



## SENSORINEURAL HEARING LOSS IN CHRONIC MIDDLE EAR CLEFT DISEASE : A PREVALENCE STUDY FROM SOUTH INDIA

ENT

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### ABSTRACT

This study examines the interplay between Sensory Neural Hearing Loss (*SNHL*) and Chronic Suppurative Otitis Media (*CSOM*) when viewed in the context of a patient's age and disease type/duration. This study was conducted at Tilak Hospital, Tiruchirappalli after examining 200 patients (200 ears) suffering from CSOM with hearing loss. The patients selected were between 15 - 45 years and with minimum 5 years of untreated CSOM. It was observed that patients with more than 16 years of untreated disease had a stronger tendency to develop SNHL. Consequently, a direct relation between the duration of untreated CSOM vis-à-vis the onset of SNHL was observed. Additionally, this study also did not show any special relationship between the causation of SNHL by the squamous variant of CSOM since the mucosal variant was found to be equally culpable. Finally, this study also documents key data on CSOM in the southern parts of India.

### KEYWORDS

CSOM, SNHL, Squamous, Mucosal.

### INTRODUCTION

A considerable difference in the prevalence rate for ear disease is evident between developed and developing countries. Some of the reasons for this disparity are stated to be dense population, poor hygiene, poor nutrition, passive smoking and high rate of nasopharyngeal colonization with pathogenic bacteria, ignorance and unavailability of medical care in the developing world.<sup>1</sup> While a true estimation of the problem of deafness is not known in India, a survey conducted by Indian Council of Medical Research in 1983 reported that the major etiological factor responsible for hearing loss in rural areas was Chronic Suppurative Otitis Media (*CSOM*).<sup>2</sup>

CSOM is typically a persistent disease, insidious in its onset and often capable of causing severe destruction and irreversible sequel. It often manifests itself with discharge and deafness<sup>3</sup> and presents in a spectrum of ways, one of them being mixed hearing loss. Even though the conductive component of the mixed hearing loss is implicated to the middle ear infection, the exact reason for presentation of the sensory neural component in patients has not been thoroughly investigated till date.

Various studies have described the impact which CSOM has on the inner ear causing Sensory Neural Hearing Loss (*SNHL*). This impact includes instances like penetration of toxins from the middle ear across the round window membrane, transmission of infection and inflammatory exudates through the preformed pathways into the labyrinth.<sup>4</sup> Co-morbid conditions like diabetes, immune-compromised conditions, autoimmune diseases, hypoproteinemia and prolonged steroid therapy also add to the causation of SNHL.<sup>5</sup>

### AIMS AND OBJECTIVES

Hearing disability in adults has a huge bearing on an individual and consequently, the society with massive social costs. This aspect has been a driving force for conducting this study which inter alia examines the association of SNHL in CSOM patients in the Tilak Hospital, Tiruchirappalli (*Hospital*) in a given set of parameters including the age of the patients, the type of disease and the duration of the same.

### Material and methodology

At the relevant time, a cross section and prospective study was performed from June 2011 to December 2013 at the Hospital. The sample size of 200 patients (200 ears) with CSOM with hearing loss was taken for the study. Sequentially selected cases from the out patients' department, fulfilling the following conditions were selected for the study:

**Age: Between 15 - 45 years;**

**Duration of untreated disease:** Minimum 5 years of untreated

unilateral CSOM where the other ear was clinically and audiological normal.

**Exclusion criteria:** Cases of pediatric age group, Presbycusis, Ototoxicity, Meniere's disease, SNHL and complications of CSOM.

Informed consent of the patients was taken at the relevant time and a detailed history was obtained. All patients underwent Otomicroscopic examination and findings were documented to classify the CSOM into Squamous or Mucosal type. Tuning fork test was performed to confirm mixed hearing loss as per inclusion criteria. All patients underwent audiological assessment using the same audiometer (Interacoustics ac 40) and by the same audiologist with standard masking technique for the non-test ear. All the above records were transferred to a master chart for analysis using SPSS 17.0 software with the interpretation by a biostatistician.



