# SENSORINEURAL HEARING LOSS AND IT'S SEVERITY IN PATIENTS SUFFERING FROM LONGSTANDING AURAL SUPPURATION – AN EXPERIENCE AT A TERTIARY CARE TEACHING HOSPITAL

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## ABSTRACT

**Objective:** The aim of the study is to; Determine the frequency of sensorineural hearing loss in patients suffering from chronic suppurative otitis media. Quantify the severity of sensorineural hearing loss in relation to the duration of aural suppuration.

**Methods:** This study was conducted in the Department of ENT at Hayatabad Medical Complex, Peshawar, during the period from July 1, 2018 to January 31, 2019. Patients presenting with ear discharge were included in the study to determine the frequency of SNHL and its severity in relation to the duration of suppuration. The severity of sensorineural hearing loss was categorized into mild, moderate, severe and profound.

**Results:** Out of a total of 150 patients, there were 85 males and 65 females. The ages ranged from 12 to 40 years with a mean age of 23.76 years and a standard deviation of +/- 8.173. Sensorineural hearing loss was diagnosed in 36.7% of patients presenting with chronic otorrhoea. "Moderate" degree of hearing loss was recorded in 18.7%.

**Conclusions:** Chronic suppurative otitis media causes sensorineural hearing loss in addition to conductive hearing loss. As SNHL is irreversible in most cases, therefore, prompt and timely treatment of this condition can prevent sensorineural hearing impairment.

**Key words:** Suppurative Otitis Media, Hearing Impairment, Sensorineural Hearing Loss.

## INTRODUCTION

Chronic suppurative otitis media (CSOM) is a source of significant morbidity and is defined as purulent discharge from the ear and a permanent perforation in the tympanic membrane. Chronic suppurative otitis media (CSOM) is either one episode of purulent discharge persisting for more than 12 weeks or recurrent acute attacks of aural suppuration[1]. There are two types of CSOM; mucosal disease and squamous disease. The latter is associated with cholesteatoma.

Chronic suppurative otitis media affects 65-330 million people worldwide, mainly in the developing countries. It is estimated that 50-85% of children experience at least one episode of acute otitis media by the age of 3 years constituting a major risk factor for the development of CSOM[2,3]. A recent systemic review estimates that there are 709 million new cases of acute otitis media with greater than half occurring in children under 5 years. There are 31 million new cases of CSOM with 22.6% occurring in children under 5 years. The review also estimated that otitis media related hearing loss was present in 30.82 per 1000 population[4]. According to the WHO estimates, worldwide 21000-28000 people die because of chronic suppurative otitis media. Mortality is typically associated with CSOM rather than other types of otitis media[5].

Hearing loss occurring as a result of perforated tympanic membrane or ossicular chain disruption is of the conductive variety. However there is recent evidence that sensorineural hearing loss (SNHL) co-exist with conductive hearing loss (CHL) which suggest cochlear damage in the process[6]. Papp et al., 2003; da Costa et al.,2009; Kolo et al.,2012; Yang et al.2014 have demonstrated that CSOM can cause SNHL in addition to CHL. The inflammatory substances and bacterial toxins can diffuse through the round window membrane and can damage the outer hair cell in cochlea. The damage to hair cells usually results in permanent hearing loss[7-10].

The incidence of sensorineural hearing loss varies greatly but the generally accepted value ranges from 10-24%. Kaur K and colleagues found an incidence of 24% of SNHL in patients suffering from chronic suppurative otitis media whereas de Avezdo and colleagues recorded the same at 13%[11,12]. The recent advances in biomedical technology, availability of modern equipments, diagnostic facilities and advances in surgical

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techniques have helped greatly to reduce the rate of complications due to chronic suppurative otitis media.

Hearing loss in association with chronic suppurative otitis media is assessed in the usual manner. Pure tone audiometry is readily available and can determine the type and quantity of hearing loss by determining the pure tone thresholds both for the air and bone conduction. Otomicroscopy and lately, oto-endoscopy is carried out to assess the extent of damage caused by disease. CT and MR imaging modalities are helpful in determining the true anatomical extent of disease, erosions and intracranianial or extracranial extension of the disease.

