



Audiogram Based Prevalence of Sensorineural Hearing Loss in Chronic Suppurative Otitis Media Patients Attending Saint Paul's Hospital Millennium Medical College Ear Nose and Throat Clinic from 2017 to 2019

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A thesis research to be submitted to Saint Paul's Hospital Millennium Medical College Department of Otorhinolaryngology, Head & Neck Surgery in partial fulfillment of the requirements for the certificate of specialty in Otorhinolaryngology, Head & Neck Surgery.

July, 2019

Addis Abeba, Ethiopia

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List of Abbreviations

ABG – Air Bone Gap

AC – Air Conduction

BC – Bone Conduction

CHL – Conductive Hearing Loss

CSOM – Chronic Suppurative Otitis Media

dB – decibel

ENT – Ear, Nose and Throat

G.C – Gregorian Calendar

Hz – Hertz

IRB - Institutional Board Review

KHz – Kilohertz

MD – Medical Doctor

MHL – Mixed Hearing Loss

MPH –Master of Public Health

PTA – Pure Tone Average

PHD – Philosophy of Doctorate

SNHL – Sensorineural Hearing Loss

SPHMMC – Saint Paul’s Hospital Millennium Medical College

WHO – World Health Organization

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Abstract

Background: Hearing loss as a sequel of chronic suppurative otitis media is often conductive, but recent studies have found an additional sensorineural component in these patients, thus demonstrating inner ear damage.

Objective: The aim of the study is to assess the prevalence of sensorineural hearing loss and describe in relation to patient's age, gender, duration of disease, and presence of cholesteatoma in patients with chronic suppurative otitis media attending Saint Paul's Hospital Millennium Medical College Ear, Nose and Throat clinic from 2017 to 2019, Addis Abeba Ethiopia

Methods: Using retrospective descriptive cross sectional study design, 121 patients with unilateral chronic suppurative otitis media between 10-60 years with clinical and audiological normal contralateral ear from Jan 2017 to Jan 2019 were studied. Patients were excluded if there was history of trauma, meningoencephalitis, chronic exposure to noise, prior ear surgery, previous ototoxic drug therapy, known comorbid illnesses like diabetes, Human Immunodeficiency Virus and family history of congenital or acquired hearing loss. Data analyzed using SPSS window version 20.0.

Results: In this study, 62 (51.2%) of patients were female and 59 (48.8%) of cases male with mean age of 29.86 ± 12.6 SD years. The prevalence of SNHL in CSOM was 26.4%. Increased prevalence with increasing age and duration of disease seen. The study showed almost similar prevalence of SNHL between Male and Female as well as between cholesteatoma and non-cholesteatoma ears.

Conclusion and recommendations: The prevalence of SNHL in patients with CSOM was 26.4% in this study and increased prevalence with longer duration of disease demonstrated. Increased prevalence with increased age of patient also seen. To prevent these irreversible sequelae through timely medical and surgical intervention providing health education to increase public awareness and expanding ENT services are recommended.. Also there is a need to conduct further prospective studies on determinant factors of SNHL in our country to reveal hidden factors behind this irreparable handicap.

Key words: Sensorineural hearing loss, CSOM, Prevalence, Ethiopia

1. Introduction

1.1 Background

Chronic suppurative otitis media (CSOM) is a common Ear, Nose and Throat (ENT) problem and still remains the commonest cause of hearing impairment which can be prevented / treated(1).

Chronic Suppurative Otitis Media (CSOM) is defined as a chronic inflammation of the middle ear or mastoid cavity, which presents with recurrent or persistent ear discharges or otorrhea through a tympanic membrane perforation(2).The WHO definition requires only 2 weeks of otorrhea, but otolaryngologists tend to adopt a longer duration, e.g. more than 3 months of active disease(3).

CSOM can be divided into safe mucosal type with permanent central perforation of pars tensa without cholesteatoma or intracranial complications and unsafe squamous type with cholesteatoma or intracranial complications. Safe mucosal type can be further subdivided into active stage with persistent ear discharge at present or within last 3 months, quiescent stage with no discharge between 3 to 6 months and inactive stage with no discharge for more than 6 months duration(2).

CSOM is considered a multifactorial disease resulting from a complex series of interactions between environmental, bacterial, host and genetic risk factors (4). The disease usually begins in childhood as a spontaneous tympanic perforation due to an acute infection of the middle ear, known as acute otitis media(AOM), or as a sequel of less severe forms of otitis media (e.g. secretory OM)(3).

