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Research Article

Myringoplasty versus Cortical Mastoidectomy with Type I Tympanoplasty in Tubotympanic Chronic Suppurative Otitis Media: A Prospective Randomized Comparative Study

M. Rama Sridhar[1], Shambhavi Sharanam[1]*, Niharika S.[1], SaiTeja Pippalapally[1]

[1] Department of Otorhinolaryngology, Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad, Telangana, India

*Corresponding Author
Shambhavi Sharanam, Resident, Department of Otorhinolaryngology, RIMS, Adilabad, Telangana, India.
Email: shambhavi.sharanam.09@gmail.comA

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Abstract: ***Introduction:*** Chronic suppurative otitis media (CSOM) of the tubotympanic type is a prevalent otological condition characterized by persistent mucosal inflammation and tympanic membrane perforation, resulting in conductive hearing loss. Surgical management remains the definitive treatment; however, the choice between myringoplasty alone and cortical mastoidectomy combined with type I tympanoplasty continues to be debated. This study aimed to compare the surgical outcomes of these two procedures in patients with tubotympanic CSOM.**Methods:** This prospective, randomized, interventional study was conducted at the Department of Otorhinolaryngology, RIMS Adilabad, Telangana, over 18 months. Eighty patients with confirmed tubotympanic CSOM were randomized equally into two groups: Group A (myringoplasty alone, n=40) and Group B (cortical mastoidectomy with type I tympanoplasty, n=40). Temporalis fascia was used as the graft material in both groups. Primary outcomes included graft uptake rate and hearing improvement measured by air-bone gap (ABG) closure at 6 months postoperatively. Statistical analysis was performed using chi-square, Fisher exact, Student t-test, and Mann-Whitney U test.**Results:** Baseline demographic and clinical characteristics were comparable between groups ($p>0.05$). Graft uptake rates were 92.5% in Group A and 97.5% in Group B ($p=0.305$), showing no statistically significant difference. However, audiological outcomes were significantly superior in Group B, with a mean ABG closure of 24.07±3.28 dB compared to 21.45±4.25 dB in Group A ($p=0.003$), and a mean hearing gain of 22.07±3.28 dB versus 19.53±4.23 dB ($p=0.004$). Intraoperatively, 87.5% of patients in Group B demonstrated abnormal mastoid mucosa (hyperplastic 45%, diseased 42.5%).**Conclusion:** While graft uptake rates are comparable between myringoplasty and cortical mastoidectomy with type I tympanoplasty, the latter yields significantly superior audiological outcomes. The high prevalence of subclinical mastoid mucosal disease supports a rationale for incorporating cortical mastoidectomy in the surgical management of tubotympanic CSOM.

Keywords: Chronic suppurative otitis media; Myringoplasty; Cortical mastoidectomy; Tympanoplasty; Hearing outcome; Graft uptake

INTRODUCTION

Chronic suppurative otitis media (CSOM) is defined as a chronic inflammation of the middle ear cleft characterized by recurrent or persistent ear discharge through a perforated tympanic membrane for a duration exceeding two weeks. It represents one of the most common otological conditions encountered globally, particularly in developing countries, and constitutes a significant public health burden. According to the World Health Organization (WHO) (2004)[1], the global prevalence of CSOM ranges from 1% to 46%, affecting an estimated 65 to 330 million individuals, with approximately 60% suffering from clinically significant hearing impairment. Monasta et al. (2012)[2] estimated a global incidence of 4.76 per 1,000 population, translating to approximately 31 million new cases annually. The disease disproportionately affects populations in South Asia, Southeast Asia, and sub-Saharan Africa, where limited access to healthcare facilities contributes to delayed diagnosis and treatment, as documented by Elemraid et al. (2016)[17].

The tubotympanic type of CSOM, also referred to as the safe or mucosal type, is the most prevalent subtype and is characterized by infection confined to the middle ear cleft without cholesteatoma formation. The pathophysiology involves Eustachian tube dysfunction, recurrent upper respiratory infections, and sustained mucosal inflammation leading to a cycle of infection, perforation, and conductive hearing loss. Kafle et al. (2023)[3] provided a comprehensive review of CSOM, emphasizing the multifactorial etiology including socioeconomic deprivation, overcrowding, malnutrition, and poor hygiene. Verhoeff et al. (2006)[4] further highlighted the role of bacterial biofilms in sustaining chronic infection and contributing to treatment resistance.

