

Analysis of Sensorineural Hearing Loss by Pure Tone Audiometry in Chronic Suppurative Otitis Media

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Abstract

Objective: To determine the frequency of sensorineural hearing loss in patients presenting with Chronic Suppurative Otitis Media.

Methods: A total of 121 patients who fulfilled the inclusion criteria and visited to ENT Department of Civil Hospital, Karachi were included in the study. Informed consent was taken after explaining the procedure, risks and benefits of the study. Bone conduction thresholds were measured at frequencies (500, 1000, 2000, 4000 Hz) utilizing diagnostic audiometer model TA 155. Air conduction and bone conduction thresholds >30 decibel and no air-bone gap was considered as SNHL. The opposite ear was masked while obtaining bone conduction results. All the collected data was entered into the proforma.

Results: Mean \pm SD of age was 35.48 ± 7.24 years. Mean \pm SD of bone conduction was 29.42 ± 4.28 db. Out of 121 patients 85 (70.24%) were male and 36 (29.76%) were female. Sensorineural hearing loss was noted in 20 (16.52%) patients. SNHL is found to be associated with age, gender, duration of symptoms and level of bone conduction with $p < 0.05$.

Conclusion: It is concluded that CSOM is associated with SNHL. Aging can act as a precipitating factor in this pathological process. It is therefore recommended that all ENT surgeons should implement early medical and surgical management of any form of CSOM to prevent SNHL which is irreversible in most of the patients.

Keywords: Sensorineural hearing loss (SNHL), chronic suppurative otitis media (CSOM), Tympanic membrane, Bone conduction. **IRB:** Approved by Dow Medical College.

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Introduction

Chronic suppurative otitis media (CSOM) has become very common globally. It has been reported that more than \$2 billion has been spent over the management of these infections¹. Approximately 7% cases have been diagnosed with chronic ear infections and the rate is relatively huge with respect to developed countries². Generally, hearing loss is considered as one of the major health related issue

despite of the fact that ear infections can lead to lethal outcomes in long run³⁻⁴.

The inflammation of middle ear cleft (middle ear cavity, eustachian tube and mastoid air cell system) is known as CSOM. In general, pathology of CSOM comprises of pus discharge either continuously or in intervals through tympanic membrane⁵. Microbiologically, there is an attack of aerobic and anaerobic bacteria causing inflammation to occur in the middle ear. Hence, the management is inclined towards eradicating these bacteria seeking medical treatment. However if medical treatment fails to provide positive response, then ultimately surgical treatment must be initiated as soon as possible⁶. These infections if not treated at early stage could invade deeper in to the inner ear causing shrinkage and dilation of vessels⁷.

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Jahn AF et al reported that there is positive correlation between sensorineural hearing loss with CSOM in older ages, however there was no correlation between duration of infection with hearing loss. He also stated that around 13% patients with CSOM had hearing loss⁸. World health organization reported around 20dB difference between diseased and control ear. Literature also revealed that infected ears had raised bone conduction thresholds at all test frequencies. It is to note that researches have shown that CSOM is a factor leading to conductive hearing loss however very few researches available regarding sensory hearing loss in infected ears.

The long term adverse effect of this disease invades inner ear causing complications in hearing ability due to chronic inflammation. This recurrent event of inflammation in the ear results in perforation of tympanic membrane causing all the toxic micro and macromolecules into cochlea ultimately leads to sensorineural hearing loss (SNHL)⁹.

Literature has reported that there were better post-operative outcomes in terms of audiological tests in children less than 10 years whereas these outcomes were found poor in older age group (>60 years). Paparella et al concluded that impairment of bone conduction had positive correlation with duration of disease and there were 83% patients diagnosed with CSOM^{10,18}.

The available data showed there are number of studies on absolute bone conduction thresholds of diseased ears whereas there was a scarcity of data regarding difference in threshold between diseased and normal (control ears). Recent studies showed the difference between threshold of bone conduction between diseased and normal ears. Studies have confirmed CSOM as a leading cause for sensory hearing loss however in-depth data is still yet to be researched. Studies show variation in sensory hearing loss in chronic suppurative otitis media patients. Few studies reported no association between neural deafness and SCOM however other studies focused on early diagnosis and treatment planning¹⁰.

