

Original Research Article

Evaluation of hearing loss by pure tone audiometry in chronic suppurative otitis media patients

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ABSTRACT

Background: Hearing loss associated with the CSOM affects the patients' communication with others and results in poor quality of life. Degree and type of hearing loss can be assessed by pure tone audiometry, which helps in predicting the status of tympanic membrane, ossicular chain, and inner ear and also helps in preoperative planning.

Methods: Patients with CSOM aged 10 years and above were included in the study. All patients underwent pure tone audiometry. With the help of air and bone conduction threshold, the degree and type of hearing loss in each ear was determined. The data collected was evaluated and results are reported as rates and proportions (%).

Results: Most of the ears (83%) had mild to moderate hearing loss. Average ABG observed was 31 dB. Maximum ABG observed was 55dB on right side and 50 dB on the left side. There was mixed hearing loss in 10.9% cases.

Conclusions: This study reinforces the idea of using preoperative pure tone audiometry, which not only helps in planning surgery but also helps in documenting the preoperative status of patients' sensorineural hearing loss, if present.

Keywords: Hearing loss, Audiometry, Chronic suppurative otitis media

INTRODUCTION

Chronic suppurative otitis media (CSOM) is one of the most common diseases encountered in Ear Nose and Throat (ENT) practice. It is a disease of the middle ear cleft, characterized by recurrent inflammation and permanent perforation of the tympanic membrane lasting for more than 12 weeks; most likely as a result of earlier acute otitis media, negative middle ear pressure or otitis media with effusion. These patients most commonly present with recurrent ear discharge and hearing loss. Incidence of this disease is more in developing nations (3% to 5.7%) when compared to developed nations (0.5% to 2%). In India, the prevalence of the disease is approximately 16/1000 in urban population and 46/1000 in rural population.¹⁻⁴

CSOM is of two types, tubotympanic or mucosal type; and atticointral or squamosal type. CSOM is known to cause several major and sometimes life threatening complications such as hearing loss, extradural abscess, subdural abscess, meningitis, cerebral abscess, lateral sinus thrombosis, mastoiditis and facial paralysis. Hearing loss is the most common complication, found in more than 50% of the CSOM patients. It affects the patients' communication with others and results in poor quality of life. This hearing loss is primarily due to poor middle ear transformer mechanism resulting due to permanent perforation in the tympanic membrane and ossicular chain erosion.⁵⁻⁷

Pure-tone audiometry measures how well someone can hear sounds of a different pitch and volume. Pitch or frequency is measured in cycles per second or Hertz

(Hz). Most speech sounds are in the 500- to 4000-Hz range. People with hearing loss usually have the most difficulty with high-frequency sounds and consonants, such as S, F, SH, CH, or H. Volume or intensity is measured in decibels (dB). Usual conversation ranges between 45 and 60 dB.⁸ Assessment of the degree and type of hearing loss can be done by pure tone audiometry, which helps in predicting the status of tympanic membrane, ossicular chain and inner ear. This preoperative hearing assessment is also useful in preoperative planning of the type of surgery; and in counseling the patient about the expected results, hearing improvement after surgery.^{2,9}

Since hearing loss is the most common complication which affects patients' day to day activities, communication and quality of life; we undertook this study to evaluate the hearing loss in CSOM patients, by pure tone audiometry.

METHODS

This study was conducted in the Department of ENT in a tertiary care hospital in Karnataka, India. This is a cross sectional study conducted from January 2018 to May 2018.

All patients having ear discharge for more than 3 months and with permanent perforation of the tympanic membrane on examination; were included in the study. Patients with intracranial complications, traumatic perforation of the tympanic membrane, history of ear surgery or significant noise exposure or use of ototoxic drugs; were excluded from the study.

The patients included in the study underwent pure tone audiometry to record hearing threshold for bone conduction and air conduction at 250, 500, 1K, 2K, 4K, 8K Hz in each ear. Pure tone average (PTA) and Air-Bone Gap (ABG) was calculated in each ear for every patient. Patients with active ear discharge were given topical and systemic antibiotics for one week and pure tone audiometry was done after the active infection, ear discharge subsided.

All patients underwent pure tone audiometry using the same audiometer; performed by the same audiologist in a

sound proof room. Earphones were placed, and the audiologist used an audiometer to produce sounds of different frequencies and intensities. The patient taking the test was asked to indicate if he or she can hear the sounds being generated. The test was repeated using a small vibrator attached behind the ear which emits vibratory sounds conducted through the bones of the skull to the inner ear. This is called a pure-tone bone conduction hearing test, which detects hearing loss from a structural or an obstructive cause. Results of the testing were recorded and printed on a graph called an audiogram. Masking was done in all cases for bone conduction and for air conduction, only if air bone gap was more than 40dB. PTA of more than 25 dB for bone conduction was considered as sensorineural hearing loss. ABG of more than 10dB was considered as conductive hearing loss. Presence of both was considered as mixed hearing loss. The parameters evaluated in the study were: age, gender, PTA for air conduction threshold and bone conduction threshold, ABG. With the help of air and bone conduction threshold, the degree and type of hearing loss in each ear was determined. The data collected was evaluated and results are reported as rates and proportions (%).

RESULTS

Table 1: Distribution of cases based on age.

