posing a significant public health challenge. Patients with the tubotympanic type of chronic otitis media commonly present with persistent tympanic membrane perforations and progressive conductive hearing loss. Such non-healing perforations often require surgical repair in the form of Type I tympanoplasty, also known as myringoplasty.

The primary objectives of tympanoplasty are to achieve closure of the tympanic membrane perforation, prevent the entry of pathogens, allergens, and contaminants into the middle ear cavity, eradicate middle ear disease, and improve hearing outcomes. Over the years, several tympanoplasty techniques have been described, including underlay, overlay, and interlay approaches. However, there is still no universal consensus regarding the optimal

surgical technique. The choice of procedure is frequently influenced by the surgeon's experience, preference, and technical expertise rather than by the specific characteristics of the tympanic membrane perforation itself.[10]

Interlay tympanoplasty is a surgical technique in which the graft is positioned between the lateral fibrous layer and the medial mucosal (endothelial) layer of the residual tympanic membrane. This approach combines the advantages of both underlay and overlay techniques while minimizing their associated complications. The interlay technique has been reported to achieve high rates of successful graft uptake and favorable postoperative hearing outcomes. Several studies have demonstrated excellent anatomical and functional results with this method, making it a reliable option for the repair of tympanic membrane perforations.[11-13]

The present study evaluated the role of cortical mastoidectomy as an adjunct to tympanoplasty in patients with chronic suppurative otitis media (tubotympanic type). The baseline demographic and clinical characteristics were comparable between the two groups, indicating that the postoperative outcomes could be reliably attributed to the surgical intervention rather than pre-existing differences.

Hearing improvement was observed in both groups following surgery. In Group 1 (tympanoplasty alone), the mean hearing threshold improved from 38.46 ± 7.92 dB preoperatively to 30.02 ± 7.96 dB at 3 months postoperatively ($p < 0.001$), while in Group 2 (tympanoplasty with cortical mastoidectomy), it improved from 39.33 ± 6.33 dB to 30.15 ± 6.75 dB ($p < 0.001$). However, the postoperative hearing outcomes were comparable between the groups ($p = 0.94$). Similarly, the mean hearing gain was 13.68 ± 4.24 dB in Group 1 and 12.06 ± 4.24 dB in Group 2, with no statistically significant difference ($p = 0.11$). These findings suggest that the addition of cortical mastoidectomy does not provide any significant advantage in terms of auditory improvement. The hearing outcomes observed in the present study are comparable with those reported in the literature. Patil et al,[11] demonstrated improvement in mean air-bone gap (ABG) from 36.42 ± 12.01 dB preoperatively to 9.7 ± 6.71 dB postoperatively. Similarly, Kawatra et al. 12 reported a reduction in ABG from 27.50 dB to 13.67 dB after 16 weeks. Jain et al 14 observed hearing improvement in 95.4% of patients, with mean ABG decreasing from 26.08 ± 8.32 dB to 10.12 ± 5.84 dB, while Bajpai et al15 reported significant hearing improvement with ABG decreasing from 23.96 ± 3.77 dB to 13.33 ± 3.38 dB at 12 weeks, accompanied by a graft uptake rate of 95.5%. These studies, together with the present findings, reinforce the effectiveness of tympanoplasty in restoring hearing in patients with chronic otitis media.

The role of cortical mastoidectomy in non-cholesteatomatous chronic otitis media has remained controversial for decades. Proponents argue that the mastoid air cell system serves as a pressure-regulating reservoir and that mastoidectomy may improve middle ear ventilation, facilitate disease clearance, and enhance graft uptake. Conversely, several studies have failed to demonstrate any additional benefit of routine cortical mastoidectomy when combined with tympanoplasty. The results of the present study support the latter view, as hearing outcomes and graft success rates were not significantly different between the two groups.

With regard to graft uptake, graft failure was observed in 3 patients (8.57%) in the tympanoplasty-alone group and 4 patients (11.43%) in the tympanoplasty with cortical mastoidectomy group ($p = 0.69$), corresponding to graft success rates of 91.43% and 88.57%, respectively. The absence of a significant difference suggests that cortical mastoidectomy does not contribute substantially to graft healing in patients with inactive mucosal disease. Similar findings were reported by Chauhan et al., who found comparable graft uptake rates and hearing outcomes between tympanoplasty alone and tympanoplasty with cortical mastoidectomy and concluded that tympanoplasty alone was sufficient in tubotympanic chronic otitis media.[16] Furthermore, a randomized study by Bhat et al,[17] also reported no significant differences in graft uptake, hearing improvement, or disease eradication between mastoidotympanoplasty and tympanoplasty alone.

An interesting finding of the present study was the significantly higher incidence of postoperative ear discharge in the cortical mastoidectomy group (31.43%) compared with the tympanoplasty-alone group (8.57%) ($p = 0.01$). Although the exact reason for this observation cannot be established from the present data, it may be related to increased surgical manipulation, postoperative cavity inflammation, or individual variations in mucosal healing. Further studies with larger sample sizes and longer follow-up are required to explore this association.

Recent evidence also supports the limited role of routine mastoidectomy in non-cholesteatomatous chronic otitis media. A 2022 systematic review and meta-analysis comparing tympanoplasty alone with tympanoplasty plus mastoidectomy concluded that the addition of mastoidectomy did not result in clinically meaningful improvements in audiological outcomes or graft success rates in most patients without cholesteatoma.[18] Likewise, contemporary reviews continue to demonstrate that tympanoplasty alone achieves satisfactory hearing restoration and anatomical success in the majority of chronic otitis media cases.[19]

This study has certain limitations. The sample size was relatively small, which may limit the generalizability of the findings. The follow-up period was short (3 months), which may not be sufficient to assess long-term graft integrity and hearing stability. The study was conducted at a single centre, which may introduce institutional and surgical bias. Additionally, more objective measures such as radiological assessment of mastoid status and long-term Eustachian tube function were not included.

Larger multicentric studies with longer follow-up are recommended to validate these findings.

CONCLUSION

Both tympanoplasty alone and tympanoplasty with cortical mastoidectomy resulted in significant improvement in hearing outcomes and satisfactory graft uptake in patients with chronic suppurative otitis media (tubotympanic type). However, the addition of cortical mastoidectomy did not demonstrate any significant advantage over tympanoplasty alone in terms of hearing gain or graft success rates. Postoperative ear discharge was significantly higher in the mastoidectomy group. These findings suggest that routine cortical mastoidectomy may not be necessary in all cases and should be reserved for selected patients based on clinical and intraoperative findings.

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