Acuin J et al also specified that chronic suppurative otitis media occurs in response to bacterial toxins causing inflammatory markers to stimulate and initiate the inflammation. This tenacious inflammation causes lethal effects on tympanic membrane and hearing loss can occur as a result of long term worst prognosis¹¹. In addition, Brook et al stated that ear infections should be treated as soon as possible in order to arrest complications and where drug therapy fails to subside the infection, surgical treatment should be preferred¹².

Hence, the study is conducted to determine the frequency of Sensorineural Hearing Loss in Chronic Suppurative Otitis Media. With increasing incidence of this disease, it is important to find out burden of hearing loss in these patients. The instability of hearing loss in this disease reckons to develop strategies for deafness. There is dearth of local data on this serious problem. This study will help estimating the local statistics of hearing loss in infected patients. So measures should be taken accordingly in order to save the patients from becoming deaf. Early diagnosis and most importantly early management of this disease would lead to save many young lives.

Patients and Methods

A cross sectional study was carried at ENT Department of Civil Hospital, Karachi from July 2018 to December 2018. Patients were enrolled through on-probability consecutive sampling technique.

All 121 clinically diagnosed patients with Chronic Suppurative Otitis Media for at least six months duration aged 20-50 years were included in this study. Those with history of mastoid surgery, aural polyps, marginal perforation, history of traumatic head injury, history of ear surgery and chronic noise exposure were excluded. Patient's confidentiality was maintained throughout the study and no harm or infringement was reported in this regards by any patient during the study.

The procedure was explained in detail to these patients and the demographic information was in-

cluded in the proforma. Each patient was provided with written informed / verbal consent before undergoing any procedure. The selected patients were subjected to the pure tone audiometry examination. Bone conduction thresholds were measured at frequencies (500, 1000, 2000, 4000 Hz) utilizing diagnostic audiometer model TA 155. Air conduction and bone conduction thresholds >30 decibel and no air-bone gap was considered as SNHL. The opposite ear was masked while a bone conduction result was obtained. The final outcome i.e. sensorineural hearing loss was included in the proforma. Data was entered and analyzed by using SPSS version 19.0. Chi-square test was applied. $P \leq 0.05$ was considered as statistically significant.

Sample size was calculated by using WHO sample size calculator, using frequency of sensorineural hearing loss i.e. 12%²⁰ (justification from previous literature for sample size calculation), at margin of error 6%, with confidence level 95%, then 121 cases were included.

Results

In this study, we analyzed pure tone audiograms to assess the sensorineural hearing loss from 121 patients suffering from CSOM.

The average age group of patients suffering from CSOM was 35.48 ± 7.24 years, BMI was 27.56 ± 6.28 , duration ranged from a minimum of 6 months to almost 65 months mean duration of disease was 9.56 ± 6.28 months. Average Bone conduction in decibel (db) of patients suffering from CSOM was 29.42 ± 4.28 (Table 1).

Table 1. Descriptive statistics of patients characteristics (n=121)

Variables	Mean +/- SD	Range
Age (in years)	35.48 +/- 7.24	20-50
Body Mass Index	27.56 +/- 6.28	22-29.2
Duration of disease (in months)	9.56 +/- 6.28	6-65
Bone conduction (in DB)	29.42 +/- 4.28	18-50

Out of 121 patients 85 (70.24%) were male and 36 (29.76%) were female. the hearing loss in Fig 2. Frequency distribution for the side of ear (n=121) patients with CSOM, there was male dominance for the occurrence of CSOM [Figure 1]. Left ear 68(56.19%) was affected

more than the right ear 53(43.80%), respectively [Figure 2]. Sensorineural hearing loss was found in 20(16.52%) patients suffering from CSOM [Figure 3].