The aim of this study is to determine the frequency of sensorineural hearing loss in patients suffering from recurrent episodes of chronic suppurative otitis media and also determine its severity in relation to the duration of aural suppuration.

## METHODOLOGY

**Objective:** The aim of the study is to;

1. Determine the frequency of sensorineural hearing loss in patients suffering from chronic suppurative otitis media.
2. Quantify the severity of sensorineural hearing loss in relation to the duration of aural suppuration.

**Place and duration of study:** This prospective study was conducted at the Departments of ENT and Head & Neck Surgery, Hayatabad Medical Complex, Peshawar from July 1, 2018 to January 31, 2019.

**Sample Size:** A total of 150 patients presenting with chronic suppurative otitis media were examined.

**Study Design:** It was a prospective and descriptive study using the non-probability consecutive sampling technique.

### *INCLUSION CRITERIA*

1. Patients in the age range of 12 - 40 years.
2. Patients belonging to both the sexes.
3. Patients presenting with unilateral or bilateral CSOM.
4. Patients having recurrent attacks of CSOM or one attack lasting for more than 12 weeks.

### *EXCLUSION CRITERIA*

1. Patients with acute otitis media or suppuration due to otitis externa.
2. Patients who are suffering from intracranial or extracranial complications due to CSOM.
3. Patients who have undergone mastoidectomy, myringoplasty and tympanoplasty.
4. Patients who have traumatic tympanic membrane perforations.
5. Patients with CSOM who are deaf and mute and/ or mentally retarded.
6. Patients with healed tympanic membrane perforations.

### *Data Collection Procedure*

Patients were included in the study in accordance with the laid down criteria. The procedure was explained and Informed consent obtained. Ethical approval was obtained from the institutional ethical committee. A detailed history was obtained about the ear discharge regarding its onset, laterality, duration, severity, persistence, aggravating & relieving factors. Associated symptoms like hearing impairment, tinnitus, vertigo, sore throat, nasal obstruction, nasal discharge, postnasal discharge and epistaxis were enquired into. Detailed ENT examination was performed. The ears were examined using otoscopy, otoendoscopy and otomicroscopy where appropriate. The condition of tympanic membrane and middle ear mucosa noted. Cholesteatoma searched for and the type of membrane perforation noted. The discharge was examined for odour, amount, colour and consistency. Pus was sent for culture and sensitivity testing when there was no response to empirical antibiotic treatment. No distinction was made in CSOM with or without cholesteatoma in as much as analysis of data was concerned. The Nose was examined for any discharge, inflammation and pathology. The paranasal sinuses were palpated to elicit tenderness. The nasopharynx was examined for enlarged adenoids or other masses. The oral cavity and oropharynx were examined for inflammation of mucosa, tonsils and pharyngeal wall. X-Ray sinuses and x-ray nasopharynx were obtained where indicated. Other imaging studies such as CT and MRI were employed when there was a suspicion of complications due to CSOM. Base line hematological investigations were also carried out when indicated. All the patients underwent pure tone audiography (PTA) for assessment of hearing. The pure tone thresholds both for air and bone conduction were obtained over the frequency range of 250 Hz, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz to identify the type and amount of hearing impairment. Hearing impairment was categorized into either; 1. Conductive Hearing Loss (CHL); Normal BC curve with A-B gap of equal to or more than 15dB and 2. Sensorineural Hearing Loss (SNHL); Bone Conduction > 25dB and no Air-Bone gap or Air-Bone gap of > 15 dB. The average of bone conduction thresholds over the frequency range 500 Hz, 1000 Hz, 2000Hz and 4000 Hz was calculated to determine the amount of sensorineural hearing loss in the affected ear. Considering 0-25dB as normal bone conduction (BC) threshold, the severity of sensorineural hearing impairment was categorized into; a. Mild; 26-40 dB b. Moderate; 41-55 dB c. Severe; 56-91 dB

d. Profound; >91 dB. In cases of bilateral CSOM; a. With SNHL in both ears, the worst ear was considered for the purpose of analysis and b. Conductive loss in one ear and sensorineural loss in the other ear; the ear with SNHL was considered for analysis. The duration of suppuration was recorded and CSOM was labeled as recurrent or persistent when the patient had otorrhoea for 2-6 weeks/ year. The duration of disease was recorded as reported by patients or in case of children, by their parents. Duration of disease was categorized into small groups for the purpose of analysis.