Surgical management is the definitive treatment for tubotympanic CSOM, aimed at eradicating disease,

restoring the integrity of the tympanic membrane, and improving hearing. Myringoplasty, the surgical repair of the tympanic membrane perforation, is a well-established procedure with documented success rates ranging from 80% to 98%. However, the role of concurrent cortical mastoidectomy—surgical clearance of the mastoid air cell system—remains a subject of ongoing debate. Proponents argue that mastoidectomy addresses subclinical disease in the mastoid, reduces the bacterial reservoir, improves middle ear ventilation, and may enhance long-term hearing outcomes and graft survival. Conversely, others contend that in the absence of overt mastoid disease, mastoidectomy adds unnecessary surgical morbidity and operative time without demonstrable benefit. Eliades and Limb (2013)[16] conducted a systematic review and concluded that the evidence remained inconclusive, underscoring the need for well-designed prospective studies.

This study was designed to address this clinical equipoise by prospectively comparing the outcomes of myringoplasty alone (Group A) versus cortical mastoidectomy with type I tympanoplasty (Group B) in patients with tubotympanic CSOM at a tertiary care center in rural Telangana, India. The primary objectives were to compare graft uptake rates and audiological outcomes between the two groups, and secondarily to assess complication rates and mastoid mucosal status intraoperatively.

MATERIALS AND METHODS

Study Design and Setting

This prospective, randomized, interventional study was conducted at the Department of Otorhinolaryngology, Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad, Telangana, India—a tertiary care referral center serving a predominantly rural population. The study was carried out over a period of 18 months. Institutional Ethics Committee (IEC) approval was obtained prior to commencement, and written informed consent was secured from all participants in their preferred language (English, Telugu, Hindi, or Urdu).

Participants

Eighty patients aged 18 to 65 years with a confirmed diagnosis of tubotympanic CSOM were enrolled. Inclusion criteria comprised: clinical and otoscopic confirmation of tubotympanic CSOM with a central tympanic membrane perforation; a dry ear for a minimum of six weeks prior to surgery; mild to moderate conductive hearing loss with good cochlear reserve; intact and mobile ossicular chain confirmed on preoperative assessment; and a pneumatized mastoid on high-resolution computed tomography (HRCT) of the temporal bone. Exclusion criteria included: presence of cholesteatoma or atticoantral disease; prior ear surgery on the affected side; pregnancy; and comorbidities such as diabetes mellitus, uncontrolled hypertension, or immunocompromised states that could confound wound healing and surgical outcomes.

Randomization and Intervention

Patients were randomly allocated to one of two groups using a computer-generated random number table with sealed envelope technique. Group A (n=40) underwent myringoplasty alone via the postaural approach using temporalis fascia as the graft material, employing the underlay technique. Group B (n=40) underwent cortical mastoidectomy with type I tympanoplasty, wherein a canal wall up mastoidectomy was performed to exenterate the mastoid air cells, followed by tympanic membrane reconstruction using temporalis fascia via the underlay technique through the same postaural approach. All surgeries were performed under general anesthesia by experienced otologists.

Outcome Measures

The primary outcome measures were graft uptake rate and audiological improvement at 6 months postoperatively. Graft uptake was assessed otoscopically at each follow-up visit (1 week, 1 month, 3 months, and 6 months). Audiological assessment included pure tone audiometry (PTA) performed preoperatively and at 6 months postoperatively, with air-bone gap (ABG) closure and hearing gain calculated as the difference between pre- and postoperative ABG values. Secondary outcomes included postoperative complications (ear discharge, graft failure, wound infection) and intraoperative mastoid mucosal status in Group B.

Statistical Analysis

Data were analyzed using SPSS software. Categorical variables were compared using the chi-square test and Fisher exact test, while continuous variables were analyzed using the independent samples Student t-test and Mann-Whitney U test as appropriate. A p-value of less than 0.05 was considered statistically significant. Results are presented as mean ± standard deviation for continuous variables and frequencies with percentages for categorical variables. significant.

RESULTS

Demographic and Clinical Characteristics

A total of 80 patients meeting the inclusion criteria were enrolled and randomized into two equal groups. The baseline demographic and clinical characteristics of the study population are summarized in Table 1. The mean age was 36.80 ±8.94 years in Group A and 38.17 ±9.56 years in Group B (p=0.509). Both groups had an identical sex distribution of 20 males and 20 females. The mean duration of disease was 25.80 ±9.81 months in Group A and 28.22 ±10.34 months in Group B (p=0.287). Large central perforations were the most common in both groups (Group A: 40.0%, Group B: 42.5%), and the distribution of perforation sizes did not differ significantly between groups (p=0.315). Mastoid

pneumatization status was also comparable, with 65.0% of Group A and 55.0% of Group B patients showing well-pneumatized mastoids (p=0.361). The preoperative air-bone gap was 29.55 ±5.51 dB in Group A and 31.45 ±5.05 dB in Group B (p=0.113). There were no statistically significant differences between the groups for any baseline parameter, confirming successful randomization**.**

Table 1. Baseline demographic and clinical characteristics of the study population.