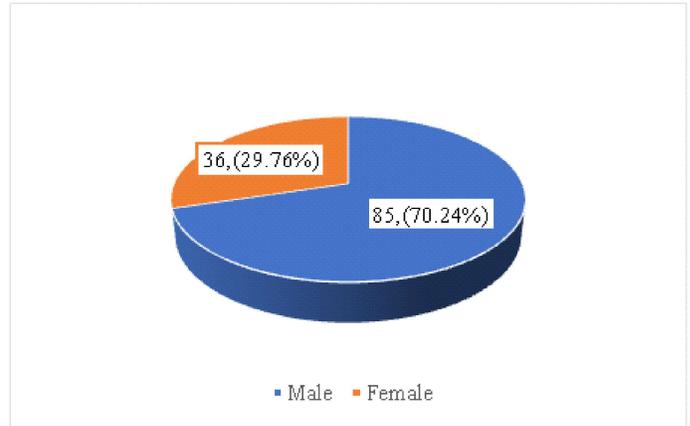


Fig 1. Frequency distribution for the gender (n=121)

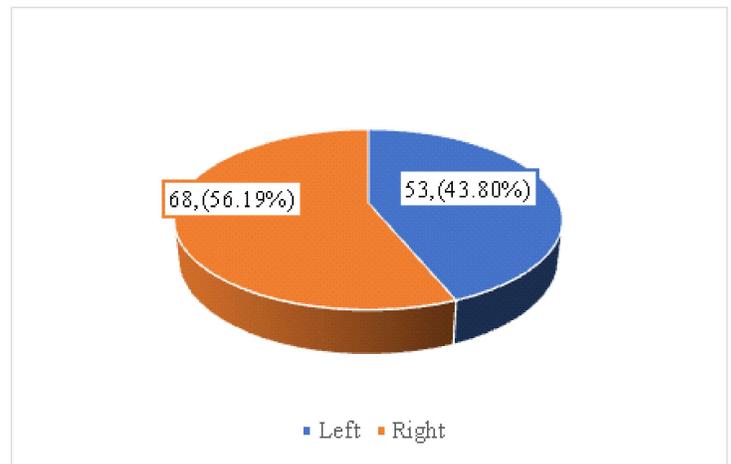


Fig 2. Frequency distribution for the side of ear (n=121)

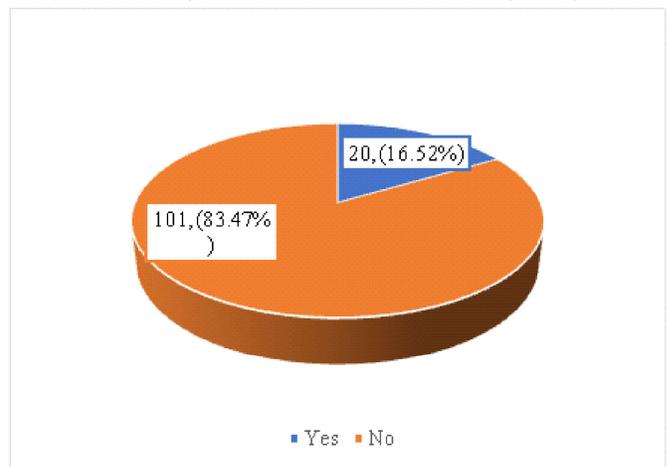


Fig 3. Frequency distribution of sensorineural hearing loss (n=121)

In stratification age, gender, duration of disease, BMI, bone conduction and side of ear with respect to sensorineural hearing loss were done from (Table 2).

Table 2. Stratification of effect modifiers according to sensorineural hearing loss(n=121)

Effect modifiers	Sensorineural Hearing Loss Yes	Sensorineural Hearing Loss No	P-Value
Age groups[in years]			
20–35	17 [22.1%]	60 [77.9%]	
>35	3 [6.8%]	41 [93.2%]	0.030*
Gender			
Male	18 [21.2%]	67 [78.8%]	0.034*
Female	2 [5.6%]	34 [94.4%]	
Duration[In months]			
?12	4 [5.6%]	68 [94.4%]	0.0001*
>12	16 [32.7%]	33 [67.3%]	
BMI [In kg/m ²]			
22-27	12 [17.9%]	55 [82.1%]	0.649**
>27	8 [14.8%]	46 [85.2%]	
Bone conduction[In db]			
18–29	7 [6.5%]	101 [93.5%]	0.0001*
>29	13 [100%]	0[0.0%]	
Side of ear			
Right	12 [17.6%]	56 [82.4%]	0.708**
Left	8 [15.1%]	45[84.9%]	

Applied Chi-square test/ Fisher exact test
 **= Non-significance, *= Significance

Age, gender and Duration showed statistically significant association with SNHL with (p<0.05), In this study, most of the CSOM patients 17 (22.1%) with hearing loss were found in the young age group of 20-35 years, there was slight male dominance for the occurrence SNHL in CSOM patients. The duration of infection is a leading factor in causing sensory hearing loss. There was no significant association between the body mass index and side of ear with sensorineural hearing loss (P >0.05). The bone conduction was observed to be significantly higher in the diseased ears than those in the contralateral healthy ears with p <0.05.