### *Statistical Analysis*

The data was recorded on a proforma and the descriptive statistics were analyzed to determine frequencies for variables like gender, age and type of hearing loss and severity of SNHL. The severity of SNHL was calculated in relation to the age groups and time duration of CSOM. The analysis was carried out using SPSS 16.0 for windows.

## RESULTS

A total of 150 patients presenting with chronic suppurative otitis media were examined. The ages of the patients ranged from 12 to 40 years with a mean age of 23.76 years and a standard deviation of +/- 8.173 as shown in Table 1. The mean duration of otorrhoea was 12.5years with a standard deviation of +/- 7.45. There were 85 males and 65 females with M:F 1.31:1 as given in Table 2. Sensorineural hearing loss was diagnosed in 36.7% of patients presenting with chronic otorrhoea (Table3). Among the patients having sensorineural hearing loss moderate degree of loss was highest at 18.7%. The cases with conductive hearing loss have been identified but not included in analysis of severity as detailed in Table 4. The commonest age group involved was 12-20 years and comprised 40% of the patients having SNHL (Table 5). The severity of SNHL in relation to various age groups has been documented in Table 6. Mild degree of sensorineural hearing loss was common in otorrhoea of lesser duration. Severe degree of hearing loss was found in otorrhoea of longer duration as shown in Table 7. Tests of significance showed that sensorineural hearing loss was present in a significant number of patients with CSOM (p-value <0.05). There was no positive correlation of severity of sensorineural hearing loss with duration of chronic suppurative otitis media (p value > .05).

## DISCUSSION

Chronic suppurative otitis media is not only potentially a life threatening condition but also one of the major causes of hearing impairment in both children and adults. Conductive hearing loss occurs as a consequence of damage to the sound conducting apparatus of the ear. Sensorineural hearing loss occurs as a result of damage to the hair cells of cochlea by absorption of inflammatory mediators and bacterial toxins through the round window membrane. As cochlear hair cells have very limited ability to repair themselves; sensorineural hearing loss is usually permanent[2].

**Table 1: Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Age in Yrs | 150 | 12 | 40 | 23.76 | 8.173 |
| Valid N (listwise) | 150 | | | | |

**Table 2: Gender of Patients**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Male | 85 | 56.7 | 56.7 | 56.7 |
| | Female | 65 | 43.3 | 43.3 | 100.0 |
| | Total | 150 | 100.0 | 100.0 | |

**Table 3: Type of Hearing Loss**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | CHL | 95 | 63.3 | 63.3 | 63.3 |
| | SNHL | 55 | 36.7 | 36.7 | 100.0 |
| | Total | 150 | 100.0 | 100.0 | |

CHL= Conductive Hearing Loss
SNHL= Sensorineural Hearing Loss

**Table 4: Severity of Hearing Loss**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Mild | 17 | 11.3 | 11.3 | 11.3 |
| | Moderate | 28 | 18.7 | 18.7 | 30.0 |
| | Severe | 8 | 5.3 | 5.3 | 35.3 |
| | Profound | 2 | 1.3 | 1.3 | 36.7 |
| | CHL cases | 95 | 63.3 | 63.3 | 100.0 |
| | Total | 150 | 100.0 | 100.0 | |

CHL= Conductive Hearing Loss

**Table 5: Age Groups of Patients**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 12-15 | 30 | 20.0 | 20.0 | 20.0 |
| | 16-20 | 30 | 20.0 | 20.0 | 40.0 |
| | 21-25 | 28 | 18.7 | 18.7 | 58.7 |
| | 26-30 | 27 | 18.0 | 18.0 | 76.7 |
| | 31-40 | 35 | 23.3 | 23.3 | 100.0 |
| | Total | 150 | 100.0 | 100.0 | |

**Table 6: Age Groups * Severity of Hearing Loss Crosstabulation**

| | | Severity of HL | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | Mild | Moderate | Severe | Profound | CHL cases | |
| Age Groups | 12-15 | 1 | 0 | 0 | 0 | 29 | 30 |
| | 16-20 | 11 | 1 | 1 | 0 | 17 | 30 |
| | 21-25 | 2 | 1 | 1 | 0 | 24 | 28 |
| | 26-30 | 2 | 12 | 3 | 0 | 10 | 27 |
| | 31-40 | 1 | 14 | 3 | 2 | 15 | 35 |
| Total | | 17 | 28 | 8 | 2 | 95 | 150 |

