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Sensorineural Hearing Loss in Patients with Chronic Otitis Media: A Clinical Study

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Abstract
Background: *Chronic Otitis Media (COM) is a commonly occurring disease worldwide. Timely management is required as this disease is capable of causing serious complications and can lead to long term pain and discharge from the ear. Traditionally, this disease is associated with conductive deafness however we organized a study to analyse the component of sensorineural deafness in patients presenting with COM.*
Methods: *We conducted a study on 75 patients of 5-40 years of age with unilateral complaints of ear discharge and hearing loss. Group COM comprises of the ears with complaints of unilateral ear discharge while the Control Group consisted of the contralateral healthy ears of the same patient included in the study. After detailed history, examination and relevant investigation findings were documented.*
Results: *It was inferred that COM is associated with sensorineural (SN) loss in small majority of patients. No significant co-relation was established between the duration of discharge and degree of SN loss ($r = 0.183$, $p > 0.05$). The average age was 25.3 years. There was no significant male or female preponderance. Significant higher bone conduction thresholds were found in the affected ear than in the normal ear for each frequency (500, 1000, 2000 and 4000Hz) ($p < 0.05$), which progressed with increasing frequency. The prevalence also increased with age of patient and duration of disease.*
Conclusions: *A significant degree of SNHL in patients with COM was noted in this study. SNHL occurred in 14% of the patients with COM, and was correlated with older age and longer duration of ear disease. There was no correlation between the degree of SNHL and duration of disease. It can be further studied that whether an early surgery in COM has any effect on impending sensorineural hearing loss.*
Keywords: *Chronic otitis media, Conductive hearing loss, Sensorineural hearing loss.*

Introduction

Chronic Otitis Media (COM) has been defined as a chronic inflammation of the middle ear or mastoid cavity, which presents with recurrent or persistent ear discharges or otorrhoea through a tympanic membrane perforation and can be associated with cholesteatoma.[1] The hearing loss in patients of COM is because of air bone gap and thus commonly known as conductive hearing impairment.[2] Many researchers had also

observed sensorineural hearing loss (SNHL) in patients of COM. However, the frequency of sensorineural hearing loss in COM is reported between none to 13%.[3]

Paparella et al did a research to understand the mechanism of sensorineural hearing loss in COM patients. They observed that in COM toxins are produced which after crossing the membrane of round window because of alteration in the permeability causes the damage to hair cells on the basal turn of cochlea.[4] Moreover, the chronic inflammation on the round window membrane causes vasodilatation and vasoconstriction of the vessels and thereby causing circulatory disturbances leading to negative influential role on inner ear.[5] However, many researchers observed no clinically significant sensorineural impairment in patients with COM.[6-10]

So this study was planned to assess the association between SNHL and COM and its relation to patient's age, sex, duration and state of disease (active or inactive).

Materials and Methods

Patient selection

The study was conducted in the department of Otorhinolaryngology, Dr Susheela Tiwari Hospital, Haldwani from October 2016 to September 2018. It was a prospective study. 75 patients in the age group of 5yr-40yr with unilateral chronic otitis media were selected for the study. The normal ear was used as a control to remove the effect of confounding factors such as presbycusis, noise induced or congenital hearing loss etc. The patients with bilateral disease, prior history of ear surgery, family history of sensorineural hearing impairment, history of noise exposure or head injury and perilymphatic fistula were excluded from the study.

Patient assessment

Detailed otolaryngologic history pertaining to hearing impairment, ear discharge, vertigo, tinnitus etc., was noted down with complete ENT examination to look for status of otorrhea, site, size of perforation and active infection in nose and throat.

All the patients underwent hearing assessment for both study and control ears by Pure Tone Audiometry (PTA) in a sound treated room. The hearing assessment was done for speech frequencies 250 Hz, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz for both ears. In a patient the average bone conduction threshold of all frequencies of 20 decibel or more was considered significant and was taken as indicative of SNHL.

The results in both ears were statistically compared. The assessment points were:

1) Prevalence of SNHL in study ear for all the patients.
2) Relation between age and sex of the patient and SNHL.
3) Correlation between type of CSOM and SNHL.
4) Correlation between duration of disease and degree of SNHL.
5) Correlation between bone conduction thresholds for both study and control ears and speech frequencies.