If appropriate treatment is not given at the right time it leads to irreversible local destruction of middle ear structures resulting in complications such as Labyrinthitis, facial nerve paralysis, lateral sinus thrombosis, mastoiditis, meningitis, and intracranial abscess(5). In spite of the fact that the complications of CSOM can be fatal hearing impairment is regarded the main health issue(6). It often manifests itself 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 (7)

Assessment of the degree and type of hearing loss can be done by pure tone audiometry, which helps in predicting the status of tympanic membrane, ossicular chain and inner ear.

This preoperative hearing assessment is also useful in preoperative planning of the type of surgery and in counseling the patient about the expected results, hearing improvement after surgery (8).

1.2 Statement of problem

Chronic Suppurative Otitis Media (CSOM) is one of the most common causes of preventable hearing loss especially in developing countries (9). Despite Africa's large population, ear disease remains understudied on the continent. Otitis media has long been recognized as a significant contributor to hearing loss in Africa (10).

The association between chronic otitis media and sensorineural hearing loss (SNHL) has been broadly studied and remains a controversial topic (11). The conductive hearing impairment resulting from this condition has been well acknowledged in the literature (6). Recently numerous studies have reported an additional sensorineural hearing loss (SNHL) in these patients, demonstrating impaired cochlear function (1, 6, 12, 13, 14).

On most recent study by Handi et al on evaluation of hearing loss by pure tone audiometry in CSOM at Indian tertiary care hospital reported the prevalence of SNHL to be 10.9%(8). Dham et al and De Azevedo et al found a 32% and 13% prevalence of SNHL in CSOM patients, respectively(7,11).

Several studies also have investigated the correlation between SNHL with patient's age, gender, duration of the disease, and presence of cholesteatoma and ossicular erosion. Amin et al and De Azevedo reported increased prevalence of SNHL in CSOM as age of the patient increased with statistical significant association(11,12).But Sharma et al and Kolo et al reported no correlation with age(1,6). Studies by Nanda et al and Dham et al described no difference between Male and Female in prevalence of SNHL in CSOM patients (2, 7).

Dham et al reported increased prevalence of SNHL as duration of CSOM is prolonged with positive correlation (7).Correlation with disease duration was also significant in many studies (2, 14, 15, 16). However some recent studies didn't show any association between disease duration and SNHL (1, 6, 11, 12).

Kasliwal N. et al found the presence of cholesteatoma was significantly correlated with severity of SNHL in CSOM cases (14). However, Sharma et al found greater SNHL in cholesteatoma ears but there was no statistically significant association (1). Studies by Azevardo et al and Amali et al also revealed no association (11, 12).

Kaur et al in their study concluded more Audiologic studies in patients with CSOM are needed to evaluate the sensorineural component of hearing loss (16). The need on further studies is also advocated by other researchers (1, 12).

1.3 Significance of the study

Despite heavy burden CSOM and its complications in developing countries like Ethiopia there is no research done on the magnitude and different aspects of the problem so far. Besides recent literatures from different parts of the world demonstrated the presence of SNHL in some CSOM patients. There is inconsistency in their results with regard to the magnitude of SNHL and associated factors. Therefore in this study we aimed to assess the prevalence of SNHL in CSOM and describe related factors among patients with CSOM at SPHMMC ENT clinic, Addis Ababa, Ethiopia.

The results of the study will be used as baseline information by local health policy makers and other responsible bodies to emphasize the need for implementing preventive measures and allocating appropriate resource to improve ENT services. It will also initiate further researches in the area and be utilized as a reference for future researchers.

2: LITERATURE REVIEW

2.1 Burden of CSOM and its impact

Chronic suppurative otitis media (CSOM) has assumed a world-wide importance (6). According to the World Health Organization (WHO), about 330 million individuals, globally, suffer from CSOM. 60% of these suffer from significant hearing impairment. CSOM accounts for 28 000 deaths and a Disease burden of over 2 million Disability adjusted Life Years (3). Hearing loss is a public health problem in developed and developing countries. Hearing loss causes impaired language development and speech skills in children and poorer life quality and psychological problems for adults (12).

Chronic Suppurative Otitis Media (CSOM) is one of the most common causes of preventable hearing loss especially in developing countries (9). Countries in the South-east Asia and Western Pacific regions, Africa, and several ethnic minorities in the Pacific Rim bear Over 90% of the burden (3).