Discussion

Chronic ear infection is most common disease in everyday practice of ENT. Literature has shown that risk of having hearing loss is higher in CSOM patients. In the present study, results showed statistically significant relation of SNHL in patients with CSOM. Sensorineural hearing loss was noted in 16.52% patients. The findings are equivalent with

national and international studies. In comparison with a systematic review carried out in Africa, the hearing loss is quite high in our study. The review comprised of 2 studies held in a community among all ages and reported 15 to 18% cases with hearing loss at 25 db⁷.

Thresholds of bone conduction of diseased ears were raised significantly compared to normal and control ears similar to the findings of study conducted by Samuel MA et al. Moreover, there was little difference between findings of frequency of hearing loss that varied from 5 db to 30 db¹⁶.

Researches also claimed that main passage for bacterial invasion is said to be through round window membrane located in middle ear. Toxins travel via this pathway causing deeper infection in inner ear specifically cochlear damage⁸. Whereas other researches claimed that diabetes, head trauma, or noise as factors leading to sensory hearing loss while there was no pathology reported between CSOM and sensory hearing loss in temporal bones¹³.

Fliss DM et al. also reported that there exist a statistically significant association between sensory hearing loss and CSOM. The drop in thresholds of bone conduction is used as a measure to estimate destruction of inner ear. The patients having CSOM tend to be greater candidates for causing changes in middle ear clefts and hence threshold of bone conduction is not analogous to function of cochlea¹⁴. Kenna MA et al. reported that there is possibility of false calculation of sensorineural loss due to mechanical hindrance in tympanic cavity which showed high thresholds of bone conduction. He also reported that there is an escalation in thresholds of bone and air conduction in patients having ossicular necrosis¹⁵.

Ali Zaidi et al. reported that duration of infection is a leading factor in causing sensory hearing loss. In his research, he concluded that hearing loss was 47% in less than 12 months that increased to around 52% with 5 years and was 100% loss in more than 5 years in both ears¹⁷. Although,

CSOM may presents with meningeal sign and symptoms along with loss of consciousness, hearing loss in major complication that needs attention. In the present study, 16.52% of patients had SNHL in the diseased ear suffering from CSOM. These findings are comparable to study conducted by Paparella 18 (43%), Kaur 19 (24%) and Levine 20 (12%).

Sakagami et al.²¹ reported that patients with CSOM were 0.61 times at risk of developing sensorineural hearing loss as compare to disease free patients that were at at risk of 0.13 times per year. He also reported that age has association with developing CSOM. His findings antagonized with the E.S. Kolo²² study that stated no relation between sensorineural hearing loss and the duration of disease. Another study by Yehudai N et al. supported our findings and recommend early treatment of tympanic membrane perforation²³.

In a study, sensorineural hearing loss was found relatively high among patients having low socioeconomic status²⁴. It could be because patients had lack of provision of healthcare facilities. Hence, patients with CSOM should be treated well and provided with all source of education regarding the complication of the disease.

It is emphasized that long term prognosis of disease depends upon early treatment. As the treatment is initiated at early stage, patients could be at lower risk for hearing loss. Early management is mandatory as the disease occurrence is high and we lack surgical resources to treat these patients. The usage of non-probability sampling techniques restrict overall generalization however, consecutive technique reduced bias in the study. In addition, the source of bias has been reduced by using objective definitions for predictor and outcome variables.

Conclusion

It is concluded that all ENT surgeons should implement early diagnosis and effectively management of any form of CSOM help to prevent the chance of developing SNHL which is irreversible in

most of the patients. According to available literature, there is great instability of hearing loss with CSOM, therefore it is still controversial to leave this disease untreated. In future prospective, there is a need to conduct studies using large sample size with multiple study centres in Pakistan.

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