**Table 7: Duration Range(yrs) * Severity of Hearing Loss Crosstabulation**

| | | Severity of HL | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | Mild | Moderate | Severe | Profound | CHL cases | |
| Duration Range(yrs) | 1-5 | 3 | 2 | 0 | 0 | 20 | 25 |
| | 6-10 | 6 | 2 | 0 | 0 | 36 | 44 |
| | 11-15 | 6 | 1 | 2 | 0 | 29 | 38 |
| | 16-20 | 1 | 6 | 2 | 0 | 7 | 16 |
| | 21-25 | 1 | 15 | 3 | 0 | 3 | 22 |
| | 26-30 | 0 | 2 | 1 | 1 | 0 | 4 |
| Total | | 17 | 28 | 8 | 1 | 95 | 149 |

CHL= Conductive Hearing Loss

Literature review reveals contrasting evidences as regards the type of chronic suppurative otitis media & its association with SNHL, ages of patients, duration of the disease and severity of hearing loss. However, there seems general agreement that sensorineural hearing loss does occur as a result of chronic suppurative otitis media. Fewer studies are available on this subject in our national literature.

In a study conducted at Aga Khan University hospital, Karachi, Ali Zaidi SS & colleagues found a higher incidence of 52% for SNHL in patients with chronic suppurative otitis media. They also found that the frequency of SNHL increased with increasing duration of the disease[13]. In another study conducted at Islamabad, Jan A & colleagues found a positive correlation between SNHL and suppurative otitis media and noted that bone conduction thresholds were elevated in all 53 patients over the whole frequency range tested. Mean duration of disease in their study was 12.7 years[14]. The frequency of sensorineural hearing loss as compared to our findings (36.7%) is higher in both these national studies. We observed that the severity of sensorineural hearing loss increased with duration of suppuration. However statistically this was not significant.

In 2010 in Iraq, Dekhil KR conducted a study on the association between chronic suppurative otitis media and sensorineural hearing loss. He found that CSOM related hearing loss involved frequencies in the higher range first (8000 Hz) and patients with cholesteatoma had a higher incidence of sensory loss than the tubotympanic variety[15]. Similar observations were made by Amali A & colleagues in Iran. They found significantly lower bone conduction thresholds in the affected ear for each frequency that increased with increasing frequency (7 dB at 500 Hz and 9.71 dB at 4000 Hz). There was a significant correlation between age and degree of sensorineural hearing loss but no significant correlation was observed in SNHL and duration of disease. The presence or absence of cholesteatoma and ossicular chain damage also had no relationship with sensorineural hearing loss[16]. de Avezdo & colleagues analyzed the data of 115 CSOM patients retrospectively. The average duration of disease was 12.4 years. They observed a mean increase of up to 40 dB in bone conduction thresholds of affected ears. There was positive correlation with increasing age but none was found with cholesteatoma or duration of disease[12].

Similar to the findings of our study, Kolo et al found a significant degree of SNHL in patients with CSOM but the patient age and duration of suppuration did not have any correlation with it[9]. In contrast Kaur K & colleagues and Raquib A & colleagues observed a significant relationship between SNHL and duration of CSOM[11,17].

Owing to the destructive and erosive nature of choleasteatma, it is generally considered that squamous disease is more likely to cause complications including SNHL. However a study conducted by Malashetti S & colleagues involving 105 patients with suppurative otitis media of mucosal type found SNHL in 28.57% of patients. This is comparable to the findings in suppurative otitis media due to cholesteatoma disease. They concluded that age, gender and duration of disease had no impact on degree of sensorineural hearing loss. This latter observation is also in agreement with our findings[18].

## CONCLUSION

Chronic suppurative otitis media causes sensorineural hearing loss in addition to conductive hearing loss. CSOM is a treatable cause of acquired deafness unless complicated by SNHL which is irreversible in most cases. Prompt and timely treatment of this condition can, therefore, prevent sensorineural hearing impairment.

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