Parameter	Group A (n=40)	Group B (n=40)	Test	p-value
Age (years)	36.80 ±8.94	38.17 ±9.56	t = 0.663	0.509
Sex (M:F)	20:20	20:20	—	1.000
Disease duration (months)	25.80 ±9.81	28.22 ±10.34	t = 1.072	0.287
Perforation size			χ^2 = 2.312	0.315
Small central	10 (25.0%)	5 (12.5%)		
Large central	16 (40.0%)	17 (42.5%)		
Subtotal	14 (35.0%)	18 (45.0%)		
Mastoid pneumatization			χ^2 = 0.833	0.361
Well-pneumatized	26 (65.0%)	22 (55.0%)		
Coalescent	14 (35.0%)	18 (45.0%)		
Pre-op ABG (dB)	29.55 ±5.51	31.45 ±5.05	t = 1.606	0.113

ABG, air-bone gap; M, male; F, female. Values are presented as mean ±SD or n (%).

Surgical Outcomes

The surgical outcomes of both groups are detailed in Table 2. Graft uptake was achieved in 37 of 40 patients (92.5%) in Group A and 39 of 40 patients (97.5%) in Group B, with no statistically significant difference between the groups (χ^2=1.053, p=0.305). Healing of the tympanic membrane at 3 months and the final outcome at 6 months demonstrated identical rates, mirroring the graft uptake results. Postoperative complications were observed in 5 patients (12.5%) in Group A and 1 patient (2.5%) in Group B; although the complication rate was lower in the mastoidectomy group, this difference did not reach statistical significance (χ^2=2.889, p=0.089). The mean dry period prior to surgery was significantly shorter in Group B (8.68 ±1.58 months) compared to Group A (11.68 ±3.58 months; p<0.001), likely reflecting differences in referral patterns and disease chronicity at the time of surgical decision-making.

Table 2. Comparison of surgical outcomes between Group A and Group B.

Outcome	Group A (n=40)	Group B (n=40)	Test	p-value
Graft uptake	37 (92.5%)	39 (97.5%)	χ^2 = 1.053	0.305
Healing at 3 months	37 (92.5%)	39 (97.5%)	χ^2 = 1.053	0.305
Final outcome at 6 months	37 (92.5%)	39 (97.5%)	χ^2 = 1.053	0.305
Post-op complications	5 (12.5%)	1 (2.5%)	χ^2 = 2.889	0.089
Dry period (months)	11.68 ±3.58	8.68 ±1.58	t = 4.854	<0.001*

*Statistically significant (p<0.05). Values are presented as n (%) or mean ±SD.

Audiological Outcomes

Audiological outcomes, as detailed in Table 3, revealed statistically significant differences favoring Group B. The mean ABG closure was 24.07 ±3.28 dB in Group B compared to 21.45 ±4.25 dB in Group A (t=3.064, p=0.003). Similarly, the mean hearing gain was significantly greater in Group B (22.07 ±3.28 dB) than in Group A (19.53 ±4.23

dB; t=3.010, p=0.004). These findings indicate that cortical mastoidectomy combined with type I tympanoplasty provides a statistically significant and clinically meaningful advantage in hearing rehabilitation compared to myringoplasty alone.

Table 3. Comparison of audiological outcomes between Group A and Group B.

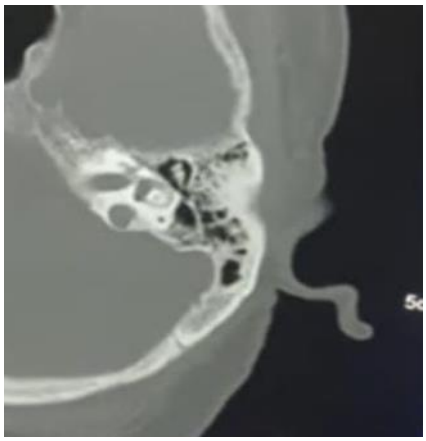
Parameter	Group A (n=40)	Group B (n=40)	Test	p-value
Pre-op ABG (dB)	29.55 ±5.51	31.45 ±5.05	t = 1.606	0.113
Post-op ABG (dB)	10.02 ±3.82	9.38 ±3.14	t = 0.818	0.416
ABG closure (dB)	21.45 ±4.25	24.07 ±3.28	t = 3.064	0.003*
Hearing gain (dB)	19.53 ±4.23	22.07 ±3.28	t = 3.010	0.004*

*Statistically significant (p<0.05). ABG, air-bone gap. Values are presented as mean ±SD (dB).