Statistical Analysis

Test of significance, correlation coefficient & comparison of performance scores using fisher paired "t" test were calculated. Data was analysed using SPSS version 16.0 software. A p value of < 0.05 was considered statistically significant. All these findings were documented as per the study performa.

Results

75 patients were enrolled in the study after taking due consent. All the patients had unilateral COM. Data of all the patients was collected in customized proforma and then transferred to Microsoft excel for analysis. All the patients included in the study were above the age of 5 years. Among them the majority were in the age group of 21-30 years (36%) followed by middle age group 31-40 yrs (29.3%) (Table1). Male and Female patients were almost equal (Table 1).

Table 1: Age and Sex distribution

Age groups	Male	Female	Total
5-10yrs	5	3	8
11-20yrs	7	11	18
21-30yrs	17	10	27
31-40yrs	9	13	22
Total	38	37	75

Regarding the prevalence of SNHL in study ears, it was found that 64 patients (85.3%) had pure conductive hearing loss and 11 (14.7%) had associated sensorineural hearing loss (figure 1). It was also found out that the prevalence was much higher in later age group that is 31-40 years (81.8%) (Table 2).

Regarding the relation of SNHL with duration of disease, it was found that patient having more than 26 years of duration of disease suffered from SNHL (Figure 2).

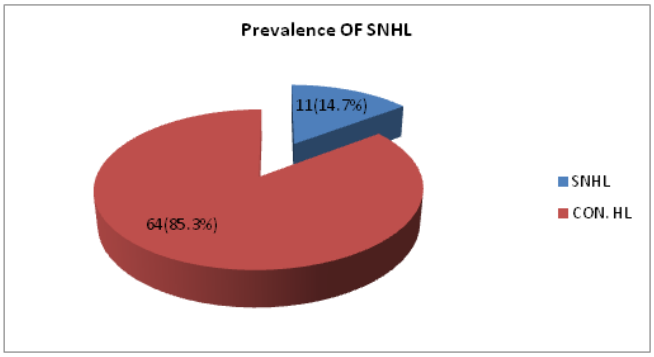

Figure 1- Pie chart showing prevalence of SNHL

Table 2- Shows relation of hearing loss with age of the patient.

Age Group	SNHL		Conductive Hearing Loss		P value
	No. of patients	percentage	No. of patients	percentage	
5-10 yrs	0	0.0%	8	12.5%	0.011
11-20 yrs	1	9.1%	7	26.5%	0.654
21-30 yrs	1	9.1%	26	40.6%	0.210
31-40 yrs	9	81.8%	13	20.3%	<0.0001
Total	11	100%	64	100%	

