

Original Research Article

A comparative study of myringoplasty versus cortical mastoidectomy with type I tympanoplasty in tubotympanic chronic suppurative otitis media

M. Rama Sridhar, Shambhavi Sharanam*, S. Niharika

Department of Otorhinolaryngology, Rajiv Gandhi Institute of Medical Sciences, Adilabad, Telangana, India

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*Correspondence:

Dr. Shambhavi Sharanam,

E-mail: shambhavi.sharanam.09@gmail.com

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) of the tubotympanic (mucosal) type is a common cause of preventable conductive hearing loss in developing countries. Although myringoplasty remains the standard surgical treatment for dry ears, the role of cortical mastoidectomy combined with type I tympanoplasty in improving anatomical and functional outcomes continues to be debated, particularly in patients with persistent mucosal disease. Objective was to compare the anatomical and audiological outcomes of myringoplasty versus cortical mastoidectomy with type I tympanoplasty in patients with tubotympanic (mucosal) CSOM.

Methods: This prospective comparative interventional study was conducted at a tertiary care centre in rural Telangana over an 18-month period. Eighty patients aged 18 to 65 years with tubotympanic CSOM were enrolled and allocated into two groups: group A (myringoplasty, n=40) and group B (cortical mastoidectomy with type I tympanoplasty, n=40). Baseline demographic variables, disease characteristics, and preoperative air-bone gap (ABG) were comparable between groups. Primary outcome measures included graft uptake and postoperative ear status, while secondary outcomes included audiological improvement assessed by ABG closure and hearing gain. Statistical analysis was performed using appropriate parametric and non-parametric tests, with $p < 0.05$ considered statistically significant.

Results: The overall graft uptake rate was 92.5% in group A and 97.5% in group B, with no statistically significant difference between the groups ($p = 0.305$). Postoperative ear healing at 3 and 6 months showed similar outcomes in both groups. The mean preoperative ABG was comparable between group A (29.55 ± 5.51 dB) and group B (31.45 ± 5.05 dB). However, group B demonstrated significantly greater audiological improvement, with higher mean ABG closure (24.07 ± 3.28 dB versus 21.45 ± 4.25 dB; $p = 0.003$) and hearing gain (22.07 ± 3.28 dB versus 19.53 ± 4.23 dB; $p = 0.004$). Postoperative complications were infrequent and did not differ significantly between the groups.

Conclusions: Both myringoplasty and cortical mastoidectomy with type I tympanoplasty provide high rates of graft uptake and satisfactory postoperative healing in tubotympanic CSOM. However, the addition of cortical mastoidectomy is associated with significantly greater audiological improvement.

Keywords: Chronic suppurative otitis media, Cortical mastoidectomy, Hearing outcome, Myringoplasty, Tubotympanic disease, Tympanoplasty

INTRODUCTION

Chronic suppurative otitis media (CSOM) continues to be a major cause of hearing loss in the entire globe and occurs disproportionately in developing countries because

overcrowding, socio-economic deprivation, and access to healthcare and frequent infection of the upper respiratory tract worsen its prevalence.¹⁻³ Although the tubotympanic or mucosal phenotype of CSOM has conventionally been considered relatively safer, it is materially significant in

terms of morbidity due to manifesting itself as persistent otorrhoea, tympanic membrane perforation, conductive hearing loss, and a reduction in the quality of life.^{4,6} In both adult and pediatric groups, this pathology bears long-term consequences on the levels of communication, educational achievement, and professional activity, so the importance of effective and sustainable surgery should be highlighted.⁷

The main objectives of surgical treatment of tubotympanic CSOM are full elimination of infection, full recovery of the integrity of the ear drum, maintenance of middle-ear ventilation and improved hearing thresholds.⁷ The most commonly accepted practice, which is believed to be the best procedure in patients, is known as myringoplasty, meaning the repair of the tympana membrane without any manipulations with the ossicles chain or without any trauma to the mastoid air-cells system.⁸ Myringoplasty has shown very high graft uptake and can bring about acceptable auditory improvement with the least amount of surgical morbidity. However, after membrane closure, a proportion of patients still have poor hearing or frequent middle-ear pathology, implying that some factors that the perforation itself does not affect have an impact on the long-term outcomes.^{9,10}

