

## TO STUDY THE OUTCOMES OF HEARING STATUS IN PATIENTS AFTER CANAL WALL DOWN MASTOIDECTOMY IN ATTICOANTRAL VARIETY OF CHRONIC OTITIS MEDIA

### Otorhinolaryngology

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### ABSTRACT

**Aim:** To compare the pre-operative & post-operative hearing of the patients after canal wall down mastoidectomy. **Methods:** patients attending to the OPD in department of otorhinolaryngology, ANMMCH with chronic otitis media (squamous variety) and underwent canal wall down mastoidectomy with ossiculoplasty. **Results:** The results concluded that the mean pre-operative PTA was calculated as an average of hearing thresholds at 500 Hz, 1 kHz and 2 kHz and came out to be  $58.73 \text{ dB} \pm 14.89$  and the post-operative PTA at the end of the study was  $47.50 \text{ dB} \pm 14.79$ . The mean pre-operative AB gap was  $39.88 \pm 12.42 \text{ dB}$  and the mean post-operative AB gap at the end of the study period was  $29.35 \pm 12.92 \text{ dB}$ . The hearing status of the patients were compared according to the severity of their disease and ossicular status, and a significant improvement was noted across the board after comparison with paired 1 tailed t test ( $p < 0.05$ ). **Conclusion:** There is significant improvement in closure of AB gap and hearing threshold, as measured with PTA in all forms of canal wall down mastoidectomy when complemented with hearing reconstruction.

### KEYWORDS

Air-bone Gap, Chronic otitis media, Canal Wall Down Mastoidectomy.

### INTRODUCTION

A significant contributor to acquired hearing loss, particularly in underdeveloped nations, is chronic otitis media. India is one of the nations with the greatest incidence and illness burden of persistent otitis media globally ( $>4\%$ ), according to a WHO survey on the disease's prevalence and burden in various regions of the world.<sup>[1]</sup>

According to WHO, the condition is "a stage of ear disease characterised by chronic infection of the middle ears cleft, a non-intact tympanic membrane, and discharge for a minimum of the preceding two weeks."<sup>[2]</sup> Chronic otitis media is used synonymously with the classic term CSOM i.e. chronic suppurative otitis media. Chronic otitis media is further classified into healed, mucosal and squamous variety depending upon the middle ear pathology. An alarming factor is the ossicular destruction in the disease process. It can be due to hyperaemic decalcification, pressure necrosis, enzymatic dissolution or resorptive osteitis. The treatment of chronic otitis media is surgical. It primarily aims to eradicate the disease, prevent its recurrence, create a dry self-cleansing cavity and secondarily aims to reconstruct the hearing mechanism as far as possible. This demands a fine balance between eradication and preservation.

There are two surgical options mainly:

1. Canal wall up:- In the canal wall up technique the posterior canal wall is left intact.
2. Canal wall down mastoidectomy:- The canal wall down technique implies lowering the bony posterior canal wall so that the middle ear cavity and mastoid air cell system is exteriorized.

Atticotomy, Bondy's surgery, atticostomy, traditional radical operation, & modified radical mastoidectomy are the various canal wall down mastoidectomy procedures.<sup>[3,4,5,6]</sup>

The canal walls down mastoidectomy allows for improved removal of middle ear disease (such as cholesteatoma and granulation tissue) by providing adequate access to the middle ear cleft.

It is generally accepted that canal walls down mastoidectomy has worse hearing results but lower cholesteatoma recurrence rates. Without obliterating the mastoid cavity or attempting to repair the canal wall, the objective of this prospective observational research is to evaluate the hearing status following canal wall down mastoidectomy.

### MATERIALS AND METHODS

The study was conducted in the Department of Otorhinolaryngology of A.N.M.M.C.H, GAYA, a tertiary health care centre, for a period of period of two years. Proper clearance from the Institutional Ethics Committee and informed consent from the patient was obtained before conducting the study. Patients meeting the requisite inclusion and exclusion criteria were included in the study population. Relevant history, clinical examination was followed by operative intervention as per study protocol. The outcome was analysed accordingly to draw the conclusion.

- Study setting: Department of Otorhinolaryngology, A.N.M.M.C.H, GAYA.
- Study Design: Prospective Observational Study.
- Time line: December 2020 to November 2022.
- Definition of population: Patients attending to the OPD in department of Otorhinolaryngology, A.N.M.M.C.H with Chronic Otitis Media (squamous variety).
- Inclusion criteria and exclusion criteria: Patients suffering from Chronic Otitis Media (squamous variety) put to surgical intervention, aged between 18 to 60 years. Patients with pure SNHL and those requiring revision surgery was excluded from the study population.
- Sample size: 60 patients
- Study tool: Tools used as mentioned in the proforma- detailed history, clinical examination, subjective hearing assessment questionnaire- visual analogue scale (VAS) score (Annexure, Item 1), documentation of hearing assessment (tuning fork test, pure tone audiometry) and imaging studies (wherever applicable). Pre and post-treatment data were studied and analysed using statistical methods. Prosthesis used were Teflon TM PORP and TORP.
- Laboratory investigations: Pure Tone Audiometry (pre and post operative), X-Ray mastoids lateral oblique view, HRCT temporal bone and other relevant investigations as and when required.