*Inactive CSOM Mucosal type*

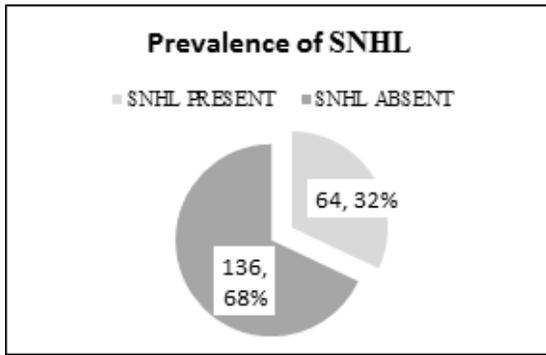


Picture :1 Clinical Picture of CSOM

### Key observation and results

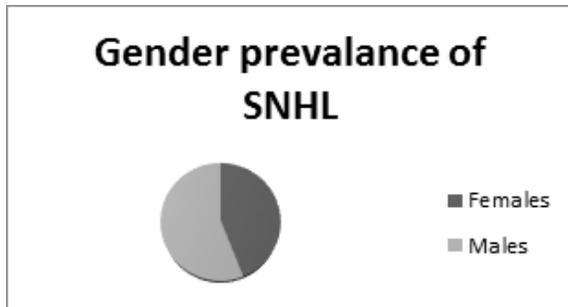
Of the 750 patients of CSOM screened in the Hospital, 200 cases fulfilled the inclusion criteria. The following were the key observations and results of the study:

1. Prevalence of SNHL was seen in 32% of the patients, i.e., 64 patients)



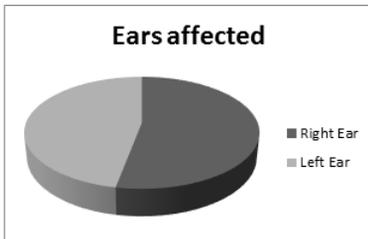
Graph 1 (n = 200)

1. Out of the 32% of the patients who were diagnosed with SNHL, 56% were males whereas 44% were female patients



Graph 2 (n = 64)

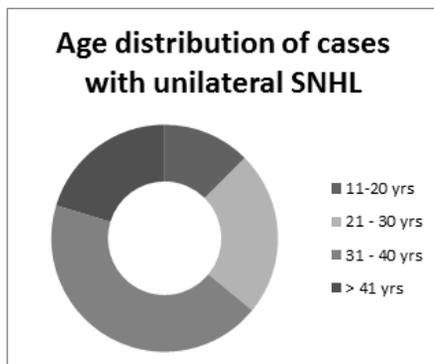
3. No significant difference in the presentation of the disease in right or left ear.



Graph 3 (n = 64)

4. Maximum number of patients (42%) presented in between the age group of 31 – 40 years.

Age of Patients	Percentage
11 – 20 year	14%
21 – 30 years	23%
31 – 40 years	42%
Table: 1	20%
>40 years	

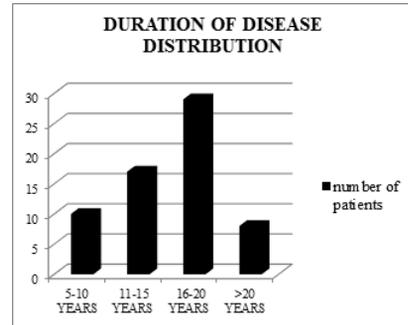


Graph 4 (n = 64)

5. 45 % of patients that presented with SNHL suffered with CSOM for 16 to 20 years.

Duration of the disease	Percentage
5-10 years	15.62%
11-15 years	26.56%
16 – 20 years	45.31%
>20 years	12.5%

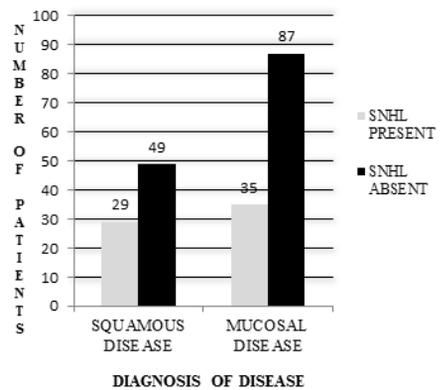
Table: 2



Graph 5 (n = 64)

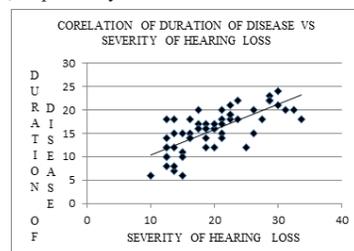
6. Of the 64 patients of SNHL, 35 patients (54%) were of Mucosal variety and 29 patients(46%) were of Squamous variety.