This is combined with the mastoid air-cell system and the cleft in the middle-ear forming a combined ventilatory unit that is essential in maintaining control of pressure and mucosal homeostasis.¹¹ Increasing mucosal inflammation, poor mastoid pneumatization and functional recovery following isolated myringoplasty have been suggested as factors contributing to graft failure and poor functional outcome.¹² Based on this, other surgeons would recommend the use of cortical mastoidectomy in addition to type I tympanoplasty, even non-cholesteatomatous CSOM, to remove diseased mastoid air cells, increase ventilation channels, and provide a more favourable environment in which the tympanic membrane could heal. According to its proponents, the treatment of potential mastoid pathology could help decrease the number of disease recurrence and enhance audiological outcomes.^{13,14}

In spite of decades of clinical practice, cortical mastoidectomy and its role in the treatment of the tubotympanic CSOM is still controversial.¹⁵ A number of reports have shown that there is no significant difference between tympanoplasty when done with or without mastoidectomy on the graft uptake or hearing results, especially between patients with inactive disease.^{16,17} On the other hand, other reports indicate that the mastoidectomy can include additional benefit in some specific situations, particularly in the cases of persistent mucosal disease, occurrence of recurring otorrhoea or in cases of poor mastoid pneumatization. The lack of consensus has been attributed by variation in patient selection, disease condition, surgery approach, and outcome measures among studies.^{13,18}

The operations option has even more implication in the resource constrained and rural health facilities in terms of the operative time, cost, duration in hospital and postoperative morbidity.¹⁹ Whether the habitual combination of cortical mastoidectomy has any quantifiable value as compared to myringoplasty alone is therefore of useful clinical interest. An insight into the comparative anatomical and functional outcomes is capable of informing the choice in surgery and make the best selection of patients.

This study was conducted to compare the surgery of myringoplasty and the cortical mastoidectomy on patients of tubotympanic (mucosal) CSOM who underwent the surgery in a tertiary care centre located in rural Telangana.

METHODS

Study design and setting

This was a prospective comparative interventional study conducted over a period of 18 months at the department of otorhinolaryngology, Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad, a tertiary care centre serving a predominantly rural population in Telangana, India from April 2024 to October 2025. The study was designed to compare surgical and audiological outcomes between two commonly employed operative techniques in tubotympanic (mucosal) chronic suppurative otitis media (CSOM).

Study population

A total of 80 patients diagnosed with tubotympanic CSOM were enrolled during the study period. Patients aged between 18 and 65 years presenting with tympanic membrane perforation and conductive hearing loss were considered for inclusion. All participants underwent a detailed clinical evaluation, otoscopic and otoendoscopic examination, and audiological assessment prior to enrolment. Patients were included if they had a diagnosis of tubotympanic CSOM, an intact ossicular chain, mild to moderate conductive hearing loss with good cochlear reserve, and a non-discharging ear for a minimum of six weeks prior to surgery. Radiological assessment demonstrated a pneumatized mastoid in all included cases. Patients were excluded if they were younger than 18 years or older than 65 years, unwilling to undergo surgery, had evidence of cholesteatoma or atticofacial disease, a history of previous ear surgery, mixed or sensorineural hearing loss, pregnancy, or significant systemic comorbidities such as diabetes mellitus, hypertension, immunocompromised states, or malignancy.

Surgical procedures

Eligible patients were allocated into two equal groups of 40 each based on the planned surgical intervention. Group A underwent myringoplasty, defined as surgical closure of the tympanic membrane perforation without manipulation

of the ossicular chain or mastoid air cell system. Group B underwent cortical mastoidectomy with type I tympanoplasty, which included exenteration of mastoid air cells with preservation of the posterior canal wall, followed by reconstruction of the tympanic membrane with an intact and mobile ossicular chain.