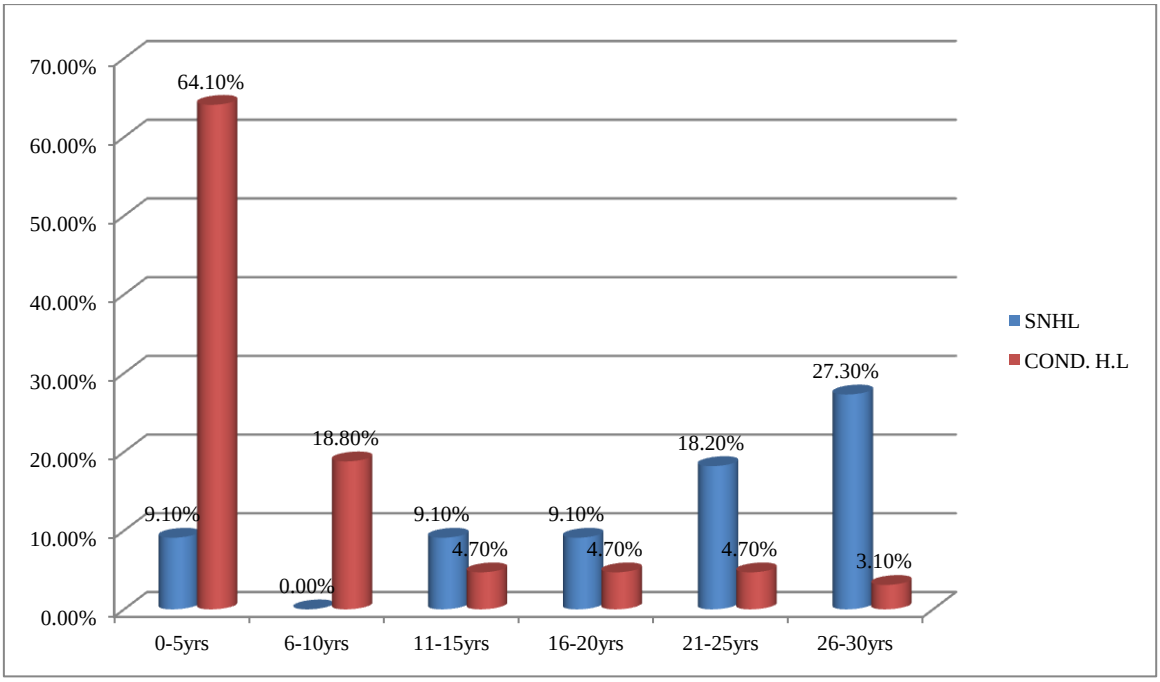

Figure 2- Relation of hearing loss with duration of disease

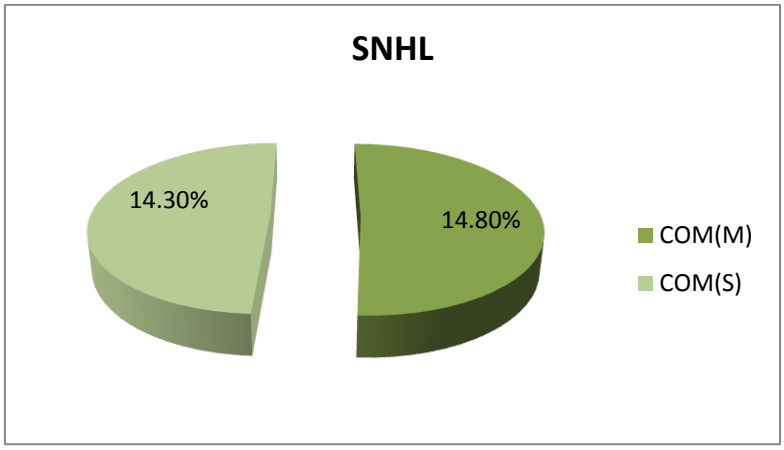

Figure 3- Relation of sensorineural hearing loss with type of disease is shown in above mentioned pie chart.

Correlation between degree of SNHL & duration of disease

		Duration of discharge	Degree of SNHL
Duration of discharge	Pearson Correlation	1	0.183
	Sig. (2-tailed)		.
	N	11	11
Degree of SNHL	Pearson Correlation	0.183	1
	Sig. (2-tailed)		
	N	11	11

P =0.590. Hence there is no significant correlation (P>0.05) between the duration of discharge & degree of SNHL in patients of COM in this study.

Correlation between Pure Tone Average of Bone conduction threshold of Normal ears and Pure Tone Average of BC thresholds of COM ears

		Bone conduction thresholds of normal ears	Bone conduction thresholds of COM Ears
Bone conduction thresholds of normal ears	Pearson Correlation	1	0.247**
	Sig. (2-tailed)		.032
	N	75	75
Bone conduction thresholds of COM ears	Pearson Correlation	.247**	1
	Sig. (2-tailed)	.032	
	N	75	75

**. Correlation is significant at the 0.05 level (2-tailed).

P value is 0.03

Significant difference ($p<0.05$) was observed across the pure tone average value of air conduction and bone conduction threshold of normal ears and ears with COM

Hence Positive correlation ($r = 0.247$) was obtained across the bone conduction pure tone average thresholds of normal ears and ears with COM.

Discussion

Safe mucosal COM is one of the most common otological conditions encountered in ENT OPD. It is one of a major cause for conductive hearing loss. The incidence of SNHL in safe COM is still a matter of debate. Conventionally, a conductive hearing loss is expected in a patient suffering from COM. Occasionally, elevated bone conduction thresholds have been observed in various

audiometric recordings in patients suffering from COM indicating a sensorineural (SN) element. On reviewing the literature results from different studies done on this issue have been discussed.

The prevalence of SNHL in unilateral COM was investigated in the present study. The aim was to assess the association between SNHL and type of COM and its relation to patient's age, sex, duration of disease and speech frequencies.

