

Original Research Article

A randomized observational study into the pattern of hearing loss in chronic suppurative otitis media

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is an important and a highly prevalent disease of the middle ear and poses serious health problem worldwide especially in developing countries. The objective of the current study was to evaluate the association between CSOM and sensorineural hearing loss (SNHL) and to study of pattern of hearing loss and clinical factors and demographic variables, if any, that might affect sensorineural component, in CSOM in North-Indian population.

Methods: A randomized observational study was conducted on 120 patients, in the age-group of 1 to 50 years, divided into two groups of 60 each: who had safe CSOM and unsafe CSOM, over a period of 6 months, i.e., from: July 2021 to December 2021, in the department of otorhinolaryngology and head neck surgery, CHC, Chenani, Udhampur, J and K, India.

Results: Out of 60 patients under safe CSOM, Male: Female ratio stood at 1:1.14 (i.e., 28:32). Mean duration \pm SD of the disease stood at: 6.2 ± 5.09 years. Incidence of hearing loss was observed in 93 (77.5%) patients of conductive type and 27 (22.5%) patients of mixed type and 19 patients (31.67%) were of unsafe mixed type. Maximum incidence of 35% was in the age group of 41-50 years and minimum in 11-20 years i.e., 7.32%. Total incidence of SNHL 16.67%.

Conclusions: A significant association between SNHL and CSOM was found in this study, with incidence of SNHL increasing with advancing age, showing that age as a risk factor for sensorineural component of hearing loss in CSOM.

Keywords: CSOM, Hearing loss, SNHL

INTRODUCTION

Chronic suppurative otitis media (CSOM) is one of the most common childhood infectious diseases worldwide and is a leading cause of hearing impairment in resource-limited settings.¹ CSOM is a persistent inflammation of the middle ear or mastoid cavity, and is characterized by recurrent or persistent ear discharge through a perforation of the tympanic membrane.² CSOM is classified into the safe (tubo-tympanic) and unsafe (attico-antral) variety depending on the likelihood of coexisting cholesteatoma.

Tubo-tympanic type of CSOM is called safe type, because the rate of complication is very low and usually

not associated with cholesteatoma, besides it is less prone to intracranial complications and attico-antral. Unsafe CSOM is characterized by an attic cholesteatoma or a posterosuperior cholesteatoma with a history of scanty foul-smelling ear discharge (at times blood stained) and deafness.³ Ossicular chain involvement is found in both safe and unsafe type of disease. Tympanic membrane rupture and ossicular chain changes often result in conductive hearing loss in CSOM. Recently numerous studies have reported an additional SNHL in such patients, demonstrating impaired cochlear function.^{4,5} Kaur et al and De Azevedo et al found a 24% and 13% incidence of SNHL in CSOM patients, respectively.^{6,7} Several studies also have investigated the correlation

between SNHL with duration of the disease, Raqib et al observed a significant relationship between SNHL and the disease duration.⁸

Otitis media is an important and a highly prevalent disease of the middle ear and poses serious health problem worldwide especially in developing countries where large percentage of the population lack specialized medical care, suffer from malnutrition and live in poor hygienic environmental conditions.⁹ Hearing loss has become a public health problem in developed and developing countries. In the United States, 48.1 million or 20.3% of the population older than 12 years have unilateral or bilateral hearing loss.¹⁰ Hearing loss causes impaired language development and speech skills in children and poorer life quality and psychological problems for adults; therefore, it becomes essential to study such cases so that sensorineural deafness in CSOM can be prevented.^{1,11}

The objective of the current study was to evaluate the association between CSOM and SNHL and to study of pattern of hearing loss and clinical factors if any that might affect sensorineural component, in CSOM in North-Indian population. We also aimed to assess the correlation among patient's age, duration of disease, and presence of cholesteatoma and ossicular erosion with the degree of SNHL.

METHODS

A randomized observational study was conducted on 120 patients divided into two groups of 60 each: who had safe CSOM and unsafe CSOM, over a period of 6 months, i.e., from: July 2021 to December 2021, in the department of otorhinolaryngology and head neck surgery, CHC, Chenani, Udhampur, J and K, India.

