

## Hearing Outcome in Cholesteatoma Patients after MRM and Type III Tympanoplasty

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### Abstract:

**Introduction:** Chronic suppurative otitis media with cholesteatoma is a common condition in ENT clinics, and its surgical management remains a significant challenge in otology. The primary objective of cholesteatoma surgery is to eliminate the disease and establish a safe and stable ear. However, there is ongoing debate about whether canal wall down or canal wall up procedures are more effective in achieving these goals.

**Material and Methods:** In this prospective study, we assessed the advantages of modified radical mastoidectomy (MRM) combined with type III tympanoplasty in terms of disease eradication and hearing improvement. The study included 100 patients with chronic otitis media (attico-antral variety) who underwent MRM with type III tympanoplasty at a tertiary care center. Temporalis fascia grafts were used for tympanoplasty.

**Results:** The study included a diverse age range, with a mean age of 24.03±6.07 years. Most participants were aged 21-30 years (43.1%) and 11-20 years (35.5%). The gender distribution was predominantly male (72%) and female (21%). In terms of presenting complaints, all patients had ear discharge (100%), followed by hearing loss (91.39%), ear pain (43.01%), tinnitus (10.75%), and headaches (2.15%). Pre-operatively, the average air conduction improved significantly from 48.22 dB to 34.24 dB (p=0.001). The pre-operative air-bone gap (ABG) of 32.26 dB decreased to 21.1 dB post-operatively (p=0.0001), indicating significant hearing improvements.

**Conclusion:** Our study shows that MRM with type III tympanoplasty effectively eradicated disease and significantly improved hearing in patients with chronic otitis media and cholesteatoma.

**Keywords:** Cholesteatoma Surgery, Modified Radical Mastoidectomy, Type III Tympanoplasty, Hearing Improvement.

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### Introduction

Chronic Suppurative Otitis Media (CSOM) is characterized by persistent or recurrent otorrhea and tympanic membrane perforation lasting over three months. It can be managed medically or surgically, with two primary surgical approaches: canal wall down mastoidectomy (CWDM) and intact canal wall mastoidectomy (ICWM). [1] The treatment of choice for diffuse cholesteatoma in chronic otitis media cases is CWDM, with the goal of removing the disease while preserving hearing function. [2] CWDM offers advantages over canal wall up mastoidectomy (CWUM), allowing for easier detection of residual cholesteatoma during follow-up and a lower rate of disease recurrence. [3] CSOM is a global health concern, with a higher prevalence in developing countries due to factors

like poor living conditions, hygiene, malnutrition, and limited access to medical care. [4] The disease is classified based on perforation location and the presence of pathologies like cholesteatoma and retraction pockets. Surgical treatment aims for complete disease clearance, a dry ear, and functional restoration within a single procedure, ideally. [5]

Modern reconstructive surgery, such as Wullstein type III tympanoplasty, has revolutionized canal wall down mastoidectomy, enabling disease clearance and middle ear reconstruction for hearing improvement. [6] This study focuses on reporting the hearing outcomes of patients with CSOM and cholesteatoma who underwent modified radical mastoidectomy with classical Wullstein type III

tympanoplasty. The primary objective is to observe and compare hearing statuses before and after canal wall down mastoidectomy with type III tympanoplasty.

### Methods and Materials

This study, conducted between July 2020 and March 2022 at the Department of Otorhinolaryngology in G.G. Hospital, Jamnagar, adopted a prospective interventional design. It aimed to examine patients diagnosed with Chronic Suppurative Otitis Media (CSOM), specifically those with cholesteatoma or the atticointral variety. These patients underwent canal wall down mastoidectomy with Type III Tympanoplasty, a surgical procedure conducted under general anesthesia, utilizing temporalis fascia as graft material.