Despite Africa's large population, ear disease remains understudied on the continent. Otitis media has long been recognized as a significant contributor to hearing loss in Africa (10). The WHO using higher prevalence rates estimates that, in Africa, 25.3 million people have CSOM 50% of whom may have hearing impairment, with estimated regional prevalence of 4.2% and accounting for almost 7.7% of the global CSOM burden.(3)

At a recent WHO meeting of experts from 15 African countries, CSOM was considered the most common cause of persistent mild to moderate hearing impairment among children and young people in developing countries. In Nairobi, Kenya, hearing loss was found in 64% of schoolchildren with CSOM and in only 3.4% of children without CSOM. However, the estimates for Africa are based on a very limited evidence base, as the review included only 11 studies (8 published and 3 unpublished), all of which relied on school-based hearing screenings (3).

Besides the lack of data on prevalence of hearing impairment in Africa, little is known about causes required to inform which prevention and treatment services are needed. Thus, 'hard data' are needed on prevalence, causes and impact of hearing impairment in the general population, and on services available to people with hearing impairment. Such data will help inform appropriate planning of policies and services and evidence based advocacy for people with hearing impairment in low- and middle-income countries (17).

2.2 Pattern of hearing loss in CSOM

Hearing loss in CSOM is regarded the main health issue(6). It often manifests itself 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 (7)

Paparella described the impact of 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 causing SNHL (18).Co-morbid conditions like diabetes, immune-compromised conditions, autoimmune diseases, hypoproteinemia and prolong steroid therapy also add to the causation of SNHL (7).There have been different studies on the subject, many clinical and some histological one to correlate the association between SNHL and CSOM. This question still remains controversial (13).

The majority agree that CSOM is associated with some degree of SNHL (13). Recently numerous studies have reported an additional sensorineural hearing loss (SNHL) in these patients, demonstrating impaired cochlear function (1, 6, 12, 13, 14).The question of concern is whether this SNHL due to CSOM is significant clinically. Another question is whether the type of disease, its severity, age of the patient and duration correlates with the severity of SNHL (11, 13).

2.3 Magnitude of SNHL in CSOM and related factors

2.3.1 Frequency of SNHL in CSOM

Several studies on the subject described varying frequencies of SNHL in CSOM among different countries. A retrospective study of 115 cases with unilateral CSOM in 2007 by Azevedo et al from Brazil showed the frequency of SNHL was 13% (11). Another cross sectional study from Dhaka by Raquib et al 2009 reported 10% prevalence of SNHL in CSOM ears (15).

An increased frequency of SNHL was reported by Deviana et al from Jakarta in 2013 and Nanda et al from India in 2015 as 27% & 21%, respectively(2, 9). Another prospective cross sectional study from South India by Dham et al in 2017 reported a highest prevalence of 32% SNHL in CSOM(7).

The most recent audiogram based cross sectional study of hearing loss in chronic suppurative otitis media patients in India tertiary hospital in 2018 found prevalence of mixed hearing loss

in 10.9% cases. The study reinforces using preoperative pure tone audiometry, which not only helps in planning surgery but also helps in documenting the preoperative status of patients' sensorineural hearing loss, if present (8).

2.3.2 SNHL in CSOM in relation to age, gender and duration of CSOM

Amin et al and De Azevedo reported increased prevalence of SNHL in CSOM as age of the patient increased with statistical significant association(11, 12).But Sharma et al and Kolo et al reported no correlation with age(1, 6). Studies by Nanda et al and Dham et al described no difference between Male and Female in prevalence of SNHL in CSOM patients (2,7).

Dham et al reported increased prevalence of SNHL as duration of CSOM is prolonged with positive correlation (7).Correlation with disease duration was also significant in many studies (2, 12, 15, 16). However some recent studies didn't show any association between disease duration and SNHL (1, 6, 11, 12).

2.3.3 SNHL in CSOM in relation to cholesteatoma

Some studies do not differentiate between CSOM with and without cholesteatoma (2, 7, 13, 16). Others assessed CSOM considering the presence or absence of cholesteatomas separately (1, 11, 12, 14).

Kasliwal N. et al found the presence of cholesteatoma was significantly correlated with severity of SNHL in CSOM cases (14). However, Sharma et al found greater SNHL in cholesteatoma ears but there was no statistically significant association (1). Studies by Azevardo et al and Amin et al also revealed no association (11, 12).

