



Comparative Analysis of Tympanoplasty Techniques: A Focus on Cortical Mastoidectomy

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Abstract

Background: The surgical procedure of tympanoplasty, either together with or instead of cortical mastoidectomy, is a concern with controversy among otolaryngologists. According to one theory, it is advantageous to combine cortical mastoidectomy with type I tympanoplasty in wet or discharging ears. Another viewpoint contends that in the tubotympanic variant of CSOM, cortical mastoidectomy in conjunction with type-I tympanoplasty has no appreciable impact on surgical results in any condition of the dry or wet ear. **Material & Methods:** This multicenter, retrospective, observational study was carried out on 258 patients with uncomplicated tubotympanic variant chronic suppurative otitis media between July 2003 and July 2013. The patients' ages ranged from 18 to 55 years old. Group I consisted of 140 patients (54%) with a history of ear discharge, while Group II consisted of 118 patients (46%) who had no complaints of ear discharge within the three months before surgery. 50% of each group underwent tympanoplasty type-I alone, and the other half experienced tympanoplasty type-I with a cortical mastoidectomy. **Results:** Only the tympanoplasty surgery (n=70) out of 140 patients with discharging ears resulted in effective graft taking in 62 patients (88.6%) and the achievement of a hearing level within 20dB in 57 patients (81.4%). Following tympanoplasty with cortical mastoidectomy (n = 70), 61 patients (87%) had effective graft taking, and 56 patients (80%) had postoperative hearing levels below 20 dB. Of the 118 patients with dry ears, only the tympanoplasty operation (n=59) produced a successful graft in 54 patients (91.5%), and 48 patients (81.36%) were able to obtain a postoperative hearing level within 20 dB. 53 patients (89.8%) had successful graft taking after tympanoplasty with cortical mastoidectomy (n = 59), and 47 patients (79.7%) had postoperative hearing levels within 20 dB. **Conclusions:** The necessity and efficacy of cortical mastoidectomy in type-I tympanoplasty for uncomplicated chronic suppurative otitis media, regardless of its dry or discharging status, has not been conclusively established.

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INTRODUCTION

Chronic suppurative otitis media (CSOM) is a condition marked by the recurring or constant discharge of fluid through a perforation in the tympanic membrane. In the tubotympanic variety, the perforation occurs in the pars tensa.^[1] Patients with this type typically experience mild to moderate conductive hearing loss, occasionally accompanied by otorrhea. CSOM stands as the leading cause of hearing impairment in regions with limited access to healthcare resources.^[2] Tympanoplasty represents a surgical intervention designed to restore the functional integrity of the middle ear and improve hearing.

Tympanoplasty, a surgical procedure aimed at restoring middle ear function and structure, has evolved over the years with various techniques and approaches. Among these, the inclusion or exclusion of a cortical mastoidectomy represents a critical decision point in surgical planning. Cortical mastoidectomy involves the removal of the external bony wall of the mastoid process, providing improved access and visualization of the middle ear structures during tympanic membrane reconstruction.^[3]

In 1953, Wulstein described the many types of tympanoplasty. Tympanoplasty, the penultimate phase in the surgical treatment of conductive hearing loss, results from more than a century of research and development into middle ear surgery for hearing improvement. Wulstein stated that the undamaged malleus handle is either covered by or beneath the graft in type-I tympanoplasty. Usually, it is done to treat a small, medium, partial, or occasionally entire ear drum perforation.^[4]

A TM perforation can cause hearing loss that ranges from 0 to 40 dB_{HL}. When performed by a skilled physician, tympanoplasty produces great results for persistent TM perforations. A successful perforation closure and hearing improvement are usually observed in over 90% of patients.^[2] A surgical operation called a cortical mastoidectomy is used to remove damaged air cells from the mastoid air cell system. The two conditions for which simple mastoidectomy is most frequently used are acute coalescent mastoiditis and as a prelude to various otologic procedures.^[5]

These days, the majority of mastoidectomies are either part of more intricate otologic surgeries or are done to treat complex chronic ear diseases.^[6] It is worth noting that some otologists opt to perform this procedure in cases of uncomplicated CSOM, asserting that it effectively addresses the source of infection within the mastoid and facilitates proper aeration of the middle ear cleft.^[7,8] However, it is essential to acknowledge that this practice is often based on empirical belief rather than a standardized clinical consensus.