The selection criteria were stringent. Inclusion criteria encompassed individuals with CSOM accompanied by cholesteatoma, aged 10 years or older, and willing to provide informed consent. Exclusion criteria, on the other hand, excluded patients with CSOM lacking cholesteatoma, those with external or inner ear abnormalities, sensorineural hearing loss (SNHL), or any systemic diseases, as well as individuals with a history of previous mastoidectomy.

The study cohort consisted of 100 patients who met the selection criteria. Data collection involved comprehensive history-taking and clinical examinations, meticulously recorded in data collection sheets. Preoperative Pure Tone Audiometry tests were conducted within seven days prior to the operation, utilizing the Hughson and Westlake method. This assessment involved both Air Conduction and Bone Conduction modes, with thresholds calculated for frequencies at 500, 1000, 2000, and 4000 Hz. The Air-Bone Gap (ABG) was determined by the difference between Air Conduction and Bone Conduction thresholds.

Both preoperative and postoperative Air and Bone conduction thresholds were recorded. Postoperative ABG closure was calculated by comparing preoperative and postoperative ABGs at the average frequencies of 500, 1000, 2000, and 4000 Hz. Audiometry results were reported following the guidelines of the American Academy of Otolaryngology-Head and Neck Surgery.

The surgical procedure involved the use of temporalis fascia graft for classical Type III tympanoplasty, aiming to bridge the middle ear airspace and place it in contact with the stapes head. The graft was then draped over the facial ridge. Follow-up assessments were conducted at 1 week postoperatively, followed by evaluations at 1 month and 6 months. During this follow-up period, ears with minimal discharge from the mastoid cavity at 1 month were managed with antibiotics and suction clearance. All patients were examined after 6 months, with those exhibiting healed middle ears subjected to pure tone audiometry (PTA) assessment.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 22.1 for Windows. A significance level of  $P \leq 0.05$  was adopted for statistical significance.

### Results

During the study period, a total of 100 patients were initially enrolled. Among these patients, 96 individuals (96%) attended the scheduled follow-up appointments, while 4 patients (4%) were unfortunately lost to follow-up. Within the group of patients who completed the follow-up, 3 cases (3%) were subsequently excluded from the study due to graft failure.

To further characterize the patient population, participants were categorized into different age groups within the cohort of study participants, 40 individuals (43.1%) fell into the 21-30 years age category, while 33 subjects (35.5%) were in the 11-20 years age group. Additionally, 15 participants (16.11%) belonged to the 31-40 years age bracket, and 5 individuals (5.37%) were categorized as being above 40 years of age. The mean age of the study population was determined to be  $24.03 \pm 6.07$  years. Regarding gender distribution, the study included 72 male participants, accounting for 72% of the total, and 21 female participants, representing 21% of the total population.

Table-1 presents the distribution of presenting complaints among study patients, showcasing the prevalence of otorrhoea (ear discharge) in all patients (100%), followed by hearing loss (91.39%), otalgia (ear pain, 43.01%), tinnitus (ringing in the ears, 10.75%), and headaches (2.15%) as less frequent concerns.

