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Original Research Article

A study of correlation of pre-operative hearing status and intraoperative ossicular findings in mucosal chronic otitis media

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ABSTRACT

Background: Mucosal chronic otitis media (COM) is a common cause of hearing loss due to tympanic membrane perforation and middle ear pathology. Preoperative audiometry helps assess hearing impairment, but it may not always correlate with intraoperative finding. This study was conducted to assess the correlation between pre-operative hearing status and intra-operative findings, particularly, in patients undergoing tympanoplasty.
Methods: This prospective study has been conducted in patients presenting with mucosal type of COM in Otorhinolaryngology- Head and Neck Department of GKGH, GAIMS, Bhuj from the period of June 2023 to September 2024. All patients with mucosal COM without any intracranial complications were included in the study. Pre-operative and post-operative pure tone audiometry (PTA) threshold and Intra-operative findings were recorded and analysed using Microsoft Excel sheets.
Results: A total of 111 patients with clinically diagnosed mucosal-type chronic otitis media were included. The mean age of patients was 33.66 years, with a female predominance (64.9% female, 35.1% male). The majority of patients (41%) were in the 21–30-year age group. Comparison of preoperative and 3-month postoperative pure-tone average (PTA) demonstrated a statistically significant improvement in hearing levels following surgery. Graft uptake was successful in 98.2% of patients at 3 months postoperatively, with only 1.8% showing residual perforation.
Conclusion: Pre-operative hearing assessment, particularly through PTA thresholds, serves as a valuable predictor of intra-operative ossicular chain status. Tympanoplasty is an effective surgical intervention, leading to significant hearing improvement in patients with mucosal CSOM. Early diagnosis and intervention are crucial in preventing further ossicular damage and optimizing surgical outcomes.

Keywords: COM, Mucosal chronic otitis media, Ossicles, PTA, Tympanoplasty

INTRODUCTION

Chronic otitis media (COM) is a long-standing infection of the middle ear characterized by tympanic membrane perforation, hearing loss, and otorrhea persisting for more than two to six weeks.[1] Globally, it affects approximately 65–330 million people, with nearly 60% experiencing clinically significant hearing impairment.[1] COM continues to be a major cause of preventable hearing loss, particularly in developing countries such as India.

The condition is commonly caused by *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, and anaerobes. Inappropriate and excessive antibiotic use has contributed to altered bacterial resistance patterns, further complicating disease management. Conductive hearing loss is the most frequent type, primarily resulting from tympanic membrane perforation and ossicular chain erosion, which occurs in nearly one-third of cases.

Pure tone audiometry (PTA) remains the primary diagnostic tool to evaluate hearing thresholds and differentiate the type of hearing loss. A significant air–bone gap often suggests ossicular discontinuity.[2-4] However, preoperative audiometric findings do not always correlate with intra-operative ossicular status, and there is no universally accepted PTA threshold that reliably predicts ossicular disruption.

This study aims to analyse the correlation between preoperative audiometric parameters and intra-operative ossicular findings in mucosal COM, thereby providing objective data to improve surgical planning, patient counselling, and hearing restoration outcomes.[5]

METHODS

This prospective study was conducted at the Department of Otorhinolaryngology, G. K. General Hospital, Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat, over a period of 18 months from June 2023 to September 2024, after obtaining approval from the Institutional Ethics Committee GAIMS, Bhuj (protocol no-IEC/RESCH/2023/55).

The sample size was calculated using the formula given.

$$SS = [Z^2 p(1-p)]/C^2$$

Here, Z is the z-score for the desired confidence level, p is the estimated proportion of the population, and C is the desired margin of error. A total of 111 patients with mucosal-type COM undergoing surgical management were included in the study. Patients who refused surgery, were unwilling to participate, or had intraoperative findings suggestive of squamosal pathology were excluded.

Clinical examination and preoperative PTA were performed at the eyes, nose and throat (ENT) department to assess baseline hearing thresholds, which were then compared with intraoperative findings documented by the otorhinolaryngology surgeon. All patients were followed up for 3 months, and postoperative PTA thresholds were recorded and compared with preoperative values. Data were collected from participants attending the ENT outpatient department (OPD) of GKGH Bhuj using a validated, predesigned questionnaire.

