ORIGINAL ARTICLE

COMPARISON BETWEEN EFFICACY OF TYMPANOPLASTY WITH AND WITHOUT CORTICAL MASTOIDECTOMY IN TUBO-TYMPANIC OTITIS MEDIA IN ADULTS

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Background: Chronic suppurative otitis media (CSOM) tubo-tympanic type is a common ear condition in underdeveloped nations. Cortical mastoidectomy in conjunction with tympanoplasty has long been regarded as the preferred surgical procedure for patients with chronic non-cholesteatomatous otitis media. Studies contrasting tympanoplasty with and without cortical mastoidectomy improved hearing, but the results were comparable. Both of these procedures are still debatable and mandate further research. This comparison has not been conducted in Pakistan before. Our objective is to evaluate whether tympanoplasty is effective in managing tubo-tympanic otitis media in patients with or without cortical mastoidectomy. **Methods:** Eighty-two patients (equally divided into two groups) were recruited from the Shaikh Zayed Hospital, Lahore. Group A (n=41) referred to tympanoplasty with mastoidectomy and group B (n=41) referred to tympanoplasty alone. Data was gathered using a pre-designed *Proforma*, and SPSS version 25.0 was used for analysis. Post-operative hearing improvement was calculated from the audiometric' air-bone gap before the operation minus the ABG of post-operative follow-up at 16 weeks. A hearing gain of at least 15dB was considered clinically relevant. **Results:** Hearing improvement was observed in 73.3% of participants in group A while 83.3% in group B, grafting status was 95.1% in group B and 90.2% in group A, and discharge presence was 7.3% and 17% in group A and group B respectively. **Conclusion:** In CSOM, mastoidectomy does not add significant benefit in terms of hearing & graft uptake, however, it is advantageous if the middle ear mucosa is unhealthy. Tympanoplasty alone is sufficient if the middle ear mucosa is healthy.

Keywords: Mastoid; Mastoidectomy; Otitis Media; Tympanoplasty

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INTRODUCTION

Conductive hearing loss is caused by chronic suppurative otitis media (CSOM), a chronic inflammatory condition of the middle ear and mastoid that frequently culminates in partial or complete loss of the tympanic membrane (TM) and ossicles, can be as severeas 60–70 dB.[1] It is a widespread disorder affecting 0.5–30% of society. Therefore, a conservative estimate puts the number of CSOM patients at approximately 20 million worldwide.[2] Tubo-tympanic and atticoantral diseases are the two primary categories of CSOM.[3] An upper respiratory tract infection or water entry through a perforation may cause an intermittent, mostly mucoid or mucopurulent discharge, which is indicative of tubo-tympanic illness. The most typical signs of tubo-tympanic illness included discharge from the ear, recurring or chronic ear discharge (otorrhea), hearing loss, ear pain,and tinnitus throughout 2 to 6 weeks. There was a central hole and a lot of mucoid, odourless discharge. Infections in the oropharynx, nasopharynx, and oesophagus can spread to the middle ear via the eustachian tube and cause tubo-tympanic (mucosal) otitis. Poor living circumstances, lack of hygiene practices, and non-nutritious food contribute to a high prevalence of CSOM among children and young adults in the middle classes of developing nations.[4] Mastoiditis is only one of several variables that might hinderthe healing of a torn tympanic membrane. The mucoperiosteal lining of the middle ear cleft is inflamed, causing this illness.

Surgery is the mainstay of CSOM treatment, with the main objectives being the elimination of the illness, preventing recurrence, and maintaining or improving hearing. Tympanoplasty is a procedure intended to repair the middle ear hearing mechanism, whereas "mastoidectomy" is intended to eliminate the illness in the mastoid and middle ear.[5] Timing of surgery and patient selection are also important factors in the success of tympanoplasty and mastoidectomy (except for patients who need emergency surgery for

extracranial or intracranial complications of CSOM). Tympanoplasty is more challenging and has less consistently favourable results in children with CSOM than in adults, thus this is very important. However, there is a lack of conclusive proof.[6] Graft-take rates were shown to increase exclusively with increasing age, according to a meta-analysis of 30 trials on paediatric tympanoplasties. Successful recovery may or may not be predicted by factors such as surgical approach, history of adenoidectomy, presence of current infection, perforation size, contralateral ear health, or eustachian tube function. In mild cases of a disease, being young may not even increase your chances of getting sick. Results were similar in ears operated on between 2.5and 7 years of age and 8 to 14 years of age in 116 children with non-cholesteatomatous CSOM who were followed for 16–27 years. During the study, only 14% of ears were modified.[7]