All surgeries were performed under standard operative protocols by experienced otologic surgeons. Temporalis fascia was used as the graft material in both groups. Perioperative antibiotic prophylaxis and postoperative care protocols were standardized across groups to minimize procedural bias.

Data collection

Baseline data collected included age, sex, duration of disease, size of tympanic membrane perforation, mastoid pneumatization status, and preoperative air-bone gap (ABG) measured by pure tone audiometry. Perforation size was categorized as small, medium, or large based on otoscopic assessment.

Outcome measures

The primary outcome measures were graft uptake and postoperative ear status, assessed clinically at follow-up visits. Graft uptake was defined as complete closure of the tympanic membrane without residual perforation. Secondary outcome measures included audiological improvement, assessed by postoperative ABG closure and hearing gain measured in decibels (dB). Postoperative complications, including persistent discharge, wound-related issues, and other adverse events, were documented.

Follow-up protocol

Patients were followed up postoperatively at regular intervals, with clinical assessment conducted up to six

months following surgery. Healing status was specifically evaluated at three and six months. Audiological assessment was repeated after surgery once the ear had healed adequately.

Statistical analysis

Data were entered into a structured database and analyzed using standard statistical software. Continuous variables were expressed as mean±standard deviation and compared using the independent sample t-test. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test. A p value of less than 0.05 was considered statistically significant.

Ethical considerations

The study protocol was reviewed and approved by the institutional ethics committee of Rajiv Gandhi Institute of Medical Sciences, Adilabad. Written informed consent was obtained from all participants prior to enrolment, and the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

RESULTS

Baseline demographic and clinical characteristics

Eighty patients with tubotympanic (mucosal) chronic suppurative otitis media were included, with 40 patients each in group A (myringoplasty) and group B (cortical mastoidectomy with type I tympanoplasty). The mean age was comparable between groups (36.80±8.94 years in group A versus 38.17±9.56 years in group B; p=0.509). Age group distribution was similar, with the majority of patients in both groups falling between 26 and 45 years of age. Sex distribution was identical in both groups, with equal representation of males and females.

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

Variables	Group A (n=40) (%)	Group B (n=40) (%)	P value
Mean age (years)	36.80±8.94	38.17±9.56	0.509
Age 18-25	12 (30.0)	11 (27.5)	0.852
Age 26-35	13 (32.5)	13 (32.5)	
Age 36-45	12 (30.0)	11 (27.5)	
Age >45	3 (7.5)	5 (12.5)	
Male sex	20 (50.0)	20 (50.0)	—
Female sex	20 (50.0)	20 (50.0)	—
Duration of disease (months)	25.80±9.81	28.22±10.34	0.287

The mean duration of disease was 25.80±9.81 months in group A and 28.22±10.34 months in group B, with no statistically significant difference (p=0.287), indicating comparable chronicity of disease at presentation (Table 1).

Otologic disease characteristics

The distribution of tympanic membrane perforation size was similar between groups. Medium-sized perforations constituted the largest proportion in both group A (40.0%)

and group B (42.5%), followed by large perforations (35.0% and 45.0%, respectively). Small perforations were less frequent overall.

Table 2. Otologic disease characteristics.

Parameters	Group A (%)	Group B (%)	P value
Perforation size			0.315
Small	10 (25.0)	5 (12.5)	
Medium	16 (40.0)	17 (42.5)	
Large	14 (35.0)	18 (45.0)	
Mastoid pneumatization			0.361
Well pneumatized	26 (65.0)	22 (55.0)	
Sclerotic	14 (35.0)	18 (45.0)	

Mastoid pneumatization patterns were also comparable, with well-pneumatized mastoids observed in 65.0% of patients in group A and 55.0% in group B, while sclerotic mastoids were present in 35.0% and 45.0% of patients, respectively. None of these differences reached statistical significance (Table 2).