Data analysis

Data were entered in Microsoft Excel and analysed using statistical package for the social sciences (SPSS) version 22 (IBM Corp., Armonk, NY, USA). Statistical tests, including the paired t-test, were applied, with significance set at $p<0.05$. Sample size estimation and odds ratio calculation were performed using EPI Info, OpenEpi, MedCalc, and Medley's Desktop. Data were tabulated and graphically presented using Microsoft Excel and Word. The parameters of comparison included; preoperative PTA thresholds, size of perforation, duration of ear discharge, malleus status, incus status, stapes status, post-operative PTA, and graft uptake.

RESULTS

Table 1 shows age and gender wise distribution of patients. In the present study, patients undergoing tympanoplasty ranged from 10 to 60 years of age. The highest prevalence was observed in the 21–30-year age group, with females predominating (72 females and 39 males among 111 cases).

Table 1: Age and gender wise distribution of patients.

Age group (years)	Female	Male
10-20	6	8
20-30	23	13
30-40	23	3
40-50	13	8
>50	7	7
Total	72	39

Figure 1 shows pre-operative hearing status with respect to size of perforation. Among 111 cases, 66 (59.5%) showed moderate perforation, 4 (3.6%) had small perforation, and 41 (36.9%) exhibited large perforation.

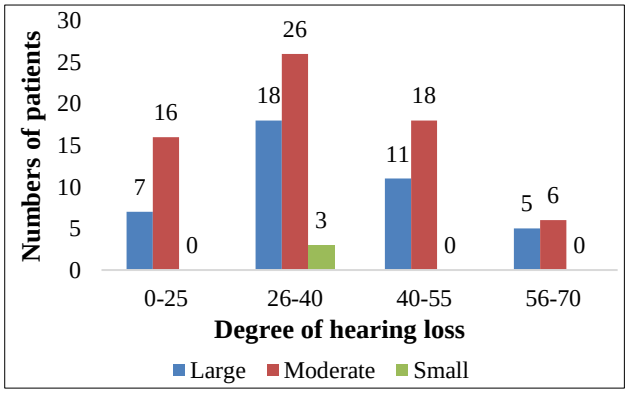

Figure 1: Pre-operative hearing status with respect to size of perforation.

A graphical representation of the intraoperative ossicular status (Figure 2) demonstrates that incus erosion was the most frequent finding, observed in 19 cases (17.1%). Malleus erosion was noted in 2 cases (1.8%), while stapes erosion occurred in 3 cases (2.7%). The graph clearly indicates that the incus was the most commonly eroded ossicle among the 111 cases studied.

Among the two cases of malleus erosion (1.8%), one patient had 0–25 dB average PTA thresholds while the other patient had 41–55 dB average hearing thresholds. Of the 19 (17.1%) cases of incus erosion, 19 patients were in the 26–40 dB group, followed by the 41-55 dB group. Stapes erosion was observed in three cases (2.7%); two in the 26-40 dB group and one in the 56-70 dB group.

Overall, incus erosion was more frequent in moderate hearing loss, whereas stapes erosion was rare and tended to occur with greater hearing loss (Table 2).

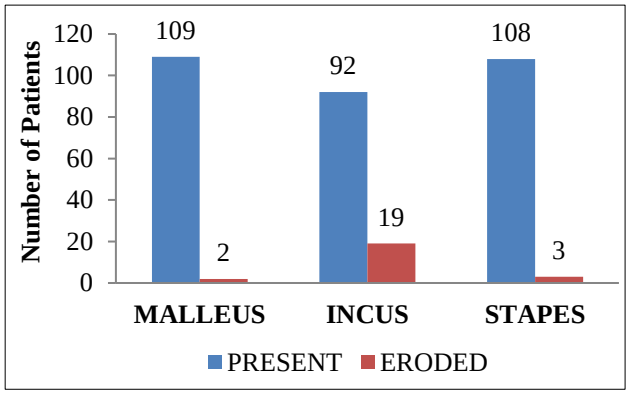

Figure 2: Intraoperative ossicular status.

The comparison between preoperative and postoperative PTA values (Figure 3) shows a significant improvement in hearing after tympanoplasty. The postoperative PTA values are lower across all degrees of hearing loss, indicating better auditory function. The highest numbers of cases preoperatively were in the 26-40 dB and 41-55 dB ranges, but these numbers decreased postoperatively, reflecting a shift toward better hearing thresholds.

Mean values of pre-operative PTA thresholds were higher that post-operative PTA thresholds (difference of 4.27 dB) were statistically significant with a $p<0.001$. At the 3-month post-operative follow-up, graft uptake was observed in 109 out of 111 patients, resulting in a success rate of 98.2%. Residual perforation was noted in only 2 patients (1.8%). Additionally, among the 109 patients with successful graft uptake, 2 patients exhibited granulation over the graft.