### RESULT

This study included, patients aged between 18 to 58 years, who were suffering from chronic otitis media, squamous variety and underwent canal wall down mastoidectomy in Department of Otorhinolaryngology, A.N.M.M.C.H, Gaya during the period December 2020 to November 2022.

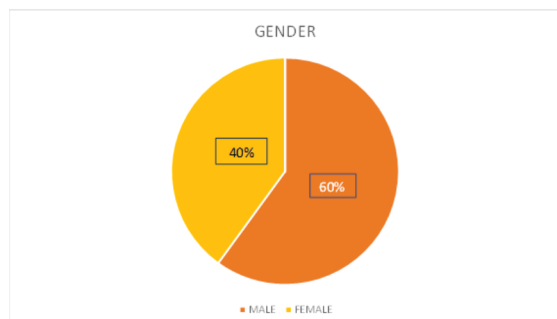
60 patients were selected who satisfied the inclusion and exclusion criteria as elucidated in the protocol. The patients were followed post operatively at 6 weeks, 12 weeks and 6 months.

## GENDER

Out of 60 patients, 24 (40%) were female and 36(60%) were male patients as shown in

Diagram 1.

DIAGRAM 1: GENDER DISTRIBUTION OF STUDY POPULATION (n=60).



## Age

The minimum age of presentation was 19 years amongst females and 18 years amongst males. The maximum age of presentation was 56 years amongst the females and 58 years amongst males. The mean age of the population of males is  $36.36 \pm 14.31$ . The mean age of the population of females is  $36.91 \pm 8.92$ .

The distribution of patients according to their age is represented in table 1.

Table 1: Age Distribution Of Patients (n=60)

|         | MALE    | FEMALE |
|---------|---------|--------|
| MIN     | 18      | 19     |
| MAX     | 58      | 56     |
| STD.DEV | 14.3114 | 8.9244 |
| MEAN    | 36.36   | 36.91  |

## Middle Ear Status

The study population had squamous variety of chronic otitis media. The status of the middle ear varied accordingly. The middle ear was found to have oedema, polyp, cholesteatoma, granulation. These were found either as a single pathological finding or in combination. Ossicular status was assessed by Austin-Kartush classification.

Table 2: Distribution Of Middle Ear Status In Both The Groups (n=60).

| Middle ear ossicular status as per Austin-Kartush classification | MODERATE DISEASE | SEVERE DISEASE | Total |
|------------------------------------------------------------------|------------------|----------------|-------|
| A                                                                | 16               | 1              | 17    |
| C                                                                | 13               | 9              | 22    |
| D                                                                | 1                | 20             | 21    |
| Total                                                            | 30               | 30             | 60    |

Table 3: Comparison Of Pre-operative And Post-operative Pure Tone Average (db) According To Surgical Procedure (n=60).

| PROCEDURE      | NO OF PT | AVG PRE-OP PTA | AVG POST OP PTA AT 6 WEEK | AVG POST OP PTA AT 12 WEEK | AVG POST OP PTA AT 6 MONTHS |
|----------------|----------|----------------|---------------------------|----------------------------|-----------------------------|
| RM             | 9        | 77.1           | 73.8                      | 70.2                       | 68.1                        |
| MRM +TYPE IV   | 1        | 89             | 87                        | 83                         | 77                          |
| MRM+TYPE IIIC  | 28       | 52.2           | 47.2                      | 43.2                       | 40.7                        |
| MRM+ TYPE IIIA | 8        | 57.5           | 54.6                      | 51.2                       | 48.6                        |
| MRM+ TYPE IIIB | 10       | 65.7           | 60                        | 54.9                       | 51.4                        |
| MRM + TYPE II  | 4        | 41.2           | 36.5                      | 33.7                       | 29.2                        |

**COMMENT:** Maximum improvement is seen in cases of Modified Radical Mastoidectomy + Type III B ossiculoplasty (hearing gain of 14.3 dB) and least improvement was seen in cases of Modified Radical Mastoidectomy with Type III A ossiculoplasty (hearing gain of 8.9 dB), closely followed by Radical Mastoidectomy (hearing gain of 9 dB).