Inclusion criteria

All CSOM cases with copious ear discharge, central perforation on otoscopy. were included in the safe group and all cases with scanty discharge foul smelling, attic or marginal perforation, granulation tissue or cholesteatoma on otoscopy were included in the unsafe group.

Exclusion criteria

Patients below 1 year and above 50 years, were excluded from the study. Patients were also excluded if they had a history of prior otological surgery, head trauma or traumatic tympanic membrane perforation, Traumatic tympanic membrane perforation, Systemic ototoxic drugs, meningococcal meningitis, chronic exposure to noise, prior ear surgery, previous ototoxic drug therapy, cardiovascular and metabolic disease, and hereditary causes were excluded from the study and family history of congenital or acquired hearing loss.

Detailed history, including demographic variables,

duration of the disease, main symptoms, were recorded from the patients. Complete ENT examination was done to look for status of otorrhea, type of perforation, ossicular disruption and presence of granulation tissue or cholesteatoma. They were then subjected to pure tone audiometry, air and bone conduction thresholds were also tested and plotted on the audiogram.¹² A hearing loss of up to 20 decibels below the hearing threshold was considered to be normal hearing. Aural swabs were collected and inoculated for culture and sensitivity. Presence of labyrinthine erosion or fistula was looked in suspected cases, and duly documented. The duration of disease was considered on the basis of onset of otorrhea except in cases of otitis media with effusion. To define the presence of cholesteatoma and ossicular erosion, we assessed the reports of the operation and direct observation of the surgeon.

On the bases of earlier studies conducted, with findings of 24% incidence of SNHL in CSOM, the sample size was calculated to be 120 (60 each for safe CSOM and unsafe CSOM), after assuming the power of the study to be 80% and 95% confidence interval.⁶

The study was duly approved by institutional ethical committee, patients' information during and after the study remained confidential. Data was analyzed using MS excel 2010 software. Independent-samples t-test and chi-square test was used to determine the associations among variables. $P \leq 0.05$ was considered statistically significant.

RESULTS

Out of 60 patients under safe CSOM, Male: Female ratio stood at 1:1.14 (i.e., 28:32) for patients under safe CSOM and 1:1.07 (i.e., 29:31) for patients under unsafe CSOM, with corresponding mean age of Study population being: 37.9 ± 15 years and 38.5 ± 14.8 years, respectively. Mean duration \pm SD of the disease was found to be: 6.2 ± 5.09 years ranging from 3 months to 27 years. Total incidence of hearing loss was observed in 93 (77.5%) patients of conductive type and 27 (22.5%) patients of mixed type. Quite significantly, we found 19 patients (31.67%) to be of unsafe mixed type (Table 1).

Table 1: Pattern of hearing loss.

Type of hearing loss	Incidence, N (%)	Safe, N (%)	Unsafe, N (%)	P value
Conductive	77.5 (93)	86.67 (52)	68.33 (41)	0.023*
Mixed	22.5 (27)	13.33 (8)	31.67 (19)	
Total	100 (120)	100 (60)	100 (60)	

* $P < 0.05$ =significant

Incidence of SNHL increased with age, the maximum

incidence of 35% was in the age group of 41-50 years. Total incidence of SNHL was 16.67% (Table 2).

Table 2: Incidence of SNHL in different age groups.

Age (Years)	No. of patents with CSOM	Incidence of SN component of hearing loss, n (%)
11-20	41	3 (7.32)
21-30	33	3 (9.09)
31-40	26	6 (23.07)
41-50	20	8 (35)
Total	120	20 (16.67)

Mean bone conduction thresholds (in the frequency range of 500 to 4000 Hz) for affected ear were tabulated against duration of CSOM. A greater incidence of hearing loss with increasing duration of disease, was found, hence, the incidence of SNHL component showed correlation with duration of disease (Table 3).

Table 3: Number of cases of SNHL component (mild deafness) and duration of CSOM.

Bone conduction threshold decibels (dB)	Duration of CSOM (Months)				
	3-12	13-24	25-36	37-48	>49
20-25	1	0	0	1	0
26-30	0	2	0	0	1
31-35	0	0	1	2	0
>35	0	3	5	3	1
Total	1	5	6	6	2

There were higher thresholds in the affected ear than in the normal ear for each frequency. In the present study, 10% (6 cases) of unsafe CSOM were found to be associated with labyrinthine fistula and 8.33% (5 cases) of granulation over oval window. Four patients (6.67%) had cholesteatoma in their surgical reports.