Table 2: Pre-operative PTA thresholds versus intraoperative ossicles.

Degree of hearing loss (dB)	Total patients	Malleus		Incus		Stapes	
		Present	Eroded	Present	Eroded	Present	Eroded
0-25	36	35	1	34	2	36	0
26-40	44	44	0	36	8	42	2
41-55	22	21	1	16	6	22	0
56-70	9	9	0	6	3	8	1
Total	111	109	2	92	19	108	3

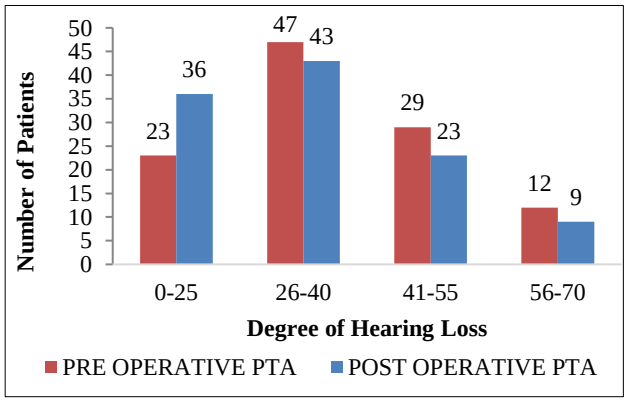

Figure 3: Pre-operative PTA thresholds compared to post-operative PTA thresholds.

DISCUSSION

In the present study, the majority of patients belonged to the 21-30 years' age group (32.4%), indicating that tympanoplasty is more commonly performed in young adults. A consistent female predominance was observed across most age groups, with an overall female-to-male ratio of 1.7:1. The mean ages of male and female patients were comparable (33.33 and 33.93 years, respectively). These findings are consistent with the observations of Shaheen et al who reported a nearly equal gender distribution, but contrast with the results of Abraham et al, who found a male predominance (54.4%) among patients with chronic suppurative otitis media.[6,7] The observed female predominance in our study may be attributed to greater healthcare-seeking behaviour and awareness among women in the study population. In this study, larger tympanic membrane perforations were associated with greater hearing loss. Among patients with large perforations, 43.9% had 26-40 dB loss, 26.8% had 41-55 dB loss, and 12.2% had 56-70 dB loss. Moderate and small perforations showed comparatively less impairment. These findings align with those of Ahmadbegh et al and Kolluru et al, confirming that hearing loss in CSOM increases proportionally with perforation size.[8,9]

Among the 2 cases of malleus erosion, one occurred in the 0-25 dB group and one in the 41-55 dB group (1.8% each). Of the 19 cases of incus erosion (17.1%), most were in the 26-40 dB group, followed by the 41–55 dB group. Stapes erosion was observed in 3 cases (2.7%), two in the 26-40 dB group and one in the 56-70 dB group. Overall, incus erosion was more common in moderate hearing loss, while stapes erosion was rare and associated with greater hearing deficits. This data represents the intraoperative status of the ossicles. Among 111 cases, malleus erosion was observed in 2 cases (1.8%), incus erosion in 19 cases (17.1%), and stapes erosion in 3 cases (2.7%), making the incus the most commonly eroded ossicle.

Before surgery, 23 patients (18.1%) had a PTA≤25 dB, 47 (37.0%) were in the 26-40 dB range, 29 (22.8%) in 41-55 dB, and 12 (9.4%) in 56-70 dB. Postoperatively, patients

with PTA≤25 dB increased to 36 (28.3%), while those in the 26-40 dB, 41-55 dB, and 56-70 dB groups decreased to 43 (33.9%), 23 (18.1%), and 9 (7.1%), respectively. These findings indicate improved hearing thresholds following tympanoplasty. Similar results were reported by Berglund et al where 51% of ears achieved an air-bone gap (ABG) ≤10 dB and 89% achieved ABG<20 dB, with 61% showing hearing improvement and 93% patient satisfaction postoperatively.[10]

Limitations

The study's limitations include a relatively small sample size, short follow-up period, and lack of analysis of surgical variations and comorbidities. Hearing assessment was limited to pure-tone audiometry without evaluation of speech or middle ear function.

CONCLUSION

In the present study, pre-operative hearing loss of mild degree was the most common finding and erosion of incus was the most common intra-operative finding. Pre-operative PTA thresholds correlated well with intra-operative ossicular status. This is useful to counsel the patients pre-operatively and planning of the type of surgical intervention.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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