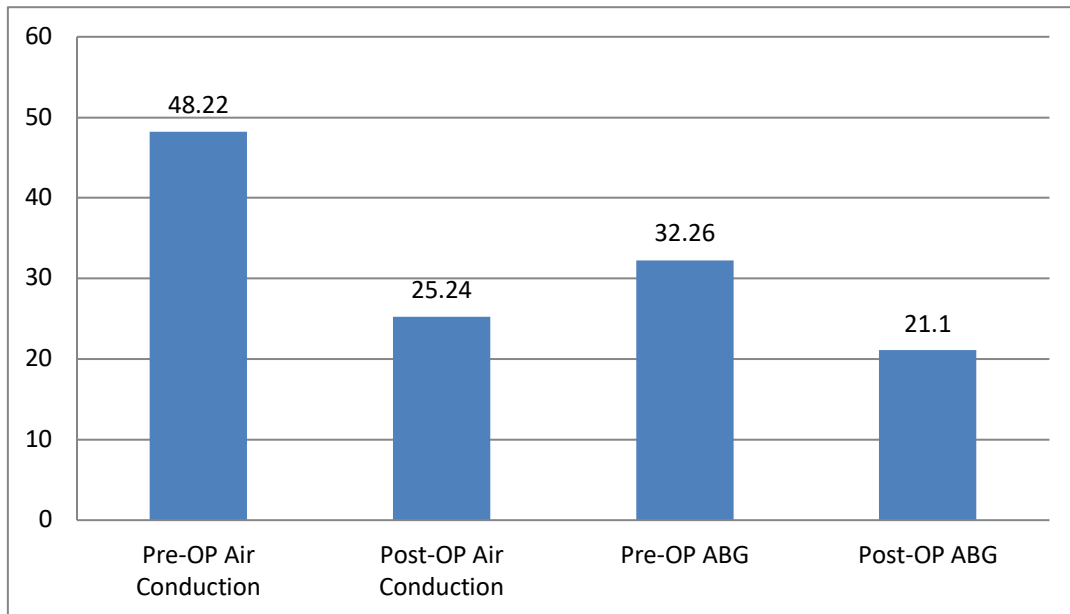
**Table 1: Distribution of Presenting Complaints in Study Patients**

Presenting Complaint	No. of Patients	Percentage (%)
Otorrhoea	93	100.00
Hearing Loss	85	91.39
Headache	2	2.15
Tinnitus	10	10.75
Otalgia	40	43.01

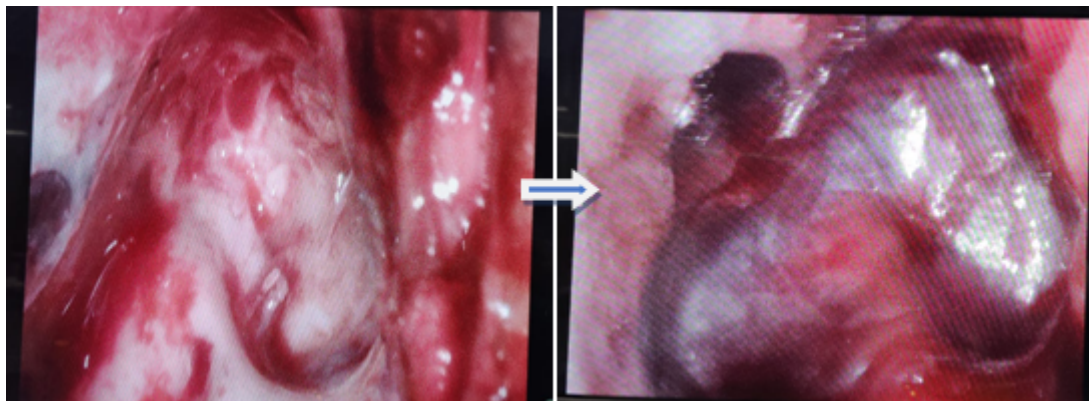
**Table 2: Audiometry Results**

Parameters	Mean (dB)	Standard Deviation	P value
Pre-op Air Conduction	48.22	5.26	0.003
Post-op Air Conduction	34.24	3.42	
Pre-op Air-Bone Gap (ABG)	32.26	6.3	0.001
Post-op Air-Bone Gap (ABG)	21.1	4.23	

Pre-operatively, the average air conduction was 48.22 dB (SD: 5.26), which significantly improved post-operatively to 34.24 dB (SD: 3.42) with p-value of 0.001. Similarly, the pre-operative air-bone gap (ABG) was 32.26 dB (SD: 6.3), and post-operatively, it decreased to 21.1 dB (SD: 4.23) with p-value of 0.0001, demonstrating significant improvements in hearing outcomes. (Fig 1)