There is still much uncertainty about whether or not mastoidectomy helps people who don't have active infectious illness. However, mastoidectomy has been demonstrated to have much better results in instances with current infections. In antibiotic-resistant instances of CSOM, a cortical mastoidectomy may be necessary to eliminate the infection.[8] The major function of mastoidectomy is to enhance ventilation and drainage of the temporal bone/mastoid air cell system, which benefits the middle ear and mastoid milieu interie mastoid air cell system (MACS). Tympanoplasty, with or without mastoidectomy, has a success rate in treating chronic paediatric otitis media. An estimated 0.5–30% of people worldwide suffer from chronic suppurative otitis media (CSOM), especially the tubo-tympanic type. The state of living, lack of hygiene, and inadequate nutrition in Pakistan continue to make the condition a serious public health concern. Children and young adults are especially prone to tubo-tympanic otitis media, which frequently results in recurrent infections and calls for surgical intervention. Reconstruction of the tympanic membrane using graft materials and techniques has been detailed in great detail since the inception of tympanoplasty by Zoellner and Wullstein in 1952.[9] Tympanoplasty and mastoidectomy are common surgical procedures used to permanently treat CSOM. Tertiary care centres in all industrialized nations often include an otologic section where such treatments can be performed. Through the use of bone drills and microsurgical tools, the mastoid air cells, granulations, and debris are removed during a mastoidectomy.[10]

Closing the tympanic membrane perforation with a soft tissue graft, with or without ossicular restoration, is what tympanoplasty is all about. Tympanoplasty procedures vary according to how severely the ossicular chain has been damaged;[11] for example, if the malleus, incus, and stapes have all been destroyed in rapid succession, the tympanic grafts will need to be gradually farther positioned medially. In cases when cholesteatoma is absent, a mastoidectomy and tympanoplasty may be done separately or concurrently to remove CSOM. In both, the middle ear is examined, and the ossicles and mucosa may be removed to ensure the infection is gone.[12]

It is also possible to remove the bony wall of the posterior canal that divides the middle ear and mastoid chambers by drilling, with the removal interrupted only to protect the facial nerve at its base. For comparison, when the posterior canal wall is kept and a hole is created through it to get access to the middle ear, this procedure is known as an intact canal-wall mastoidectomy (ICW).[13] The latter helps make tympanoplasty, which restores hearing by reshaping the eardrum, a more viable option by preserving the middle ear's natural architecture. However, because of the restricted surgical access to the middle ear, ICW mastoidectomy is more technically challenging and frequently results in recurring or persistent illness.[14] So, it's important to keep an eye on patients after surgery and have them informed about additional procedures if they need to checkfor complications or remove any lingering cholesteatoma. The Canal Wall Down (CWD) mastoidectomy may be less complicated to carry out, and it certainly provides excellent access to the middle ear,which is very helpful when dealing with large cholesteatomas. Recent investigations showed satisfactory postoperative hearing gain; nevertheless, the absence of graft support supplied by the posterior canal wall may be a threat to successful surgical restoration of hearing.[15] Compared to pre-CWD patients, those who have undergone CWD have a reduced risk of ear disease recurrence and require fewer further surgeries like tympanoplasty or mastoidectomy. Choosing the right operation frequently has less to do with research findings and more to do with individual patient characteristics and the surgeon's level of experience. When the air cells in the mastoid are constricted, for instance, an ICW mastoidectomy is impossible to perform.[16]

Successful graft (97%) take has been reported by Dave and the hearing outcomes were quite positive.[17] Eighty-seven percent of the type I tympanoplasties, seventy-three percent of the type III partial ossicular replacement prosthesis (PORP), and seventy percent of the type III total ossicular replacement prosthesis (TORP) tympanoplasties in their series were successful in closing the ABG to within 10 dB. In a broad series of cartilage tympanoplasties, Baz found that 92% of patients experienced successful drum closure and had average ABGs of less than 30 dB.[18] The percentage of type I

cartilage tympanoplasty among the 52 patients described by Dispenza *et al*. was 18%. In all cases, the TM closed, and the average ABG was 4 dB. Adkins documented 55 instances of tympanoplasties performed on cartilage to correct retractions. Successful graft take was seen in 18 patients, and the average conductive loss was less than 10 dB. Comparison of graft uptake, hearing improvement, and disease clearance noticed after tympanoplasty alone versus cortical mastoidectomy.[19]

Repair of a perforated tympanic membrane by tympanoplasty is well-established. Many recent studies have examined whether or not cortical mastoidectomy can enhance the effectiveness of tympanoplasty.[20,21]