Preoperative audiological profile and disease activity

Preoperative audiological assessment demonstrated a mean air-bone gap of 29.55±5.51 dB in group A and 31.45±5.05 dB in group B, with no statistically significant difference (p=0.113).

Table 3: Preoperative audiological status and disease activity.

Parameter	Group A	Group B	P value
Preoperative air-bone gap (dB)	29.55±5.51	31.45±5.05	0.113
Dry period before surgery (months)	11.68±3.58	8.68±1.58	<0.001*

*Statistically significant

However, the preoperative dry period before surgery differed significantly between the two groups. Patients in group A had a mean dry period of 11.68±3.58 months, compared to 8.68±1.58 months in group B, representing a mean difference of approximately 3 months (p<0.001) (Table 3).

Surgical and anatomical outcomes

High anatomical success rates were achieved with both surgical techniques. Successful graft uptake was observed in 37 patients (92.5%) in group A and 39 patients (97.5%) in group B, corresponding to an absolute difference of 5.0%, which was not statistically significant (p=0.305).

At six months of follow-up, healed ears were documented in the same proportions as graft uptake in both groups.

Postoperative complications occurred in 5 patients (12.5%) in group A and 1 patient (2.5%) in group B, reflecting a 10% absolute difference; however, this did not reach statistical significance (p=0.089) (Table 4).

Table 4: Surgical and anatomical outcomes.

Outcome	Group A (%)	Group B (%)	P value
Graft uptake	37 (92.5)	39 (97.5)	0.305
Healed ear at 6 months	37 (92.5)	39 (97.5)	0.305
Postoperative complications	5 (12.5)	1 (2.5)	0.089

Audiological outcomes

Both surgical groups demonstrated postoperative hearing improvement; however, quantitatively greater audiological gains were observed in group B. The mean air-bone gap closure was 24.07±3.28 dB in group B compared to 21.45±4.25 dB in Group A, representing a mean difference of 2.62 dB, which was statistically significant (p=0.003).

Table 5: Audiological outcomes.

Parameters	Group A	Group B	P value
Air-bone gap closure (dB)	21.45±4.25	24.07±3.28	0.003*
Hearing gain (dB)	19.53±4.23	22.07±3.28	0.004*
Mastoid mucosa (Group B only) (%)			
Normal	—	5 (12.5)	
Hyperplastic	—	18 (45.0)	
Diseased	—	17 (42.5)	

*Statistically significant

Similarly, mean hearing gain was significantly higher in group B (22.07±3.28 dB) than in group A (19.53±4.23 dB), corresponding to a mean difference of 2.54 dB (p=0.004) (Table 5).

DISCUSSION

This prospective comparative study evaluated whether adding cortical mastoidectomy to type I tympanoplasty confers incremental benefit over myringoplasty alone in tubotympanic (mucosal) chronic suppurative otitis media. The clinical question is relevant because mastoid surgery increases operative extent, and its routine use in non-cholesteatomatous disease remains debated. In our cohort, both procedures produced high anatomical success, while the combined procedure yielded superior functional outcomes. This pattern, namely comparable graft take with variable hearing advantage, mirrors the broader evidence base in which anatomical closure is often achievable with tympanic membrane reconstruction alone, whereas hearing outcomes may be influenced by middle ear

ventilation, inflammatory load, and mastoid reservoir disease.