3: Objectives

3.1 General objective:

- To assess the prevalence of SNHL and describe related factors among patients with CSOM from Jan 2017 to Jan 2019 G.C at SPHMMC ENT clinic, Addis Ababa, Ethiopia

3.2 Specific objectives:

- To describe the prevalence of SNHL in relation to age among patients with CSOM from Jan 2017 to Jan 2019 G.C at SPHMMC ENT clinic , Addis Ababa, Ethiopia
- To describe the prevalence of SNHL in relation to sex among patients with CSOM from Jan 2017 to Jan 2019 G.C at SPHMMC ENT clinic, Addis Ababa, Ethiopia
- To describe the prevalence of SNHL in relation to duration of disease among patients with CSOM from Jan 2017 to Jan 2019 G.C at SPHMMC ENT clinic, Addis Ababa, Ethiopia
- To describe the prevalence of SNHL in relation to presence of cholesteatoma among patients with CSOM from Jan 2017 to Jan 2019 G.C at SPHMMC ENT clinic, Addis Ababa, Ethiopia

4: Methodology

4.1. Study Area

This study was conducted at St Paul's Hospital Millennium Medical College ENT clinic, Addis Abeba, Ethiopia. St Paul's Hospital Millennium Medical College department of Otolaryngology-Head & Neck surgery serves as one of the 3 ENT surgery referral centers in the country. It has 1 separate operation theater, a ward with 10 beds, 3 outpatient department clinics and 1 audiology unit. The department has 1 head and neck oncologic surgeon subspecialist, 1 otology subspecialist, and 4 general ENT surgeons. And currently there are total of 16 residents from 1st to 4th year in its post graduate program in Otorhinolaryngology, Head and Neck surgery. The estimated monthly average outpatient department patient flow is 1350 and about 40 major operations are done. And the rough estimate of patients with chronic suppurative otitis media to the OPD clinics is about 50 new patients with CSOM per month. Most patients with CSOM are from Addis Ababa and it receives CSOM patients from almost all the regional states of the country and where the patients are managed and followed up.

4.2. Study design and period

A retrospective descriptive cross sectional study from Jan 2017 to Jan 2019 G.C

4.3. Population

4.3.1 Source population:

- All patients with CSOM who attended SPHMMC ENT clinic from Jan 2018 to Jan 2019 G.C.

4.3.2 Study population:

- Selected patients with CSOM who attended SPHMMC ENT clinic from Jan 2017 to Jan 2019 G.C.

4.3.3 Inclusion criteria

- Presence of unilateral otorrhea lasting at least for 3 months and tympanic membrane perforation on otoscopy; Patients with unilateral CSOM only were included so as to indicate infection as a cause, rather than other possible etiologies in causing SNHL.
- Normal tympanic membrane in contralateral ear based on otoscopy and normal audiogram measure. The use of unilateral CSOM cases with a normal

contralateral ear eliminates common variables like Presbycusis, parenteral ototoxic medications, metabolic disorders, and the effect of sex or genetics.

- Patients with age ranging from 10–60 years. Children below 10 years were excluded as they were expected to be uncooperative for accurate testing. Also above 60 years, there is a possibility of an element of Presbycusis.

4.3.4 Exclusion criteria

- Patients were excluded if they had a history of head trauma or traumatic tympanic membrane perforation, meningoencephalitis, chronic exposure to noise, prior ear surgery, previous ototoxic drug therapy, and family history of congenital or acquired hearing loss to avoid confounding factors.

4.4 Sample size determination

- The sample size was determined using single proportion formula;

$$n = Z^2 p(1-p)/d^2 ; \quad n = 150$$

P was taken as 10.9% by considering prevalence of SNHL in CSOM from recent study in ENT tertiary care hospital in India in 2018(8) since there was no similar study in our country or Africa.

- Confidence interval of 95% is taken making $Z = 1.96$

Marginal error (d) = 5%

Since the source population was less than 10,000, the following correction formula was done;

$$nf = n / (1 + n / N) \quad nf = 133$$

nf - corrected sample size n- Uncorrected sample size= 150

N(total number of source population i.e. patients with CSOM during the study period) = 1200

- Total estimated sample size was 133.

4.5. Sampling technique:

- Purposive sampling technique was used to select patients with CSOM based on the inclusion and exclusion criteria. Though the estimated sample size was 133, only 121 patients fulfilled the criteria and all were included in the study.