In the study of 40 patients, Shew *et al*. found a 94% success rate when tympanoplasty was performed in conjunction with cortical mastoidectomy and a 93% success rate when tympanoplasty was performed alone, demonstrating that mastoidectomy is always necessary.[22] Zhu *et al*. found that Myringo plasty was successful in closing tympanic membrane perforations in 76.1% of 46 patients and in 78.3% (n=36) of 46 patients who also underwent mastoidectomy.[23] There was no discernable statistically significant change. Krishnan *et al*. found that postoperative hearing gain was 75% across the board for their study's two groups. Similarly, Huang *et al*. observed no statically significant difference in graft failure rates or hearing outcomes between tympanoplasty with and without mastoidectomy in a trial including 48 patients with CSOM. Poor eustachian tube function, a history of numerous bouts of acute otitis media, and living in crowded surroundings all raise the risk of CSOM.[12] In most cases, the disease manifests itself in young children. Acute otitis media (AOM) is an acute infection of the middle ear that can cause a tympanic perforation (eardrum rupture) in around 11 percent of the world's population every year. Approximately 4.4% of the population is affected by COM. There is a striking disparity in the global prevalence of COM, with rates being only one-third as high in high-income countries as they are in low-income ones. Around 21,000 individuals worldwide perish every year as a direct result of COM problems.[9]

Persistent mucosal inflammation causes permanent deformities in the middle ear and mastoid cavity in tubotympanic CSOM. In addition to a medialized uncinate process and middle turbinate hypertrophy, DNS is the most often seen etiopathological component in the development of CSOM.[11] The use of computed tomography (CT) scan documentation to validate DNS was crucial for the treatment of patients with active, no-risk CSOM who had sinus or nasal disease. It was determined that the average age was 32.45±12.36 years. Sixty-one percent of patients were between the ages of 31 and 50, and the male to female ratio was 1.20. Sixty-two percent of patients with benign CSOM had DNS, making it the most prevalent associated sinonasal pathology (*p* 0.003). The least prevalent reason was a hypertrophied middle turbinate (25% of cases). Significantly, CT scans confirmed DNS in62% of patients.[10] The goal of surgical procedures like mastoidectomy and tympanoplasty is to remove middle ear disorders and restore hearing. The need for cortical mastoidectomy in addition to tympanoplasty, however, is a topic of much discussion, especially when the middle ear mucosa seems to be in good condition. The purpose of this study is to compare the effectiveness of cortical mastoidectomy and tympanoplasty in treating adult patients with tubotympanic otitis media in 82 patients from Shaikh Zayed Hospital in Lahore. The study closes a gap in the literature and offers information on the best surgical treatments for Pakistani patients with CSOM.

MATERIAL AND METHODS

We conducted a randomized controlled trial involving adult patients of tubotympanic otitis media of both genders, who were admitted through OPD in Shaikh Zayed Hospital, Lahore. The sample size was estimated by using a 7% margin of error with a confidence level of 95%. The total sample size is 82 divided into two groups (41 in each group) using a lottery technique. The sample selection criteria included age 18–50 years of both genders, type I tympanoplasty (myringoplasty), while exclusion were extreme age patients, recurrent surgery, active infection of the nose and paranasal sinuses, comorbid DM, HTN, and other immunocompromised states.

A written informed consent was taken from each patient after explaining the risk, purpose, and benefits of this research. Detailed history including age, gender, and medical number were noted in data collection *Proforma*. The types of tympanic membrane perforations included in the study were categorized into central, anterior, and posterior perforations. Only stable and dry middle ears were included in the study, with perforations confirmed to be dry for a minimum of 4 weeks before surgery. Patients with unstable, wet, or discharging ears were excluded. The presence or absence of aural polyps was assessed, and patients with polyps were excluded from the study to minimize variability in post-operative healing. A pre-operative tonal audiogram was conducted for all patients, describing both air and bone conduction thresholds as a baseline for later comparison of hearing improvement. We performed a detailed ear examination with an otoscope, examination under a microscope, and CT scan in a few

cases to rule out cholesteatoma, aural polyp, and granulations. The fate of granulation tissue and aural polyp was assessed intra-operatively and during follow-up to evaluate the effectiveness of tympanoplasty with or without cortical mastoidectomy. First, 41 patients included in group A were referred to tympanoplasty with cortical mastoidectomy in tubo-tympanic otitis media. The second 41 patients of group B were referred to tympanoplasty alone in tubo-tympanic otitis media. Post-operative hearing improvement was calculated from ABG before the operation minus the ABG of post-operative follow-up at 16 weeks. Grade of assessment was assessed as full take rate, partial take, or reperforation 4 months after surgery while post-operative hearing of the patient was also assessed.

Data was entered and analyzed through SPSS version 25.0. Quantitative variables like age, hearing, gender, lateral side, cause of perforation, graft uptake, reperforation, recurrence of discharge, and frequencies and percentages were presented. Comparison between groups was made by applying an independent sample t-test and Whitney U-test. Both groups were compared for efficacy and findings between with and without cortical mastoidectomy.