PATHOLOGY OF DISEASE PRESENTING WITH SNHL	
<b>SQUAMOUS TYPE</b>	
29 patients	Present
49 patients	Absent
<b>MUCOSAL TYPE</b>	
35 patients	Present
87 Patients	Absent



Graph 6 (n = 200)

In light of the above, it was observed that on correlating the duration of disease and average PTA bone conduction threshold, a positive correlation was found with the Spearmans correlation r value being 0.750, p=0.01. Additionally, a positive correlation was also seen between the duration of disease and severity of hearing loss among Squamous and Mucosal variety, with r values of 0.644, p=0.01 and 0.850, p=0.01, respectively.

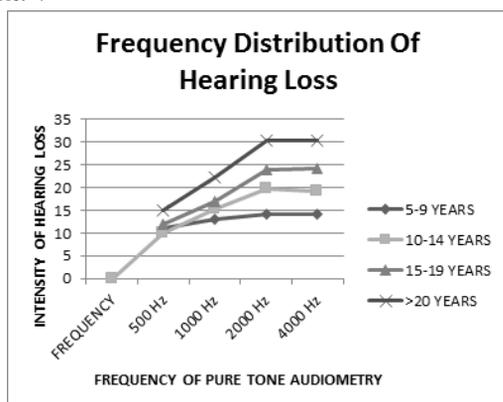


**Graph 7**

1. It was also found that bone conduction threshold increased with the duration of the disease with a more pronounced effect at 2000 Hz and 4000 Hz.

DURATION OF DISEASE	5-9 YEARS	10-14 YEARS	15-19 YEARS	<20 YEARS
FREQUENCY	MEAN BONE CONDUCTION THRESHOLD			
500 Hz	11	10	11.89	15
1000Hz	13	15.28	16.8	22.3
2000 Hz	14	19.7	23.96	30.22
4000 Hz	14	19.1	24.13	30.38

Table: 4



**DISCUSSION**

Firstly, this study has revealed a direct correlation between CSOM and SNHL. For the purposes of this study, SNHL has been understood to mean a case where the difference in the average bone conduction threshold between the diseased ear and the control ear was more than or equal to 10 DB. With that definition of SNHL, this study revealed that 32% patients (i.e., 64 out of the 200 patients) presented with unilateral SNHL.

The results of this study are also inconsonance with the study conducted by Kamaljit Kaur et al (2003) which showed a direct correlation between CSOM and SNHL and saw a prevalence of SNHL in 24% of its patients. Similar results were obtained by some internationally acclaimed investigators including Bluvstein (1963) and Levine (1989) who found the prevalence of SNHL at 34.6% and 37.2% respectively and also reported a direct correlation between CSOM and SNHL. Kaplan et al (1996) reported that CSOM has little effect on the cochlear function.

Secondly, this study observed that the majority of patients who presented with SNHL were between the age group of 31 - 40 years. Insofar as the data of the patients is concerned, the overall distribution of the age spectrum in our study was from 16 years to 44 years whereas the mean average age was 33.37 years. A study by Ahmed Raquib et al (2009) concluded the mean age at 31.1 years. This age range was also similar in studies by Paparella et al (1984). However, in the study conducted by Kirtane MV et al (1985) and Cussimano (1989), the mean average was around 24 years and 19.35 years, respectively, which is not in tune with our study. Thirdly, this study has also showed that patients presenting with untreated CSOM for more than 16 years had a stronger tendency to develop SNHL. This aspect has also been investigated in the past where in Walby (1983) found that one third of his patients suffered from SNHL after 10 years of the onset of the disease. Similarly Levine (1989) had found mean duration of presentation to be 11 years. Slightly higher mean duration of illness (13.477 years) was also reported by Cussimano (1989). The study of Neeraj Kasliwal et al (2004) however reported lower durations at 2-5 years.

Fourthly, in our study of 200 patients of unilateral CSOM, 61% (122 patients) presented with mucosal disease and 39% (78 patients) presented with squamous disease. SNHL was present in 29% of the mucosal type and 37% of the squamous type.

Fifthly, our study inferred that bone conduction threshold increased with duration of disease and that the effect is more pronounced at 2000Hz and 4000 Hz. Even Neeraj Kasliwal et al (2004) found significant average bone conduction threshold of 27 dB at higher frequencies e.g. 2000Hz and 4000Hz. This data also correlates with that of Paparella (1984), which showed SNHL of 19 - 33 DB across these frequencies in ears with chronic infections.