4.6. Study variables

- Age
- Sex
- Duration of disease
- Presence of cholesteatoma
- Sensorineural Hearing loss(SNHL)

4.7. Data collection procedure

Data was collected retrospectively from Feb 2019 to March 2019. Medical records of patients who underwent audiometric measurement, from Jan 2017 to 2019 G.C, were retrieved from audiogram registration log book. A total of 253 patients' medical records with unilateral CSOM identified, checked for completeness of data, screened for inclusion and exclusion criteria. Finally data was collected on 121 patients that fulfilled the criteria. Data on age, gender, clinical presentation, duration of ear disease, and PTA results was collected. The presence of cholesteatoma was assessed based on clinical diagnosis and temporal bone CT scan reports. Air conduction and Bone conduction (BC) hearing thresholds for diseased ear at frequencies 500, 1000, 2000, and 4000 Hz were extracted to assess type of hearing loss.

4.8. Operational definitions

- **Air Conduction (AC):** is an individual's hearing threshold of a pure tone stimulus (sound wave) through air using headphones or ear inserts. Air conduction tests the outer, middle, and inner ear.
- **Bone Conduction (BC):** is an individual's hearing threshold of a pure tone stimulus (sound wave) through a bone oscillator. Bone conduction bypasses the outer and middle ear and tests only the inner ear.
- **Pure Tone Average (PTA):** is the sum of hearing thresholds of pure tones at 500 Hz, 1000 Hz and 2000 Hz divided by 3
- **Air bone gap (ABG):** if PTA of AC is greater than 10db that of PTA of BC
- **Normal hearing:** if PTA air conduction (AC) and bone conduction (BC) are in the normal range (≤ 25 dB), with no Air-Bone Gap

- **Sensorineural Hearing loss (SNHL):** Pure Tone Average (PTA) result that shows Hearing level of 25 dB and above, with no Air-Bone Gap
- **Conductive hearing loss (CHL):** Pure Tone Average (PTA) result that shows Hearing level of 25 dB and above, with Air-Bone Gap
- **Mixed hearing loss (MHL):** if the BC thresholds are raised above 25 dB HL and there is a significant Air-Bone Gap (greater than 10 dB)
- **Cholesteatoma:** Keratinizing squamous epithelial growth of the middle ear or mastoid
- **Prevalence of Sensorineural Hearing loss in CSOM:** The proportion of diseased ears showing MHL in the study population.
- **Degree of hearing loss:** the level of PTA results in study participants having levels above 25 dB, to be graded as follows;

Degree of hearing loss	PTA (dB)
Mild	26 – 40
Moderate	41 – 55
Moderately severe	56 – 70
Severe	71 - 90
Profound	> 90

4.9. Data quality control

Data was collected retrospectively by principal investigator and trained year three ENT residents. Data collectors were trained on inclusion and exclusion criteria and data collection process beforehand. Data collection checklist was prepared including patient ID, age, sex, clinical presentation, Otoscopic finding and audiogram result (Annex). Data collectors were trained on inclusion and exclusion criteria and data collection process beforehand. Completeness of data was cross checked throughout data collection period by personal investigator.

Audiometric measurements were done in a sound proof booth in quite surrounding to ensure no bias of results occur due to environmental Noise masking. Audiometric Evaluations were done with same calibrated Amplivox 270 diagnostic audiometers and by audiology trained nurse, to avoid evaluator bias.

Audiometric measurements were checked if narrow band masking was used whenever appropriate. Before feeding the data into computer, it was checked for completeness and accuracy.

4.10. Data processing and analysis:

Collected data was checked for completeness, coded and entered to a computer and analyzed using SPSS window version 20.0. Results are tabulated in relevant tables and figures and chi-square test was done to assess significance of associations. A P-value of <0.05 was considered statistically significant. Conclusions and recommendations have been made based on the results.

4.11. Ethical consideration

Ethical clearance was obtained from SPHMMC Institutional Board Review (IRB). Then the obtained letter of permission has been given to audiology unit and the medical record keeping personnel for consent before data collection. Patients' information during and after the study were kept confidential.

5. Result

5.1 Socio-demographic characteristics

The number of female patients was 62(51.2%) and male patients was 59 (48.8%) in the study. The mean age of the patients was 29.86 ± 12.6 SD years with the age group of 21-30 years accounting for greater proportion (34.7%, n=42)(Table 1).