RESULTS

This study included 82 patients, divided into two categories: tympanoplasty with cortical mastoidectomy and tympanoplasty without cortical mastoidectomy. Descriptive statistics of sex, duration of symptoms, course of perforation, eustachian tube dysfunction, deviated nasal septum, traumatic, grafting status, discharge and re-perforation status, and hearing outcome were performed. The mean age of both groups was 35.4±12.7. The PTA test was done preoperatively and postoperatively, with a mean preoperative value of 39.4±9.7 and postoperatively 27.9±8.4. Bifurcation of demographic and clinical features in Group A, tympanoplasty with cortical mastoidectomy and Group B, and the bifurcation in hearing outcome (pure tone audiometry test) were performed. In this study, acute otitis media (AOM) perforation was present in 27 (65.9%) in group I and 38 (92.7%) in group II, with a statistical significance (*p*-value 0.04). The grafting rate was 80.4% in group A and 85.6% in group B, with no statistically significant difference. Ear discharge was observed in 3 cases in group A and 7 cases in group B, showing marginal significance (*p*=0.08). Re-perforation occurred in 4.9% of patients in group A and 12.2% in group B, with marginal statistical significance (*p*=0.07). Hearing outcome, measured by the pure tone audiometry test, showed significant improvement in group A compared to group B.

Table-1: Bifurcation of grafting status, discharge, and re-perforation status in Group A; tympanoplasty with cortical mastoidectomy and Group B; tympanoplasty alone after surgery postoperatively.

Variable Categories	Group A 41 (50%)	Group B 41 (50%)	*p*-value
Grafting status			0.17
No	4 (9.8)	2 (4.9)	
Yes	37 (90.2)	39 (95.1)	
Discharge			0.08
No	38 (92.7)	34 (82.9)	
Yes	3 (7.3)	7 (17.1)	
Re-perforation status after surgery			0.07
No	39 (95.1)	36 (87.8)	
Yes	2 (4.9)	5 (12.2)	

DISCUSSION

Tymangioplasty with or without mastoidectomy is performed to eliminate middle ear disease and reconstruct the conductive hearing issue. In the current study, the patients selected were between 18 and 50 years old. Mastoid factors include the extent of mastoid pneumatization and the presence of inflammatory disease. A study conducted by Lasisi and Afolabi[5] reported that the commonest perforation size was medium but, in this study, the most common perforation size was central 37 (45.1%) followed by peripheral 28 (34.2%).

A study by Biswas *et al*. reported that the majority of patients had duration of symptoms within 1 year (62%) and had a right lateral side 51 (62.2%). Research has been carried out[24] which showed that the majority of the patients had a duration of symptoms within 1 year (62%) which was comparable with the present study as in this study majority of patients had a duration of symptoms up to 1 year (57.5%). Also, in this present study majority of patients had a right lateral side 51 (62.2%).

This investigation found that acute otitis media (AOM) lead to perforation was present in 27 (65.9%) in group I and 24 (58.5%) in group II with a statistically insignificant (*p*-value 0.04). Eustachian tube dysfunction was seen in 7 (17.1%) and 9 (22.0%) in groups I and II, respectively. The overall grafting rate was 76 (92.7%), with 37 (90.2%) grafting with cortical mastoidectomy and 39 (95.1%) grafting without. Ear discharge was reported only in 3 (7.3%) cases in group I, and recurrent perforation status after surgery was in 2 (4.9%) and 5 (12.2%) cases. These results were also comparable with the published data.[25] Hearing outcome (pure tone audiometry test) before and after surgery was 38.5±10.6 and 39.2±9.7. These results were comparable with published data.[26] The results may vary among institutions due to varying sterilization processes, the expertise of the surgeons, and the surgical facilities available at each hospital.

Almost all of the patients included in this

study were presented in Shaikh Zayed Hospital Lahore. This study's primary limitations include its single-center design and rather small sample size, which may restrict how broadly the findings may be applied. Furthermore, we are unable to evaluate the long-term sustainability of the surgical outcomes due to the absence of long-term follow-up. Future research should assess long-term safety and efficacy using longer follow-up periods and a larger, multi-center sample to get beyond these limitations. Furthermore, a more varied patient base might offer a clearer picture of the outcomes for various demographic categories.

CONCLUSION

We concluded that tympanoplasty provides a similar outcome to mastoidectomy in the tubo-tympanic type of CSOM, in terms of graft success rate and hearing gain. In our study, the p-value for both hearing outcome and grafting status was significant. However, if the middle ear mucosa is healthy, tympanoplasty alone is sufficient. For cases where there is persistent ear discharge or granulation tissue in the middle ear mucosa at a pre-operative examination under magnification, mastoidectomy may be more beneficial. Our research adds new insight by suggesting that mastoidectomy may be preferred in such cases, though its overall effect on postoperative hearing gain was not significantly positive.

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AUTHORS' CONTRIBUTION

ES, ZUS: Literature search. SL: Conceptualization of the study. IUR, IU: Data analysis, data collection. TH: Data interpretation. ES: Proof reading.

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