Mastoid Mucosal Status

Intraoperative assessment of mastoid mucosal status in Group B revealed that the majority of patients (87.5%) harbored abnormal mucosa despite having clinically quiescent ears preoperatively. Normal mucosa was found in only 5 patients (12.5%), while 18 patients (45.0%) had hyperplastic mucosa and 17 patients (42.5%) exhibited overtly diseased mucosa with granulation tissue. This finding is clinically significant as it demonstrates that subclinical mastoid disease is highly prevalent in tubotympanic CSOM and may serve as a reservoir for ongoing inflammation, potentially compromising long-term surgical outcomes when left unaddressed.

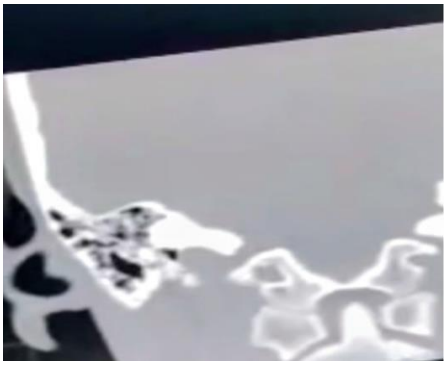
Right temporal bone - normal



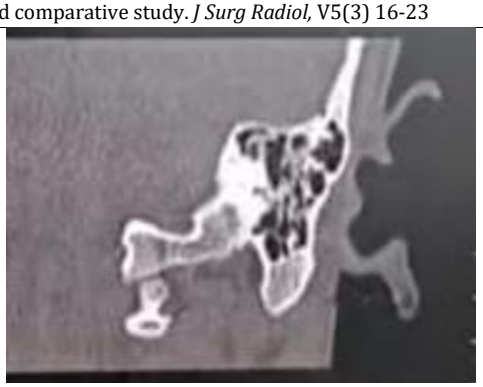
Left temporal bone with mucosal thickening in middle ear cavity, aditus and mastoid antrum

Right temporal bone - Normal

Left temporal bone - Normal



Right temporal bone - Mucosal thickening in middle ear cavity, aditus and mastoid antrum



Left temporal bone - Normal

DISCUSSION

The management of tubotympanic CSOM has been a subject of considerable debate, particularly regarding the necessity of cortical mastoidectomy in conjunction with tympanoplasty. This prospective randomized study provides valuable evidence to inform this discourse by directly comparing myringoplasty alone with cortical mastoidectomy combined with type I tympanoplasty in a homogeneous population of patients with tubotympanic CSOM. The principal findings of our study are twofold: first, graft uptake rates are comparable between the two procedures; and second, cortical mastoidectomy confers a statistically significant advantage in audiological outcomes.

The graft uptake rate in our study was 92.5% in the myringoplasty group and 97.5% in the cortical mastoidectomy group, with no significant difference (p=0.305). These results are consistent with several published studies. McGrew et al. (2004)[5] reported a graft success rate of 91% in both groups in their series of 484 patients. Albu et al. (2012)[6], in a randomized controlled trial of 329 patients providing moderate-level evidence, concluded that cortical mastoidectomy did not confer additional benefit in terms of graft take. Similarly, Gharib et al. (2014)[7] observed graft uptake rates of 70% and 80% in the myringoplasty and mastoidectomy groups, respectively, without a statistically significant difference (p=0.7). Shahzadi et al. (2024)[13] reported comparable graft uptake rates of 90.2% and 95.1% in their study of 82 patients. Our graft uptake rates compare favorably with the literature and are consistent with the findings of Indorewala et al. (2015)[12], who reported a 98.6% success rate in their extensive series of 789 tympanoplasties. These converging results from multiple study designs suggest strong evidence that the addition of cortical mastoidectomy does not significantly improve graft survival.

The key finding of our study lies in the significantly superior audiological outcomes observed in the cortical mastoidectomy group. The mean ABG closure was 24.07 ± 3.28 dB in Group B compared to 21.45 ± 4.25 dB in Group A (p=0.003), and the mean hearing gain was 22.07 3.28 dB versus 19.53 ± 4.23 dB (p=0.004). This finding aligns with Agrawal and Bhargava (2017)[8], who reported a trend toward better hearing gain in the mastoidectomy group (12.05 dB vs. 9.41 dB), although their study did not achieve statistical significance. Sharma et al. (2016)[9] similarly observed comparable hearing outcomes but noted a qualitative advantage in the mastoidectomy group. Garg and Kakkar (2018)[10], in a study with a 5-year follow-up period, demonstrated that mastoidectomy reduced the need for revision procedures, indirectly supporting the hypothesis of improved long-term outcomes. Our statistically significant results add to this body of evidence by providing prospective, randomized data (moderate-level evidence) demonstrating a clear audiological benefit of cortical mastoidectomy.