Table 1: Age and sex distribution of patients with CSOM at SPHMMC ENT clinic, Addis Abeba 2019

Variable	Frequency(N)	Percent (%)
Age (In years)		
10 -20	33	27.3
21 -30	42	34.7
31 -40	20	16.5
41 -50	16	13.2
51 -60	10	8.3
Sex		
Male	59	48.8
Female	62	51.2

5.2 Patients clinical presentation and type of CSOM

Mode of clinical presentation demonstrates that ear discharge was the commonest symptom followed by decreased hearing, tinnitus, ear pain & dizziness. The duration of illness was <2 years for most, 38 (31.4%) patients, while 28 patients (23.1%) had ≥ 10 years duration. The type of disease was CSOM without cholesteatoma in 90(74.4%) of diseased ears and 31 (25.6%) of cases had diagnosis of cholesteatoma (Table 2).

Table 2: Distribution by clinical presentation, duration of disease of and type of CSOM in patients with CSOM at SPHMMC ENT clinic, Addis Abeba 2019

Variable	Frequency (N)	Percent (%)
Presenting complaint		.
Decreased hearing	111	91.7
Ear discharge	117	96.7
Ear pain	25	20.7
Tinnitus	53	43.8
Dizziness	15	12.4
Duration of disease		
< 2 years	38	31.4
2 – 4 years	29	24.0
5 – 9 years	26	21.5
≥ 10 years	28	23.1
Type of CSOM		
Cholesteatoma	31	25.6
Non cholesteatoma	90	74.4

In the study 64(53%) of patients had CSOM on the right ear and 57(47.1%) patients on the left ear (Figure 1).

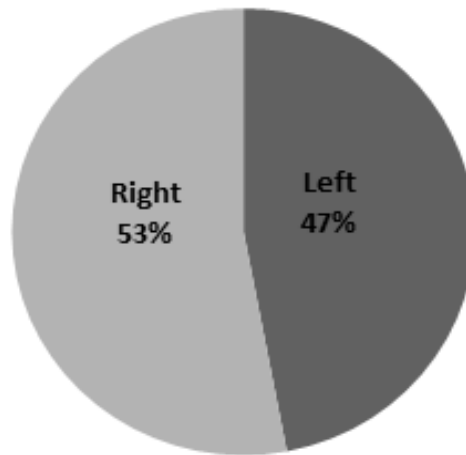


Figure 1: Side of affected ear by CSOM in patients with CSOM at SPHMMC ENT clinic, Addis Abeba 2019

5.3 Prevalence of SNHL and related factors

Analysis of type of hearing loss in the study revealed the prevalence of SNHL was 26.4 % (32 out of 121 patients). Type of hearing loss was CHL in 88 (73.7%) patients. The Prevalence of SNHL in CSOM ears in relation to age showed highest prevalence in 41- 50 years (50%) followed by 41-60 years and 31 -40 years age group and least prevalence 8(19%) in 21 – 30 years age group. However no statistically significant association between age and prevalence of SNHL seen ($P= 0.171$)(Table 3).The prevalence of SNHL in Female patients was 18(29%) and in Male 14 (23.7%).There was no statistically significant association between gender and prevalence of SNHL in this study ($P = 0.509$).

Table 3: Prevalence of SNHL in CSOM ears in relation to age of patients with CSOM at SPHMMC ENT clinic, Addis Abeba 2019.

Age group in years	Total number of patients	Number of Patients with SNHL	Percentage of patients with SNHL (%)	Pearson Chi-Square test
10 – 20	33	7	21.2	0.171 df=4
21 – 30	42	8	19	
31 – 40	20	6	30	
41 – 50	16	8	50	
51 - 60	10	3	30	

This study showed prevalence of SNHL in CSOM ears in patients with longer duration of disease was highest for ≥ 10 years (46.4%) and least for < 2 years (10.5%). Pearson Chi-Square test for relation of duration of disease and the prevalence of SNHL in CSOM ears showed significant association ($P = 0.007$). (Table 4).

Table 4: Prevalence of SNHL in CSOM ears in relation to duration of disease of patients with CSOM at SPHMMC ENT clinic, Addis Abeba 2019.

Duration of disease	Total number of patients	Patients with SNHL	Percentage (%)	Pearson Chi-Square test
< 2 years	38	4	10.5	0.007 df=3
2 – 4 years	29	6	20.7	
5 - 9 years	26	9	34.6	
≥ 10 years	28	13	46.4	

Regarding the relation of presence of cholesteatoma and the prevalence of SNHL the study showed almost equal prevalence between cholesteatoma ears and CSOM ears without cholesteatoma with no statistical association ($P= 0.925$) (Table 5).