This study will also consider potential subgroups of patients who may benefit more from one technique over the other, considering anatomical variations, pathology characteristics, and patient-specific factors. Such nuanced insights hold the promise of tailoring surgical strategies to individual patient needs, ultimately optimizing the outcomes of tympanoplasty procedures.

In summary, this comparative analysis seeks to shed light on the critical decision-making process surrounding tympanoplasty techniques, with a specific emphasis on the role

of cortical mastoidectomy. Through a rigorous examination of outcomes and potential patient-specific considerations, we aim to contribute valuable insights to the evolving landscape of otologic surgical practice.

MATERIAL AND METHODS

This retrospective observational study was carried out at two referral hospitals, namely Combined Military Hospital in Dhaka and Combined Military Hospital in Chittagong. The study spanned from July 2003 to July 2013. A total of two hundred fifty-eight patients were included in the study, selected from the Ear, Nose, and Throat (ENT) outpatient departments of both hospitals. These patients were diagnosed with uncomplicated chronic suppurative otitis media of the tubotympanic variety. The age range of the participants in this study varied from 18 to 55 years old.

Excluded from the study were cases with cholesteatoma, ossicular chain erosion, disruption, or loss of ossicles discovered following surgery, either clinically or microscopically. One hundred forty patients (54%) who had experienced ear discharge three months before surgery were placed in Group I. After their ears dried up, all patients with discharged ears had conservative care before having surgery. 50% of this group underwent tympanoplasty type-I (subgroup-I A) at random, and 50% experienced tympanoplasty type-I in conjunction with a cortical mastoidectomy (subgroup-I B).

Group II included the remaining 118 patients (46%) who had not complained of ear discharge in the three months previous to surgery. Of those, 50% underwent tympanoplasty type-I

alone (subgroup-II A), and the other 50% received tympanoplasty type-I combined with cortical mastoidectomy (subgroup-II B). Every patient had surgery using a post-aural technique. The perforation in the tympanic membrane was repaired using an autologous temporalis fascia transplant.

RESULTS

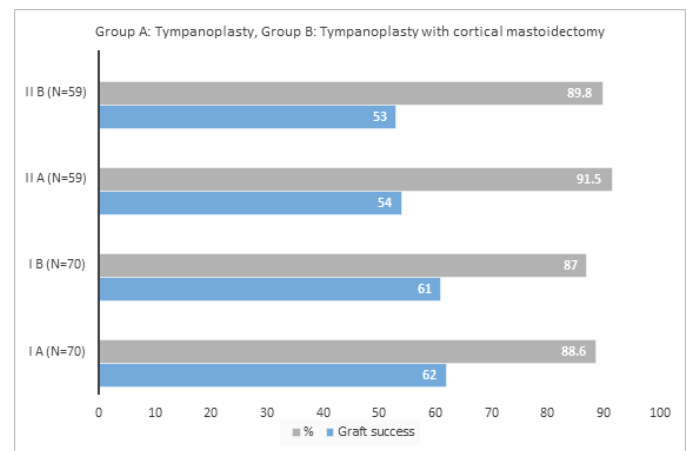


Figure 1: Perforation graft success representation of both discharging and dry ear groups

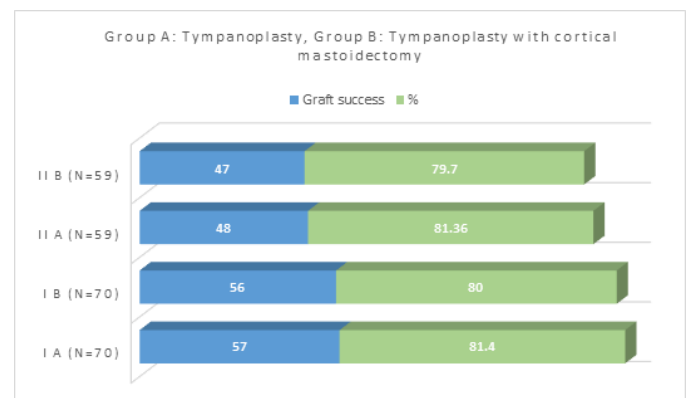


Figure 2: Comparison graphical representation regarding hearing improvement, Air-bone gap closure within 20 dB for (Group-I, n=140) and (Group-II, n= 118)

Analyzing the results of patients with discharging ear (group-I, n=140), in its subgroup-IA (only tympanoplasty, n=70), grafts were successfully taken in 62 patients (88.6%). In another subgroup-IB (tympanoplasty with cortical mastoidectomy), grafts were effectively taken in 61 patients (87%). Of the 118 patients in group II who had dry ears, 54 (91.5%) in subgroup II A (n=59, tympanoplasty only) and 53 (89.8%) in subgroup II B (n=59, tympanoplasty with cortical mastoidectomy) had successful graft operation.