A critically important finding in our study was the intraoperative mastoid mucosal status in Group B. An overwhelming 87.5% of patients who had clinically dry ears and met the criteria for tubotympanic disease harbored abnormal mastoid mucosa—45.0% hyperplastic and 42.5% overtly diseased with granulation tissue. This observation corroborates the findings of Sunny et al. (2024)[14], who identified mucosal disease as a significant clinical predictor of postoperative outcomes in mucosal-type chronic otitis media. Bánvölgyi et al. (2023)[11], in their systematic review and meta-analysis (strong evidence), identified several prognostic factors influencing successful tympanic membrane reconstruction, among which middle ear mucosal status was paramount. The presence of subclinical mastoid disease suggests that the mastoid serves as a reservoir for chronic inflammation even in the absence of overt clinical symptoms, and its surgical clearance may explain the superior audiological outcomes observed in our mastoidectomy group. Wu et al. (2022)[15] further supported this notion by identifying mucosal status as a significant prognostic factor in their multivariate analysis of hearing outcomes

following tympanoplasty. This finding provides a plausible biological mechanism for the audiological advantage of cortical mastoidectomy: by eliminating subclinical disease, the procedure facilitates better middle ear aeration, reduces the inflammatory milieu, and creates a more favorable environment for sound conduction.

The significantly shorter dry period in Group B (8.68 ± 1.58 months) compared to Group A (11.68 ± 3.58 months; $p<0.001$) is a noteworthy observation. This may reflect clinical decision-making patterns wherein patients with shorter disease quiescence may have been preferentially considered for a more comprehensive surgical approach, or it may indicate that earlier intervention with mastoidectomy is associated with favorable outcomes. Taneja et al. (2016)[18] documented significant improvements in quality of life following type I tympanoplasty, highlighting the broader impact of successful surgical intervention beyond audiometric parameters alone.

Eliades and Limb (2013)[16] had previously noted in their systematic review that the heterogeneity of study designs and outcome measures in the existing literature precluded definitive conclusions regarding the role of mastoidectomy. Our study, being a prospective randomized study with standardized outcome measures, addresses several of these methodological limitations and provides clearer evidence for the audiological benefit of cortical mastoidectomy.

Limitations

This study has several limitations that must be acknowledged. First, it was conducted at a single center, which may limit the generalizability of findings to other populations and settings. Second, the sample size of 80 patients, while adequate for detecting the observed differences, is relatively modest and may have been underpowered to detect smaller differences in secondary outcomes such as complication rates. Third, the follow-up period of 6 months, although sufficient for initial assessment of graft uptake and hearing outcomes, is insufficient to evaluate long-term outcomes, revision rates, and the durability of the audiological advantage. Fourth, Eustachian tube function was not formally assessed, which represents a potentially confounding variable in middle ear surgery outcomes. Finally, patient-reported outcome measures such as quality of life assessments were not incorporated, limiting the evaluation of the subjective impact of surgical intervention.

CONCLUSION

This prospective randomized study demonstrates that while graft uptake rates are comparable between myringoplasty and cortical mastoidectomy with type I tympanoplasty in tubotympanic CSOM, the addition of cortical mastoidectomy yields significantly superior audiological outcomes, as evidenced by greater ABG closure ($p=0.003$) and hearing gain ($p=0.004$). The finding that 87.5% of patients with clinically quiescent ears harbored abnormal mastoid mucosa provides compelling evidence for the existence of subclinical mastoid disease and supports the rationale for incorporating cortical mastoidectomy in the surgical management of tubotympanic CSOM. These findings suggest that cortical mastoidectomy should be considered as an integral component of comprehensive surgical management rather than an optional adjunct. Future multicenter studies with larger sample sizes and longer follow-up periods are recommended to validate these findings and assess the long-term durability of the observed audiological advantage.

ETHICAL STATEMENT

This study was approved by the Institutional Ethics Committee (IEC) of Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad, Telangana, India. Written informed consent was obtained from all participants in their preferred language (English, Telugu, Hindi, or Urdu) prior to enrollment. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. No external funding was received for this study.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest. No financial or non-financial support was received from any organization that could have influenced the conduct, analysis, or reporting of this study.

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