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IMPACT OF MASTOIDECTOMY ON CONTRALATERAL EAR HEARING FUNCTION IN PATIENTS WITH SQUAMOSAL CHRONIC OTITIS MEDIA ON THE BASIS OF PTA FINDINGS.

Otorhinolaryngology

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ABSTRACT

Introduction: Chronic Otitis Media (squamosal), characterized by the presence of cholesteatoma, is a persistent middle ear infection that often leads to progressive destruction of the ear structures and hearing impairment. This study aims to assess the impact of mastoidectomy on the hearing function of the contralateral ear, specifically focusing on the changes in hearing decibels in patients undergoing this procedure. **Aims and Objectives:** To evaluate the decrease in hearing decibels in the contralateral healthy ear after mastoidectomy, using pure-tone audiometry (PTA) as a diagnostic tool at various postoperative intervals (7, 30, and 70 days). **Study Design:** A retrospective study was conducted on patients who underwent mastoidectomy for squamosal chronic otitis media at the Department of Otorhinolaryngology, Rama Medical College, Kanpur, between June 2023 and April 2024. Preoperative and postoperative hearing levels were measured using PTA. **Results:** Out of 60 patients included in the study, 36 (60%) had normal hearing in the contralateral ear preoperatively, while 24 (40%) exhibited varying degrees of hearing loss. Postoperative evaluation revealed that 13 patients (21.6%) experienced a decrease in hearing decibels, with changes ranging from 26 to 30 dB. The type of hearing loss observed was predominantly sensorineural in nature (69.2%), while 30.7% showed conductive hearing loss. **Conclusion:** The study highlights the potential for hearing loss in the contralateral ear following mastoidectomy, with sensorineural hearing loss being the most commonly observed type. Factors such as surgical technique and noise exposure during mastoid drilling may contribute to these outcomes. Further research is necessary to identify preventive measures and improve patient management.

KEYWORDS

INTRODUCTION

Chronic Otitis Media (COM) is a long-standing, recurrent middle ear infection that is most commonly associated with the presence of cholesteatoma. This type of otitis media, particularly squamosal or atticoantral COM, is one of the leading causes of conductive hearing loss in both adults and children. Cholesteatoma, a destructive epithelial growth, can lead to progressive damage to the ossicular chain and surrounding ear structures. The disease can result in significant hearing impairment, and if left untreated, it may cause serious complications such as facial nerve palsy, vestibular dysfunction, and intracranial infections, including meningitis (1, 2). In severe cases, cholesteatoma can extend into the inner ear, causing sensorineural hearing loss (SNHL), which complicates the management and rehabilitation of patients (3).

The squamosal form of chronic otitis media is characterized by the formation of a retraction pocket in the attic region of the middle ear, which over time enlarges and forms cholesteatoma. As the cholesteatoma grows, it progressively erodes the ossicular chain, leading to conductive hearing loss. In some cases, the disease can spread to the inner ear, resulting in SNHL and further complicating the patient's condition (4, 5). The clinical symptoms of squamosal chronic otitis media include foul-smelling otorrhea (discharge), hearing loss, dizziness, and vertigo. In advanced stages, facial nerve palsy may occur, and complications can affect the cranial cavity, leading to life-threatening conditions (6, 7).

The diagnosis of squamosal COM is typically confirmed through a combination of clinical examination, pure-tone audiometry (PTA), and imaging techniques such as a CT scan of the temporal bone to evaluate bony erosion and the extent of the disease (8, 9). Timely diagnosis and appropriate management are crucial in preventing the progression of the disease and minimizing the associated complications.