**Figure 1: Pre- and Post-Operative Audiometric Results (mean dB)**



**Figure 2: Cavity showing stapes with its supra structure then temporalis graft over stapes head**

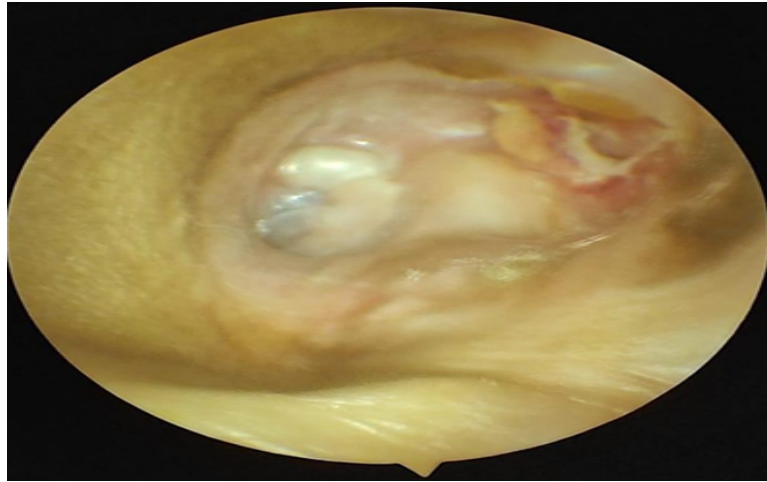
The gain in air conduction was measured at 13.98 dB, and an air-bone gap (A-B gap) reduction of 11.16 dB was achieved. The p-values for both improvements were found to be highly statistically significant ( $p \leq 0.0001$ ), indicating substantial positive changes in hearing outcomes following the surgical intervention. (Table 3)

**Table 3: Audiometric Improvements**

Parameters	Change (dB)	P-Value (Assumed)	T-Test Statistic
Gain in Air Conduction	13.98	$\leq 0.0001$	41.234
Air-Bone Gap Reduction	11.16	$\leq 0.0001$	22.253

At the 6-month follow-up, the status of the cavity was assessed in a group of 93 patients. Among these patients, 68 individuals exhibited a well-taken-up graft with a dry cavity, while 25 patients had cavities characterized by

discharge, polyps, or granulations. Notably, the presence of discharge, polyps, or granulations in the cavity was found to be statistically significant ( $p < 0.005$ ) in comparison to the group with well-healed grafts and dry cavities.



**Figure 3: Post op cavity on 6 month follow up**

### Discussion

In this prospective interventional study, we conducted canal wall down (CWD) mastoidectomy with Type III tympanoplasty for patients with chronic suppurative otitis media (CSOM) accompanied by cholesteatoma. We evaluated the pre and post-operative hearing outcomes in terms of the average post-operative air-bone gap (ABG), the size of ABG closure, and the status of the cavity six months post-surgery. Our study included patients with a mean age of  $24.03 \pm 6.07$  years, and we observed that most patients fell within the 20 to 30 years age group which was in line with the other studies [7,8].

This age distribution contrasted with other studies [9], where the majority of patients were in the 10-20 years age group. This difference can be attributed to social and cultural practices in our region, which tend to discourage surgical interventions in younger individuals. Additionally, we noted a significant gender imbalance, with 72 male patients compared to 21 females. This discrepancy can be attributed to sociocultural factors, where females in our region may have less access to healthcare and are less likely to seek medical attention.

Our findings revealed that 100% of the patients presented with ear discharge, and 91% experienced hearing loss. Otalgia was reported by 43% of the patients. These symptoms are consistent with the typical clinical presentation of CSOM with cholesteatoma. [7,10] In terms of hearing outcomes, we observed a statistically significant improvement in post-operative pure tone audiometry (PTA) - ABG compared to the pre-operative values. Pre-operatively, patients had an average PTA-ABG of 32.26 dB, which improved to

21.1 dB post-operatively, resulting in a net gain of 11.26 dB. These results align with previous studies, such as Cheang et al's myringostapediopexy study [11], where a similar improvement in PTA-ABG was observed. Our findings were also consistent with Utpal Kumar Dutta et al's study [10], which demonstrated significant post-operative improvements in hearing thresholds.