DISCUSSION

Although several studies have proposed the association between CSOM and SNHL, there is still lack of consensus about its importance. At the same time, age-related hearing loss (ARHL) or presbycusis is one of the most common disabilities in elderly people, which affects approximately 27.6% of individuals between 65 to 79 years and 36.5% of those aged 80 and older.¹³ The present study showed that sensorineural loss, either alone or with conductive loss may occur in acute as well as CSOM. Out of the 120 cases of CSOM were examined clinically and with the aid of audiometry, 20 patients showed up with mixed hearing loss.

Incidence of hearing loss was observed to be 77.5% for conductive type and in 22.5% patients of mixed type, in which 86.67% were of safe conductive, 13.33% safe mixed type and 68.33% were of unsafe conductive type.

SNHL increased with age, being maximum in age group of 41-50 years i.e., 35% and minimum in 11-20 years i.e., 7.32%. Studies by Amali et al had also found that older patients were more vulnerable to the effects of middle ear inflammation on cochlear function, and this vulnerability could lead to intense hearing impairment due to aging.¹³ Redaelli et al and Vartiainen et al also have reported similar findings.^{14,15} It seemed that older patients are more vulnerable to the effects of middle ear inflammation on cochlear function, and this can intensify hearing impairment due to aging.

Study by Maharjan et al on 119 patients with perforated tympanic membrane, age ranked between 8 to 60 years, had found that bilateral tympanic membrane perforation were seen in 19 patients and a relation that longer the duration of ear discharge, the more the hearing loss.¹⁶ Similarly in our study, a greater incidence of hearing loss, as well as higher bone conduction threshold decibels were found with increasing duration of disease. Studies by Silveira et al and Orji et al had found that air conduction, bone conduction thresholds and air-bone gaps in children and teenagers with CCOM were significantly greater.^{17,18} Impaired hearing by bone conduction thresholds of affected ears, correlated with increased age at every frequency. Therefore, surgical treatment of dry and apparently stable tympanic membrane perforation was warranted.

Papp et al observed that CSOM is associated with SNHL.¹⁹ When ace and normal side were corrected for, pure-tone threshold and bone conduction threshold at either the speech frequencies or at 4 kHz increased gradually according to the duration of the CSOM. The threshold shift was more accentuated as age increased. The SNHL at 4 kHz seemed to be higher than that at the speech frequencies. The findings from the present study were consistent with those found in several studies.²⁰ In another study with similar methodology, SNHL was progressively increased with increasing CSOM duration.⁶

In the present study, 10% (6 cases) of unsafe CSOM were found to be associated with labyrinthine fistula, this was the commonest cause of sensorineural component in unsafe CSOM followed by 8.33% (5 cases) of granulation over oval window. Four patients (6.67%) had cholesteatoma in their surgical reports. There were 2 cases with SNHL in safe CSOM group, the cause of which could not be ascertained. The inner ear is vulnerable against CSOM. Older age increases this vulnerability. The proximity of the sensory cells to the potential source of harm (inflamed middle ear) may mean higher exposure, as reflected by the fact that sensory cells processing higher frequencies are more seriously damaged.¹⁹ As such, medications such as topical aminoglycosides are commonly used for treatment of otitis. Lundy et al who have studied toxicity of ototopical medications, have found that 80% of respondents feel higher risks for ototoxicity of otitis media than using ototopical preparations.²¹

The study also had some limitation, as differences between BC thresholds between affected and normal ears of each patient was not analysed. However, some audiometric changes are found, which might have had negligible influence on patient's hearing in comparison with the changes in tympanic membrane and ossicular chains. Further studies are needed to elucidate this subject.

CONCLUSION

A significant association between SNHL and CSOM was found in this study, with incidence of SNHL increasing with advancing age, showing that age is a risk factor for sensorineural component of hearing loss in CSOM. A significant association was observed between SNHL with duration of disease and presence of cholesteatoma and ossicular erosion. However, these findings demonstrate significant audiometric cochlear damage; clinical relevancy should be evaluated in future studies.

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