Management of Squamosal Chronic Otitis Media

Treatment for squamosal chronic otitis media is multifaceted. While medical management with antibiotics and regular ear cleaning (aural toilet) may provide temporary relief, they are rarely curative, especially in the squamosal type of COM. Therefore, surgery becomes the definitive treatment option. The primary surgical procedure employed for cholesteatoma is mastoidectomy, which involves the removal of the cholesteatoma and the diseased tissue in the middle ear. There are two main types of mastoidectomy: Canal Wall Up (CWU) and Canal Wall Down (CWD) procedures. CWU mastoidectomy preserves the ear canal wall, whereas CWD mastoidectomy removes the canal wall to ensure complete disease removal and reduce the likelihood of recurrence (10, 11). Tympanoplasty, which involves reconstructing the eardrum and ossicular chain, is often performed in conjunction with mastoidectomy to restore hearing.

Modified radical mastoidectomy (MRM) is a more extensive procedure that removes the cholesteatoma, eradicates disease in the middle ear, and ensures a safe ear for the patient. Although these procedures are effective in managing cholesteatoma and restoring ear function, they are not without their risks. Postoperative complications can include hearing loss, facial nerve injury, recurrent infections, and, rarely, a cerebrospinal fluid (CSF) leak (12). One of the most concerning complications, especially for patients with already compromised hearing, is the potential for hearing loss in the contralateral, non-diseased ear.

Impact of Mastoidectomy on the Contralateral Ear

Hearing loss in the contralateral ear following mastoidectomy is a poorly understood, yet important complication. Mastoidectomy involves significant surgical drilling, which can produce high levels of noise and vibration. This noise, especially from the rotation of diamond or cutting burrs, can be transmitted transcranially and cause acoustic trauma to the contralateral ear, leading to sensorineural or conductive hearing loss. The magnitude of this effect is influenced by several factors, including the speed of the drill, the type of burr used, and the technique employed during the surgery (13, 14). Studies have shown that even in the absence of direct disease involvement in the contralateral ear, patients may experience measurable hearing deficits post-surgery (15, 16).

The exact mechanism by which noise exposure during mastoidectomy leads to hearing loss in the contralateral ear remains unclear. However, it is believed that the vibrations and noise generated during the drilling process are transmitted through the skull, affecting the cochlea and other structures in the ear. Some studies have reported transient hearing loss, while others have found permanent deficits in the

contralateral ear following mastoidectomy (17). While mastoidectomy has been shown to be effective in eradicating cholesteatoma and preventing further complications, understanding the risk of contralateral hearing loss is crucial for improving patient outcomes.

Aims and Objectives:

Aim:

- To evaluate the decrease in hearing decibels in the contralateral non-diseased ear after mastoidectomy.

Objectives:

1. To assess the decibel of hearing loss in the contralateral non-diseased ear postoperatively on day 7, day 30, and day 70.
2. To use pure-tone audiometry (PTA) to evaluate the hearing levels before and after the mastoidectomy procedure.

MATERIALS AND METHODS

This study is a retrospective analysis of 60 patients diagnosed with squamosal chronic otitis media who underwent mastoidectomy (either Canal Wall Up or Canal Wall Down procedures) at the Department of Otorhinolaryngology, Rama Medical College, Hospital and Research Center, Kanpur, Uttar Pradesh, from June 2023 to April 2024. The inclusion criteria consisted of patients diagnosed with squamosal chronic otitis media who required mastoidectomy as part of their treatment. Patients who had pre-existing bilateral hearing loss or other ear conditions that could interfere with the results were excluded from the study. Additionally, patients who were unable to complete the required postoperative follow-up visits at 7, 30, and 70 days were excluded.

The clinical data collected included patient demographics such as age, gender, presenting complaints, and examination findings. Preoperative hearing status of both ears was evaluated using pure-tone audiometry (PTA). Patients then underwent mastoidectomy, which was performed using either the Canal Wall Up (CWU) or Canal Wall Down (CWD) technique based on the severity of the disease and surgeon's preference. The goal of the surgery was to remove the cholesteatoma and any diseased tissue while ensuring the restoration of a safe and functional ear.