Furthermore, at the six-month follow-up, 73% of our patients exhibited a dry cavity with a well-taken-up graft, while 27% displayed either polyps, discharge, or granulations in the cavity. These results are in accordance with Castrillon et al's study [12], which reported a high percentage (95%) of patients with dry and disease-free ears after CWD mastoidectomy.

### Conclusion

In conclusion, our study demonstrates that CWD mastoidectomy with Type III tympanoplasty is effective in improving hearing outcomes for patients with CSOM and cholesteatoma. It also highlights the importance of considering sociocultural factors in patient demographics and emphasizes the favorable results in achieving a dry and disease-free ear post-surgery. The study strongly supports Type III tympanoplasty with CWD mastoidectomy, as it reduces recurrence, improves hearing, and achieves a dry cavity.

### Bibliography

1. Gleeson M, Scott-Brown WG. Scott-Brown's otorhinolaryngology, head and neck surgery. (No Title). 2008.
2. Kim MB, Choi J, Lee JK, Park JY, Chu H, Cho YS, et al. Hearing outcomes according to the types of mastoidectomy: a comparison between canal wall up and canal wall down

- mastoideotomy. Clinical and experimental otorhinolaryngology. 2010; 3(4):203–6.
3. Bhat SM, Vuppala R. Cavity Problems Following Canal Wall Down Mastoideotomy in Chronic Suppurative Otitis Media: Are We Treating Adequately or Making Them Regular Outpatients? An International Journal of Otorhinolaryngology Clinics. 2021; 13(1):11–7.
  4. Shaheen MM, Raquib A, Ahmad SM. Chronic suppurative otitis media and its association with socio-economic factors among rural primary school children of Bangladesh. Indian Journal of Otolaryngology and Head & Neck Surgery. 2012; 64:36–41.
  5. Cebeci S, Özbilen MS, Bayramoğlu İ, Kemaloğlu YK, Uygur KK, Bayazit YA, et al. Impact of the demographic and aetiological factors and intraoperative findings on postoperative outcomes in chronic otitis media surgery. Turkish Journal of Medical Sciences. 2020; 50(1):155–62.
  6. Afzal V. Hearing Results following Canal Wall down Mastoideotomy in Attico-Antral Disease. 2010;
  7. Hanif M, Alam MZ, Tarafder KH, Haque MR, Arafat MS, Rahman MM. Evaluation of Hearing Status in Pre and Post-operative Canal Wall Down Mastoideotomy with Type III Tympanoplasty with or without Cartilage Augmentation. Bangladesh Journal of Otorhinolaryngology. 2020; 26(2):86–94.
  8. Islam SS, Siddiquee BH, Kabir AL, Islam MR, Razzak MA. Comparative study of hearing status after modified radical mastoideotomy with and without reconstruction. Bangladesh Journal of Otorhinolaryngology. 2019; 25(1):41–6.
  9. Lasisi AO. Hearing outcome after canal wall down mastoideotomy and Wullstein type III tympanoplasty. East and central African Journal of surgery. 2007; 12(2):44–7.
  10. Dutta UK, Alam MM, Akhter N, Saha KL, Hossain MA, Biswas AK, et al. Study of Hearing Status After Canal Wall Down Mastoideotomy with Type-III Tympanoplasty. Bangladesh Journal of Otorhinolaryngology. 2017; 23(1):52–8.
  11. Cheang P, Kim D, Rockley T. Myringo stapedioplexy and myringo lenticuloplexy in mastoid surgery. The Journal of Laryngology & Otology. 2008; 122(10):1042–6.
  12. Castrillon R, Kos I, Montandon P, Guyot J. Long-term results of canal wall down mastoideotomy. Schweizerische medizinische Wochenschrift. 2000; 58S-61S.