According to our study, majority of the COM patients 27 out of 75 (36.0%) were in the age group of 21-30 years of age. This is in concordance with the study carried out by Kirtane MV et al, Erkan Mustafa, Induharan R and Vijaya D; and also Gulati S.K., where the commonest age group was between 20 to 30 years.[11,12,13,14]

In our study, we found that out of 75 patients evaluated, 11patients (14.7%**)** had associated sensorineural hearing loss, whereas remaining 64 patients (85.3%) had purely conductive hearing loss. Azevedo and Alexendre Fernandes et al (2007) and Mustafa Tuz et al (2006) also concluded that COM with or without cholesteatoma may evolve towards sensorineural hearing loss which they observedin 13% of the total patients involved in the study.[3,15] Data analysis of this study shows that conductive hearing loss is more frequently seen in younger age group whereas in middle age group conductive hearing loss associated with SNHL is commonly encountered. Eightpatients (12.5%) in the age group of 5-10 years had purely conductive hearing loss whereas in age group of 30-40 years 9 patients(81.8%) had sensorineural component in their hearing loss. Only13 patients (20.3%) had purely conductive hearing loss. Kamaljit Kaur (2003) in her study revealed that older age group patients had increased bone conduction thresholds.[16]

This fact that the inner ear is vulnerable against chronic otitis media and as age increases this vulnerability was well explained by Papp, Zoltan and his team (2003). This also explains changes of presbycusis occur early in diseased ear as compared to normal ear.[17] In our study there was a very strong correlation of hearing loss with the duration of disease. As the duration of disease increased the prevalence of SNHL also increased. And it is evident from the data that 3.10% conductive and 27.3 % mixed hearing loss in patients between 26-30 yrs of duration of disease. Paparella et al (1970), Kamaljit kaur et al (2003) and English et al (1973) et al also observed more prevalence of SNHL in patients with longer duration of disease.[18,19] We have found that the prevalence of SNHL was almost equal in both squamous and mucosal type of COM. i.e. 14.3% in squamous type of COM and 14.8% in mucosal type of COM. It was also found that patients with active middle ear disease were more prone to sensorineural disease. Kamaljit Kaur et al and kirtane MV et al revealed that there is no statistical difference between the sensorineural deafness produced by unsafe and safe types of COM.[16,20] Furthermore this study found no significant correlation between duration of discharge and degree of SNHL as P value is 0.590 (P value > 0.05). Likewise, previous authors had also arrived at the same conclusion.[3,10] The relationship between mean bone conduction thresholds did not show any rise when ears with different ranges of duration of discharge were analyzed. In a similar assessment, deAzevedo et al, Noordzi et al, Kaplan et al, E S Kolo et al and Mac Andie et al did not find any significant difference in the Bone Conduction thresholds of patients having prolonged history of ear discharge.[21,22] Significant difference ($p<0.05$) was observed across the pure tone average values of air conduction and bone conduction threshold of normal ears and ears with COM. The higher frequencies tend to be more affected. This was similar to the findings of MacAndie and Redaelli et al. who performed the same kind of study.[10,23]

The findings from this study lend credence to the theory that cochlear damage in patients with COM might be due to bacterial toxins that diffuse through the round window membrane causing damage to the hair cells especially those at the cochlear base which are sensitive to high

frequency sounds.[24, 25] Engel et al in a study proposed that the deleterious effect on inner ear could be attributed because of the ionic disequilibrium at the level of cochlea.[26] Moreover, they also observed cytolysins (streptolysin O and pneumolysin) are the culprits behind the leakage of ions from the round window membrane. However, we acknowledge that this study lacked control for the possible use of topical antibiotics acted as a confounding factor. This was a limitation as almost all our patients have used such medications. But quite interestingly, some investigators have found little or no evidence that topical antibiotics can cause significant SNHL in human ear.[27]

Conclusion

In the analysis of sensorineural hearing loss in CSOM, the following conclusions were drawn. Chronic otitis media appears to be associated with sensorineural hearing loss, but the degree of SNHL is small in majority of patients. Although, the degree of sensorineural hearing impairment is independent on the duration of disease but still providing better education and timely management of COM could help in eliminating the element of sensorineural deafness in patients suffering from COM. It was observed that the prevalence of SNHL increased with the increasing duration of disease and this factor should be also considered while managing the patients with COM. The higher frequencies were more affected, and there were no correlations between the degree of SNHL and duration of disease. However, these findings demonstrate significant audiometric cochlear damage, clinical relevancy should be evaluated in future studies.

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