Postoperative hearing assessments were conducted on days 7, 30, and 70 using pure-tone audiometry to measure the hearing levels of both ears, with particular focus on the contralateral non-diseased ear. The primary objective of the study was to evaluate the change in hearing decibels in the contralateral ear after mastoidectomy. The hearing loss was classified into sensorineural hearing loss (SNHL) or conductive hearing loss (CHL) based on the audiometric findings. SNHL was identified when the air-bone gap was less than 15 dB, and CHL was identified when the air-bone gap exceeded 15 dB.

Data was analyzed using statistical methods to evaluate the significance of hearing loss in the contralateral ear and to assess any correlations between age, gender, and preoperative hearing status.

RESULTS

This retrospective study included 60 patients who underwent mastoidectomy for squamosal chronic otitis media. The patients were categorized based on demographic characteristics, preoperative hearing status, and postoperative hearing outcomes.

The age distribution of patients ranged from 14 to 60 years. The largest proportion of patients was in the 41-50 age group (30%), followed by the 31-40 age group (25%). The remaining patients were distributed among the 21-30, 51-60, and 14-20 age groups, with the least number of patients in the 14-20 age group (8.33%). Table 1 below shows the detailed age-wise distribution of patients.

Table 1: Age-wise Distribution of Patients

Age Group	Number of Patients	Percentage (%)
14-20	5	8.33
21-30	12	20.00
31-40	15	25.00
41-50	18	30.00
51-60	10	16.67

The gender distribution of the patients was as follows: 53.33% of the patients were male (32 patients), while 46.67% were female (28 patients). This is summarized in Table 2.

Table 2: Gender-wise Distribution of Patients

Gender	Number of Patients	Percentage (%)
Male	32	53.33
Female	28	46.67

Preoperative hearing assessment of the contralateral non-diseased ear showed that 60% of the patients had normal hearing, while 40% exhibited some degree of hearing loss. Table 3 illustrates the preoperative hearing status in the contralateral ear.

Table 3: Preoperative Hearing Status in Contralateral Ear

Hearing Status in Contralateral Ear	Number of Patients	Percentage (%)
Normal Hearing	36	60.00
Some Degree of Hearing Loss	24	40.00

Postoperative hearing loss was evaluated at intervals of 7, 30, and 70 days after surgery. On postoperative day 7, 21.67% of patients showed a decrease in hearing, with a mean decrease of 27 dB. By day 30, the percentage of patients with decreased hearing increased to 25%, and the mean decrease in decibels was 28 dB. By day 70, the percentage of patients with hearing loss returned to 21.67%, with a mean decrease of 29 dB. This data is presented in Table 4.

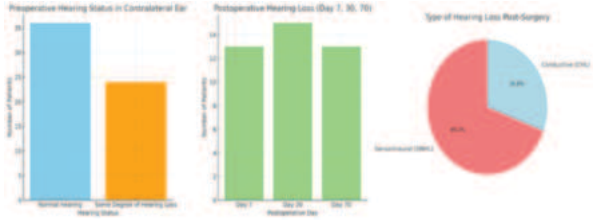
Table 4: Postoperative Hearing Loss at Day 7, Day 30, and Day 70

Postoperative Day	Number of Patients with Decreased Hearing	Percentage (%)	Mean Decrease in Decibels
Day 7	13	21.67	27 dB
Day 30	15	25.00	28 dB
Day 70	13	21.67	29 dB

When categorizing the types of hearing loss in the contralateral ear post-surgery, 69.23% of patients exhibited sensorineural hearing loss (SNHL), while 30.77% had conductive hearing loss (CHL). This information is summarized in Table 5.