Within the discharging ear group (Group-I), 56 patients (80%) in Group-I B (tympanoplasty with cortical mastoidectomy) and 57 patients (81.4%) in Group-I A (just tympanoplasty) were able to reach a postoperative-hearing-level-within 20 dB in air conduction. Of the 48 individuals in group II A (tympanoplasty only) and 47 individuals (group II B) (tympanoplasty plus cortical mastoidectomy), there was a functional improvement in post-operative hearing level in air conduction of up to 20 dB.

Table 1: Perforation closure or graft success rate in discharging ear group (Group-I, n=140) and dry ear group (Group-II, n=118)

Sub-groups	Operation	Graft success	%	Z value	P value
I A (n=70)	Only Tympanoplasty	62	88.6	0.1136	0.91
I B (n=70)	Tympanoplasty with Cortical mastoidectomy	61	87.0		
II A (n=59)	Only Tympanoplasty	54	91.5	0.1250	0.90
II B (n=59)	Tympanoplasty with Cortical mastoidectomy	53	89.8		

Since the P-value is very high, we cannot reject the null hypothesis. So, there is no significant statistical difference between the two procedures in all groups [Table 1].

Table 2: Hearing improvement, Air-bone gap closure within 20 dB (Group-I, n=140) and hearing level within 20 dB in air conduction (Group-II, Dry Ear group, n=118)

Sub-groups	Operation	Graft success	%	Z value	P value
I A (n=70)	Tympanoplasty only	57	81.4	0.1112	0.91
I B (n=70)	Tympanoplasty with Cortical mastoidectomy	56	80.0		
II A (n=59)	Tympanoplasty only	48	81.36	0.1210	0.90
II B (n=59)	Tympanoplasty with Cortical mastoidectomy	47	79.7		

We cannot reject the null hypothesis due to the very high P-value. The statistics of the two procedures do not significantly vary.

DISCUSSION

In both wet and dry ears, graft uptake, neotympanum development rate, and the percentage of hearing improvement up to a functional level are nearly the same, regardless of whether tympanoplasty with or without

cortical mastoidectomy was performed during the surgical procedure. After conducting the statistical analysis for this study, we can conclude that there is no significant statistical difference between the outcomes of these two techniques and that we cannot reject the null

hypothesis because the P-value is very high in all tables.

[Table 1] presents a comprehensive breakdown of the perforation closure or graft success rates within the discharging ear group (Group-I, n=140) and the dry ear group (Group-II, n=118), organized into distinct sub-groups based on the surgical intervention performed. In sub-group IA (n=70), where tympanoplasty was performed without cortical mastoidectomy, a notable graft success rate of 88.6% was achieved. Sub-group IB (n=70), which underwent tympanoplasty along with cortical mastoidectomy, exhibited a slightly lower but still considerable graft success rate of 87.0%. Moving to the dry ear group, sub-group IIA (n=59) underwent tympanoplasty alone, resulting in an impressive graft success rate of 91.5%. On the other hand, sub-group IIB (n=59), which underwent tympanoplasty along with cortical mastoidectomy, demonstrated a graft success rate of 89.8%. The observed differences in graft success rates between the sub-groups, as denoted by the Z values and corresponding p-values, were not found to be statistically significant (Z=0.1136, p=0.91 for sub-group IA vs. IB; Z=0.1250, p=0.90 for sub-group IIA vs. IIB). These findings suggest that the inclusion of cortical mastoidectomy did not lead to a significant difference in graft success rates, regardless of the ear's discharge status. This data provides valuable insights into the comparative effectiveness of tympanoplasty with and without cortical mastoidectomy in both discharging and dry ear scenarios.