Table 5: Prevalence of SNHL in CSOM ears in relation to presence of cholesteatoma in patients with CSOM at SPHMMC ENT clinic, Addis Abeba 2019

Type of CSOM	Total number of patients	Patients with SNHL	Percentage (%)	Pearson Chi-Square test
Cholesteatoma	31	8	25.8	0.925 df=1
Non cholesteatoma	90	24	26.7	

6. Discussion

This study included 121 patients with unilateral CSOM with clinically and audiological normal contralateral ear to ascribe the SNHL in diseased ear only to the CSOM by excluding confounding systemic conditions like Presbycusis, metabolic, genetic and congenital factors. The study used a criteria of pure tone average of bone conduction threshold at 0.5khz , 1khz and 2khz > 25db in CSOM ears to define SNHL.

This study found that the prevalence of SNHL in our patients to be 26.4%. The result is comparable with a hospital based observational descriptive study in Indonesia that reported 27% prevalence of SNHL in CSOM (9). However the prevalence in this study was lower to other hospital based study done in India that showed 32% prevalence of SNHL in CSOM after studying 200 unilateral CSOM cases (7). The higher prevalence in their study can be explained by the outcome measure for SNHL used in the study. The study used mean BC threshold difference between diseased and normal contralateral ear >10 dB to define SNHL which is relatively a low sensitive measure compared to this study (7).

On the other hand this study showed remarkably higher prevalence of SNHL in CSOM compared to many studies on the subject from different countries (2, 8, 11, 15, 16). Studies from India and Dhaka reported 10.9% and 10% prevalence of SNHL in CSOM respectively (8, 15). De Azevedo et al studied 115 unilateral CSOM ears retrospectively using almost similar outcome measure to our study in Brazil and found out 13% prevalence of SNHL in CSOM (11). Two other studies in India reported incidence of SNHL in CSOM in their study to be 21% and 24% using prospective study designs which is lower to the current study (2,16).

This indicates SNHL as sequelae of CSOM has different prevalence among people of different geographical region and socioeconomic status. Some studies have shown SNHL associated with CSOM is more in patients from low socio economic status due to delayed treatments, lack of education, poor hygiene and inadequate follow up (3,19).

World Health Organization (WHO) acknowledged presence of considerable difference in the prevalence rate for ear disease between developed and developing countries (3). Kasliwal et al mentioned that 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 (14).

This study used a strict criterion to decrease the effect of confounding factors, but could not exclude patients' use of topical ototoxic antibiotics reliably from review of medical records. Though ototoxic antibiotics ear drops accepted as risk factors there is still controversy about their toxicity and effects on cochlear function. Linder et al. mentioned possible ototoxic side effects of ototopical preparation in continuous use beyond 2 weeks in patients with CSOM as a cause of SNHL in such patients (20). But other investigators have found little or no evidence that topical drops can cause SNHL (21, 22).

In line with other studies the gender prevalence of SNHL in CSOM in this study showed no significant difference between Male and Female patients. This also goes hand in hand with study results of Nanda et al and Dham et al who reported no difference between Male and Female patients in relation to magnitude of SNHL (2, 7).

Regarding the prevalence of SNHL in CSOM in relation to age this study showed higher prevalence (50%) in age 41-50years followed by age groups 31-40 & 51-60 years with equal prevalence of 30%. Almost similar lower prevalence in younger age groups 19% in 21-30 years and 21.2% in 10-20 years. Overall this study showed increased prevalence with increasing age despite no statistically significant association ($P= 0.171$). This complies with some of previous studies noticed greater SNHL with increased age with no correlation (1,2). Analytic studies done in Iran & Brazil revealed significant correlation of age with SNHL in CSOM (11, 12). However a study in Nigeria tertiary hospital showed no association between age and SNHL in CSOM (6).