Finally, co-relation of duration of disease with severity of hearing loss is positive, with r value of 0.750, p value 0.01. Past concurring literature on this aspect include Vartainen (1987), Levine (1989), Cussimano (1989), Ho (1990), Vartiainen (1995), Eiseman (1998), which in fact show a more significant hearing loss in patients with unsafe CSOM.

**CONCLUSION**

The present study has thrown light upon the incidence and prevalence of the hidden factors of SNHL among patients of CSOM. This study may assist an otologist to be mindful of the fact that patients presenting with CSOM may also have co-existent SNHL, possibly due to damage of the middle ear. Such conditions need to be judiciously attended to within time to prevent any irreparable loss and at to provide the patient with the best possible audiological outcome(s). Given the outcomes of this study, in our view, it is absolutely imperative that an early diagnosis is made and appropriate medical care is given in order to prevent the cumulative damage to the inner ear due to CSOM which if progressed, may create irreversible hearing loss.

Moreover, further research needs to be done to look at the aspect of recovering the loss component by, newer technologies like neural regeneration factors like stem cell therapy, interferons etc. which are promising advancements in the field. Clinical application of such technological innovation would probably help eradicate the incidence of SNHL due to long standing CSOM.

1. Neeraj Kasliwal, Sanjeev Joshi, S. M. Pareek. Determinants of Sensorineural Hearing Loss in Chronic Middle-Ear Disease. Indian J Otolaryngol Head Neck Surg. 2004; 56(4): 269-273.
2. Report on prevalence and Aetiology of hearing impairment. ICMR. New Delhi 1983.
3. Ahmed Raquib, Ahmmad Taous, Rojibul Haque. Sensorineural Component in Chronic Suppurative Otitis Media. Bangladesh J Otorhinolaryngol. 2009; 15(2): 69-74.
4. Paparella MM, Hirade OM, Brady D. Pathology of Sensorineural Hearing Loss in Otitis Media. Ann Otol Rhinol Laryngol. 1972; 81: 632-647.
5. Supra note 2
6. Kamaljit Kaur, Nishi Sonkhya, A.S Bapna. Chronic Suppurative Otitis Media and Sensorineural Hearing Loss: Is there a correlation? Indian J Otolaryngol Head Neck Surg. 2003; 55(1): 21-24.
7. Ibid
8. Levine BA, Shelton C, Berliner KI, Sheey JL. Sensorineural Hearing Loss in Chronic Otitis Media, Is it clinically significant? Arch Otolaryngol Head Neck Surg. 1989; 115(7): 814-816
9. Kaplan DM, Fliss DM, Kraus M, Dagan R, Leiberman A. Audiometric Findings in Children with Chronic Suppurative Otitis Media without Cholesteatoma. Int J Pediatr Otorhinolaryngol 1996; 35(2): 89-96.
10. Supra note 3
11. Kirtane MV, Merchant S N, Rajee A R, Zantye S P, Shah K L. Sensorineural Hearing Loss in Chronic Otitis Media- A statistical evaluation. J Postgrad Med 1985; 31: 183
12. Cussimano F, Cocita VC, D'Amico A. Sensorineural Hearing loss in Chronic Otitis Media. J Laryngol. Otol. 1989; 103: 158-163
13. Walby AP, Barrera A and Schunecht HF. Cochlear Function in Chronic Suppurative Otitis Media. Ann.
14. Otol. Rhinol. Laryngol. 1983; 92 (Suppl. 103): 3-19.
15. Paparella MM, Morizono T, Le CT, Mancini F, Sipila P, Choo YB, Liden G, Kim C.S. Sensorineural hearing loss in otitis media. Ann Otol Rhinol Laryngol. 1984; 93: 623-9.
16. Vartainen E and Karjalainen S. Factors influencing Sensorineural Hearing Loss in Chronic Otitis Media. Am. J. Otolaryngol. 1987; 8: 13-15
17. Ho KY, Chen YK, Juan KH. Sensorineural Hearing Loss in Chronic Otitis Media. The Kaohsiung Journal of Medical Sciences 1991; 7(9): 460-465
18. Vartiainen E, Vartiainen J. Age and Hearing function in patients with Chronic Otitis Media. J Otolaryngol. 1995; 24(6): 338-9
19. Eisenman DJ, Parisier SC. Is Chronic Otitis Media with Cholesteatoma associated with Neurosensory Hearing Loss? Am J Otol. 1998 Jan; 19(1): 20-5