We found a comparable with research by Chavan SS et al. that found that, at four months after surgery, graft uptake following tympanoplasty with cortical mastoidectomy

(97.33%) did not differ significantly from that following tympanoplasty without mastoidectomy (93.33%). Additionally, they discovered that, when compared to tympanoplasty alone, aerating the sclerosed mastoid adjunct with tympanoplasty did not significantly alter the improvement of hearing status after surgery.^[9] In addition, Hall et al.'s work provided evidence that tympanoplasty by itself would be adequate to repair a straightforward tympanic membrane perforation.^[10] According to Krishnan et al., the results of graft uptake and hearing improvement are nearly identical to those of tympanoplasty with mastoidectomy if a careful tympanoplasty is carried out with special care to remove all the disease from the middle ear and provided the eustachian tube function is good. This finding is also consistent with our study.^[11]

[Table 2] presents a detailed breakdown of the study's outcomes pertaining to graft success and hearing improvement across different sub-groups. In Group I, consisting of 140 cases, Sub-group A (n=70) underwent tympanoplasty exclusively, resulting in a graft success rate of 81.4%. Meanwhile, Sub-group B (n=70) in the same group underwent tympanoplasty with cortical mastoidectomy, achieving a comparable graft success rate of 80.0%. The marginal difference of 1.4% in graft success between the two sub-groups is statistically non-significant (Z value = 0.1112, P value = 0.91), indicating that the addition of cortical mastoidectomy did not significantly alter the graft success rate in Group I.

In Group II, comprising 118 cases classified as the Dry Ear group, Sub-group A (n=59) underwent tympanoplasty exclusively,



resulting in a graft success rate of 81.36%. Sub-group B (n=59) within the same group opted for tympanoplasty with cortical mastoidectomy, achieving a graft success rate of 79.7%. Similar to Group I, the marginal difference of 1.66% in graft success between the two sub-groups in Group II is statistically non-significant (Z value = 0.1210, P value = 0.90), suggesting that the inclusion of cortical mastoidectomy did not significantly impact the graft success rate in this sub-group. Furthermore, [Table 2] also provides insights into hearing improvement, specifically air-bone gap closure within 20 dB, for Group I, as well as hearing level within 20 dB in air conduction for Group II. These metrics serve as critical indicators of the efficacy of the surgical interventions. The data presented in the table offers a comprehensive overview of the outcomes for each sub-group, enabling a detailed assessment of the impact of cortical mastoidectomy on both graft success and hearing improvement within the context of the study's patient population.

It is important to highlight that the results of this studies show that the post-operative mean air-bone gap following tympanoplasty with mastoidectomy is 18.94 +/- 10.2 dB, and the post-operative mean air-bone gap following tympanoplasty alone is 17.9 +/- 7.01 dB. These results are nearly identical and thus compatible with the present investigation. The outcomes are similar to those of the Vertianen et al. study.^[12] Graft uptake is similar to the series of investigations published in the American Journal of Otology by Gersdorff et al. (1995).^[13] According to studies by Rickers et al. and Balyan et al., mastoidectomy did not appear to significantly improve postoperative hearing gain or graft uptake.^[14,15] The results of a study

by Mishiro et al. revealed that the graft success rate in the first group of big patients treated with tympanoplasty plus mastoidectomy (90.5%) and the second group treated with tympanoplasty alone (93.3%) did not differ statistically significantly. The percentage of postoperative air-bone gap within 20dB was 90.4% in the second group and 81.6% in the first group, according to the same study, with no statistically significant difference between the two groups. According to the same study, the first group's graft success rate for dry ears was 90.7%, while the second group's rate was 94.4%. Therefore, there was no statistically significant distinction between dry ears and discharged ears.^[16] These results align with the current investigation.

CONCLUSIONS

Both anecdotal and empirical evidence have established a prevalent practice of combining mastoidectomy with tympanoplasty in the treatment of chronic suppurative otitis media, particularly of the tubotympanic variety. Advocates for this concurrent procedure contend that it offers benefits such as improved mastoid aeration, with minimal associated risks or added burdens for the patient. However, both the findings of this study and existing literature suggest that, in cases of uncomplicated chronic suppurative otitis media, mastoidectomy does not confer significant advantages to tympanoplasty alone. This holds true even when the ear is actively discharging, as tympanoplasty in isolation proves adequate for repairing straightforward and uncomplicated tympanic membrane perforations. Notably, it also leads to a noteworthy enhancement in hearing acuity for

a substantial proportion of individuals within this patient demographic.

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