With respect to the anatomical success, our graft uptake rates were high in both groups (92.5% in group A versus 97.5% in group B; absolute difference 5%). These findings align with landmark and large comparative series that report no meaningful improvement in graft success from adding mastoidectomy in non-cholesteatomatous CSOM. Balyan et al (n=323) reported graft success rates of 90.5% (tympanoplasty without mastoidectomy in discharging ears), 85.7% (tympanoplasty with mastoidectomy in discharging ears), and 89.2% (tympanoplasty without mastoidectomy in dry ears), with no significant intergroup difference.²⁰ Mishiro et al (n=251 ears) similarly reported graft success of 90.5% with mastoidectomy versus 93.3% without mastoidectomy, again without significant difference, and reported postoperative ABG within 20 dB in 81.6% versus 90.4%, respectively.¹⁷ Contemporary comparative studies report the same directionality: Tawab et al. noted graft uptake of 70% with myringoplasty alone versus 80% with cortical mastoidectomy (p=0.7).²¹ In a prospective Indian cohort by Agrawal et al, graft uptake was 80% with tympanoplasty alone versus 95% when combined with cortical mastoidectomy, with statistical non-significance reported by the authors.²² Collectively, these data support the interpretation that, in well-selected mucosal disease, membrane repair can achieve high closure rates irrespective of mastoidectomy, and that any incremental difference in graft take is likely modest and context dependent.¹⁷

We observed significantly greater audiological improvement with cortical mastoidectomy plus tympanoplasty: mean ABG closure 24.07±3.28 dB versus 21.45±4.25 dB (difference 2.62 dB; p=0.003), and mean hearing gain 22.07±3.28 dB versus 19.53±4.23 dB (difference 2.54 dB; p=0.004). While some comparative series report no significant hearing advantage, several report numerically greater gain with mastoidectomy, consistent with our direction of effect. In Agrawal et al, mean hearing improvement was 9.41 dB with tympanoplasty alone and 12.05 dB with tympanoplasty plus cortical mastoidectomy (difference 2.64 dB), closely paralleling the magnitude we observed.²² Large outcome reviews also frame expected hearing improvement after tympanoplasty within a range where small intergroup differences may be clinically plausible depending on baseline ABG and middle ear status; for example, Indorewala et al (n=789) reported mean ABG improvement from 26.30±8.1 dB preoperatively to 14.0±10.41 dB postoperatively, with a mean hearing improvement of 12.5±9.5 dB overall.²³ Mechanistically, the hearing advantage with mastoidectomy is biologically plausible when the mastoid harbors persistent mucosal disease or impaired aeration, and notably, in our mastoidectomy group, 87.5% had abnormal mastoid mucosa (hyperplastic 45.0% and diseased 42.5%). This intraoperative burden supports the concept that removal of inflammatory reservoir tissue and improved aeration

pathways could contribute to better conductive outcomes even when graft take is similar.²¹

Overall, our study adds pragmatic evidence that myringoplasty alone can deliver high anatomical success in tubotympanic CSOM, while cortical mastoidectomy with type I tympanoplasty may offer incremental audiological benefit in selected patients, particularly when occult mastoid mucosal disease is prevalent. In real-world practice, these findings support tailoring the extent of surgery to preoperative disease activity and intraoperative mucosal status rather than applying mastoidectomy uniformly. The observed complication rate was low in both arms (12.5% versus 2.5%), and while the difference did not reach statistical significance, it reinforces the need to weigh incremental hearing benefit against added operative extent on an individual basis.

Key limitations include the single-center design, modest sample size, and follow-up restricted to six months, which may limit inference regarding long-term retraction, recurrent otorrhea, or delayed graft failure. Future multi-center studies with longer follow-up and stratification by mastoid pneumatization and mucosal status would better define the subgroup that derives the greatest functional benefit from mastoidectomy.

CONCLUSION

In patients with tubotympanic (mucosal) chronic suppurative otitis media, both myringoplasty and cortical mastoidectomy with type I tympanoplasty resulted in high rates of anatomical success. The addition of cortical mastoidectomy did not significantly improve graft uptake or postoperative ear healing but was associated with greater audiological improvement. These findings suggest that while myringoplasty alone is sufficient for anatomical closure in selected cases, cortical mastoidectomy may provide additional functional benefit in appropriately chosen patients.

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