The current study of prevalence of SNHL in CSOM in relation to duration of disease demonstrated increase in prevalence as disease duration increased with the highest prevalence 46.4% in >10 year duration and lowest 10.5% for < 2 years. Pearson Chi-Square test for relation of duration of disease and the prevalence of SNHL in CSOM ears showed significant association ($P = 0.007$). Similarly a prospective cross-sectional study in South India found increased prevalence of SNHL as duration of CSOM increased. They reported highest prevalence 45% in 16-20 years of CSOM (7). Also a prospective study of 100 unilateral CSOM from India by Nanda et al.2015 noticed correlation of disease duration with highest incidence of SNHL 30.3% in >10 year duration (2). Correlation of SNHL with duration of CSOM has been reported researchers from different areas (14, 15, 16). However some studies didn't show any relation of SNHL with regard to duration of CSOM (1, 6, 11, 12).

The prevalence SNHL in relation to type of CSOM in the present study demonstrated almost similar prevalence in cholesteatoma ears 25.8% and non-cholesteatoma CSOM ears 26.7%. A study from India also showed similar prevalence in cholesteatoma ears 29.6% and in non-cholesteatoma CSOM ears 28.7% (7).

Studies by Amin et al in Iran and Azevedo et al in Brazil also reported no correlation between cholesteatoma and SNHL in CSOM in their studies (11, 12). A study by Sharma et al in India on this regard demonstrated the presence of SNHL in cholesteatoma ears but failed to show statistical significant association (1). On the other hand a study on determinants of SNHL in CSOM in North India studied 510 unilateral CSOM ears and reported consistent correlation between magnitude of SNHL and presence of cholesteatoma (14).

7. Limitations of the study

- The study is retrospective chart review of CSOM patients. So some information on previous medication history and comorbidities might have been missing due to poor documentation.
- The diagnosis of cholesteatoma was based on documentation of CT finding. Cholesteatoma appears as a homogeneous mass with similar density to edematous mucosa which may falsely elevate the diagnosis of cholesteatoma (23).
- It was difficult to assess correlation of magnitude of SNHL and related factors because of retrospective descriptive design of the study. SNHL due to ototoxicity from topical antibiotics couldn't be reliably ruled out for various reasons like lack of vigilant documentation on medical records of patients' previous medications

8. Conclusions

The prevalence of SNHL in patients with CSOM was 26.4% in this study. There was also increased prevalence of SNHL with prolonged duration of CSOM. The prevalence of SNHL in CSOM patients was also greater with increased age. This study didn't reveal noticeable difference in prevalence of SNHL in CSOM with regard to gender and presence of cholesteatoma.

9. Recommendations

Based on the findings in the study, the following recommendations are forwarded to SPHMMC and Otolaryngology and head & neck surgery department.

SPHMMC

- To increase public awareness about the importance of early treatment of CSOM in order to prevent these irreversible sequelae through timely medical and surgical intervention by providing health education in collaboration with different social media
- To organize trainings for health care providers at health centers on early detection and referral of patients for appropriate intervention
- To increase the number of OR tables and ENT ward beds to decrease the long waiting list for Otologic surgery.

Otolaryngology and head & neck surgery department

- To facilitate periodic school based Otologic screening and treatment as CSOM usually begins as sequelae of inappropriately treated otitis media.
- To conduct further prospective studies on determinant factors of SNHL in our country to reveal hidden factors behind this irreparable handicap

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ANNEX 1: DATA EXTRACTION MATERIAL

A. PATIENT DEMOGRAPHIC DATA

1. Age:
2. Sex:
3. Region:
4. Card no.:

B. Clinical Data

1. Presenting complaint
 - Decreased hearing
 - Ear discharge
 - Ear pain
 - Tinnitus
 - Dizziness
2. Duration of disease
 - < 2 years
 - 2 – 4 years
 - 5 – 9 years
 - ≥ 10 years

C. Otologic examination

1. Otoscopy
 - Diseased ear:
 - ✓ Right ear
 - ✓ Left ear

D. Presence of cholesteatoma in diseased ear:

- Present
- Absent

E. Audiometric assessment results

Frequency	Diseased ear	
	AC	BC
0.5Khz		
1Khz		
2Khz		
4Khz		
PTA		
ABG		
Type of hearing loss		

Declaration: signed by both student and primary advisor

Declaration

I, the undersigned declare that this thesis is my original work in partial fulfillment of the requirement for the degree of Master of otolaryngology and head & neck surgery. I also declare that it has never been presented in this or any other university and that all resources and materials used in the thesis have been duly acknowledged.

Student Name: _____

Signature: _____

Place of submission: _____

Date of submission: _____

This thesis has been submitted with my approval as college/university advisor.

Advisor Name: _____

Signature: _____

Date of submission: _____