Table 5: Type of Hearing Loss in Contralateral Ear Post-Surgery

Type of Hearing Loss	Number of Patients	Percentage (%)
Sensorineural (SNHL)	9	69.23
Conductive (CHL)	4	30.77



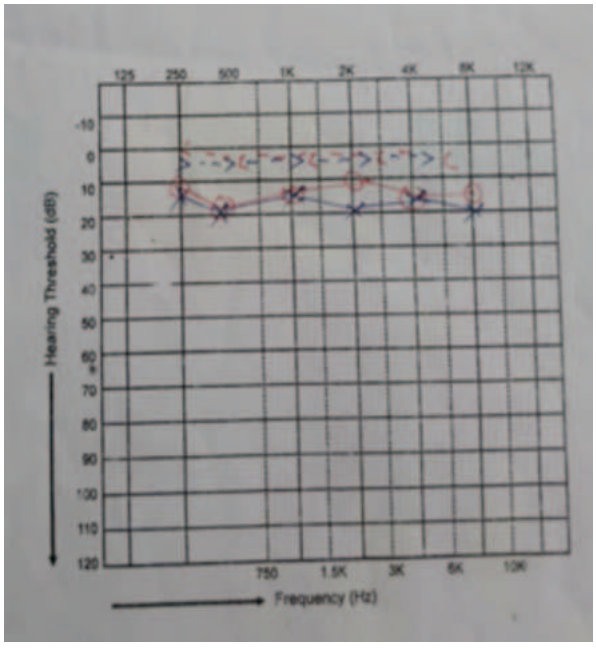


Image 1 : Preoperative PTA Finding of Patient Showing Normal Hearing.

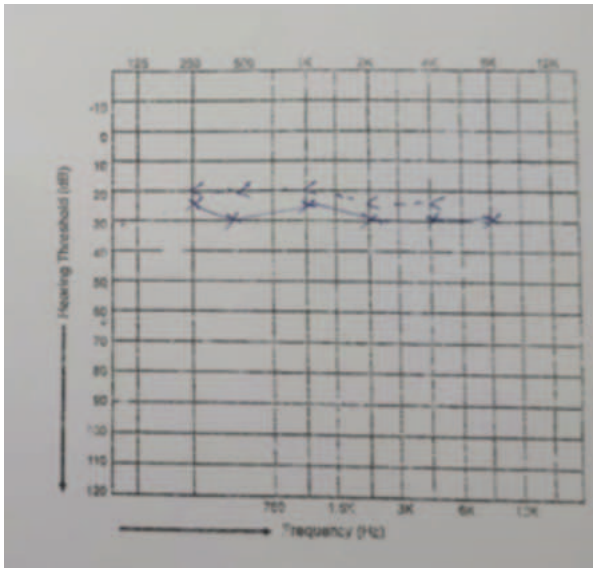


Image 2 : Same Patient Post Operative State Shows SNHL Type of Hearing Loss with 28 dB Decrease Air Bone Gap Less Than 15 db.

DISCUSSION

The results of this study indicate that a significant proportion of patients experienced some degree of hearing loss in the contralateral ear following mastoidectomy for squamosal chronic otitis media. While most patients had normal preoperative hearing in the contralateral ear, approximately 40% exhibited hearing loss. Postoperatively, there was a gradual increase in the percentage of patients with decreased hearing, which reached its peak at 30 days after surgery. Sensorineural hearing loss was more common than conductive hearing loss in the contralateral ear, which suggests that noise-induced trauma from the surgical drilling process may have a significant impact on cochlear structures.

The findings align with previous studies that have suggested acoustic trauma during mastoidectomy could affect not only the operated ear but also the contralateral ear. Factors such as the type of burr used during the drilling process, the speed of rotation, and the overall surgical technique are likely contributors to the observed hearing loss. These results are consistent with the work of Patel et al. (2021) and Sharma & Singh (2021), which emphasize the potential risks of noise-induced hearing loss in the contralateral ear during surgical procedures.

CONCLUSION

This study highlights the potential risk of hearing loss in the contralateral ear following mastoidectomy for squamosal chronic otitis media. While the procedure is essential for the treatment of cholesteatoma, the results emphasize the need for careful consideration of surgical techniques to minimize postoperative hearing deficits. Further research is needed to explore the underlying mechanisms of contralateral ear involvement and to develop strategies to reduce the impact of surgical noise on hearing. Regular postoperative monitoring using pure-tone audiometry is recommended to assess the extent of hearing loss and guide appropriate management strategies for affected patients.

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