Age group (in years)	Number of patients	Percentage (%)
01-10	2	4
11-20	17	34
21-30	11	22
31-40	13	26
41-50	3	6
51-60	3	6
61 and above	1	2

In this study, we evaluated pure tone audiograms from 50 patients suffering from CSOM, of which 23 were male and 27 were female patients with age ranging from 10 years to 64 years. Most [17 (34%)] of these patients were in 11 to 20 age group (Table 1). 41 patients (82%) were in the age range of 11 to 40 years.

Table 2: Degree of hearing loss (pure tone average).

Degree of hearing loss	Right ear	Left ear	Total	Percentage (%)
Mild (26-40 dB)	13	17	30	41.1
Moderate (41-55 dB)	14	17	31	42.4
Moderately severe (56-70 dB)	8	3	11	15
Severe (71-91 dB)	-	1	1	1.4
Profound (more than 91 dB)	--	-	-	-

Among the 50 patients included in the study, 73 ears with CSOM (unilateral or bilateral) were evaluated by pure tone audiometry. 23 patients had bilateral hearing loss (46 ears), 15 patients had hearing loss in left ear (15 ears) and 12 patients had hearing loss in right ear (12 ears). Most of the ears [61 ears (83%)] had mild to moderate hearing loss. Only one ear showed severe hearing loss (Table 2). Average ABG observed was 31 dB. Maximum ABG observed was 55dB on right side and 50 dB on the left side (Table 3). Of the total 50 patients having CSOM in 73 ears, there was mixed hearing loss in 8 ears (10.9%) (Table 4).

Table 3: Average AB Gap.

ABG	Right ear	Left ear
Average ABG	31.7 dB	31.65 dB
Maximum ABG	55 dB	50 dB

Table 4: Type of hearing loss.

Type of hearing loss	Number	Percentage (%)
Conductive hearing loss	65	89.1
Mixed hearing loss	8	10.9

DISCUSSION

CSOM is one of the most common conditions managed by an otologist in routine practice. The incidence of CSOM is 0.5 to 5.7%, with 22.6% of these cases occurring annually in under-five year old children. Otitis media related hearing impairment has a prevalence of 30.82 per ten thousand globally. Hearing loss resulting from chronic otitis media is a matter of concern, because hearing loss results in impaired development of speech, language there by affecting the learning and social interaction.¹⁰

In this study assessing the hearing loss in patients with CSOM, there was slight female preponderance for the occurrence of CSOM, with male to female ratio at 1:1.17. This is similar to the observations made by Priyadarshini et al and Nagle et al in their studies.^{11,12}

In this study, most (82%) of the CSOM patients with hearing loss were found in the age group of 11 to 40 years, which is comparable to the observations made in the studies conducted by Priyadarshini et al, Nagle et al and Singh et al.¹¹⁻¹³

In the present study, we found mild to moderate hearing loss in 83% of the ears. Only 17% had moderately severe to severe hearing loss. This is similar to the observations by Priyadarshini et al and Maharjan et al.^{11,14} We found average hearing loss of 31 dB, which is in line with studies conducted by Kaplan and Paparella.^{15,16}

The extent of hearing loss continues to worsen with longer duration of CSOM. This is because of multiple factors like ossicular resorption and necrosis with long standing infection in the middle ear cleft; mastoid air cell sclerosis leading to decline in the mastoid air cell volume and also due to passage of bacterial toxins into the scala tympani through round window membrane resulting in sensorineural component of mixed hearing loss.¹¹ These findings suggest that, if a patient with chronic otitis media undergoes surgery early, it not only improves the hearing, but also prevents worsening of hearing loss which may have occurred over time. Thus, patients who undergo surgery early stand a chance of much better hearing improvement than those delaying surgery.

Conventionally, a conductive hearing loss is expected in a patient with CSOM, but sensorineural hearing loss does occur with long standing infections because of the diffusion of bacterial toxins through the round window membrane into the inner ear.¹⁰ In our study we observed mixed hearing loss (higher bone conduction thresholds) in 10.9% of the cases. This is comparable to the studies conducted by Shruthi et al, Cusimano et al and Alexandre et al.^{10,17,18} The higher frequencies were affected more compared to the lower frequencies, similar to the observations in other studies as well.^{10,19,20} Paparella et al, Spandow et al and Goycoolea et al, in their experimental studies, have also shown this association between sensorineural hearing loss and chronic otitis media highlighting the deleterious consequences of chronic ear discharge on the inner ear. The cochlear damage has been attributed to the passage of toxins through the round window membrane, causing damage to the hair cells, particularly in the cochlear base. Recurrent inflammation over long time coupled with chronic ear discharge increases the round window's permeability to bacterial toxins.²¹⁻²³ A higher prevalence of sensorineural hearing loss is observed in CSOM patients of low socioeconomic status.^{10,18,24} This is possibly because these patients have poor access to health care, lack of adequate follow up during treatment, poor hygiene and lack of education. Improving health care access of these patients and educating them regarding the complications of CSOM, may help in them seeking intervention early and may reduce the prevalence of hearing loss due to CSOM.

CONCLUSION

In this study, mild to moderate conductive hearing loss was most commonly observed among CSOM patients. If left untreated, CSOM results not only in progression of conductive hearing loss but also predisposes to the development of mixed hearing loss. This highlights the need for the early surgical intervention in CSOM patients to prevent worsening of hearing. Significant proportions of patients with CSOM have mixed hearing loss. This study reinforces the idea of using preoperative audiometry to assess the degree and type of hearing loss, which not only helps in planning surgery but also helps in

documenting the preoperative status of patients' hearing which is supportive in the event of medico-legal issues.

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