Table 4: Comparison Of Average AB Gap (dB) According To Surgical Procedure (n=60).

| PROCEDURE      | NO OF PT | AVG PRE OP AB GAP | AVG POST OP AB GAP AT 6 WEEK | AVG POST OP AB GAP AT 12 WEEK | AVG POST OP AB GAP AT 6 MONTHS |
|----------------|----------|-------------------|------------------------------|-------------------------------|--------------------------------|
| RM             | 9        | 54.4              | 52.3                         | 49.4                          | 45.7                           |
| MRM +TYPE IV   | 1        | 50                | 50                           | 50                            | 45                             |
| MRM+TYPE IIIC  | 28       | 34.2              | 29.2                         | 25.5                          | 22.2                           |
| MRM+ TYPE IIIA | 8        | 38.6              | 36.5                         | 33.1                          | 30.2                           |
| MRM+ TYPE IIIB | 10       | 43.4              | 38.3                         | 31.4                          | 26.8                           |
| MRM + TYPE II  | 4        | 25                | 21.2                         | 17.5                          | 14.2                           |

**COMMENT:** Maximum improvement is seen in cases of Modified Radical Mastoidectomy with type III B ossiculoplasty (closure of AB gap by 16.6 dB) and least improvement was seen in cases of Modified Radical Mastoidectomy with type III A ossiculoplasty (closure of AB Gap by 8.4 dB), closely followed by Radical Mastoidectomy ( closure of AB Gap by 8.7 dB).

## DISCUSSION

The aim of the thesis was to assess the post-operative hearing status in patients with canal wall down mastoidectomy both subjectively and objectively. Surgical treatment has to be tailored to the individual; hence in our set up canal wall down mastoidectomy still remains a procedure of choice due to poor compliance to prolonged follow up and meets the criterion of providing a disease-free ear to our patients. A total of 60 patients were included in this study as per the exclusion and inclusion criteria.

## Demographical Data

Out of 60 patients, 24 (40%) were female and 36(60%) were male patients. The minimum age of presentation was 19 years of age amongst females and 18 years of age amongst males. The maximum age of presentation was 56 years amongst the females and 58 years amongst males. The mean age of the population of males is 36.36 years and that of females is 36.91 years.

## Pre- Operative Assessment

The average preoperative PTA was  $58.73 \pm 14.89$  dB which was in the same range as the studies conducted by Abdullah et al, Kos et al and Berenholz et al.<sup>[7,8,10]</sup> The average preoperative AB gap was  $39.88 \pm 12.42$  dB which was in the same range as Kim et al.<sup>[9]</sup>

## Post Operative Results

The mean pre-operative PTA was calculated as an average of hearing thresholds at 500 Hz, 1 kHz and 2 kHz and came out to be  $58.73 \text{ dB} \pm 14.89$  and the post-operative PTA at the end of the study was  $47.50 \text{ dB} \pm 14.79$ . The mean pre-operative AB gap was  $39.88 \pm 12.42$  dB and the mean post-operative AB gap at the end of the study period was  $29.35 \pm 12.92$  dB. This compares with other studies Kos et al and Kim et al<sup>[8,9]</sup> which show similar results.

The severity of the disease in terms of MERI score shows a positive correlation with the hearing threshold and AB gap both pre-operatively and post operatively. Along with stratification of patients according to the severity of the disease we also sub classified them according to the pre operative ossicular status using Austin- Kartush classification.

Out of the 30 ears with moderate disease, 16 patients had type A ossicular status, 13 had type C and one had type D. Of the remaining patients with severe disease, 20 had ossicular status Type D, 9 had ossicular status Type C whereas only 1 patient had Type A ossicular status as per Austin-Kartush classification.

33 out of 60 patients showed an improvement in hearing threshold by a gain of 10-15 dB at the end of 6 months, 12 patients had a hearing gain of > 16 dB, whereas 14 patients had no or marginal improvement. In one patient there was further deterioration of hearing.

The hearing status of the patients were compared according to the severity of their disease and ossicular status, and a significant

improvement was noted across the board after comparison with paired 1 tailed t test ( $p < 0.05$ )

As far as hearing reconstruction was concerned most studies with CWDM had an associated ossiculoplasty, commonly Type III with results similar to this Berenholz and Abdullah et al.<sup>[7,10]</sup>

Wetmore et al. found in a series of 161 patients with cholesteatoma, the mean pure tone average remained unchanged after surgery<sup>[11]</sup>. They concluded that the presence or absence of the posterior canal wall had no influence on the hearing outcome. Regarding the air bone gap closure, this study showed 25% had improvement of ABG closure.

ANOVA analysis shows improvement in AB gap and pure tone average in all forms of canal wall down mastoidectomy.

In this study there was no recurrence or residual disease up to 6 months postoperatively. 2 patients had facial palsy and 3 patients had vertigo in the postoperative period.

## CONCLUSION

In conclusion, we can appreciate that canal wall down mastoidectomy is still a very good treatment modality which can render the ear serviceable.

The learning curve for canal wall down mastoidectomy is not as steep and when this technique is used correctly, it is an excellent modality of treatment.

## Observations Of This Study Are

There is significant improvement in closure of AB gap and hearing threshold, as measured with PTA in all forms of canal wall down mastoidectomy when complemented with hearing reconstruction.

There are a few limitations of this study. Firstly, there was no control group within the study itself, so comparison of the two procedures, canal wall up vs canal wall down mastoidectomy could not be carried out. Secondly, the follow up period should have been longer to assess the post-operative behaviour of the mastoid cavity and long-term hearing results for this procedure.

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