

**PREVALENCE AND AUDIOLOGICAL CHARACTERISTICS OF
CSOM IN INDIVIDUALS WITH CONDUCTIVE PATHOLOGY
REPORTED TO AIISH (2014-2015)**

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This Dissertation is submitted as part fulfillment
for the Degree of Master of Science in Audiology
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MAY, 2016

CERTIFICATE

This is to certify that this dissertation entitled **“Prevalence and Audiological Characteristics of CSOM in individuals with Conductive pathology reported to AIISH (2014-2015)”** is a bonafide work in part fulfillment for the degree of Master of Science (Audiology) of the student (Registration No. 14AUD017). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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DECLARATION

This is to certify that this dissertation entitled **“Prevalence and Audiological Characteristics of CSOM in individuals with Conductive pathology reported to AIISH (2014-2015)”** is the result of my own study under the guidance of Ms. Chandni Jain, Lecturer in Audiology, Department of Audiology, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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Dedicated to me, mom-dad, bro and Phandni Ma'am.

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Abstract

Chronic suppurative otitis media (CSOM) is a chronic inflammation of the middle ear, if not treated appropriately, can lead to complications and disabling hearing loss. Thus, a retrospective study on prevalence and audiological characteristics in individuals with CSOM was conducted. A total of 12,836 cases with ear related problems reported to Audiology OPD at All India Institute of Speech and Hearing from August 2014 to May 2015. Out of these, 1652 cases were diagnosed with CSOM. However, data of 1558 individuals with CSOM was available for review. Thus, the prevalence of individuals with CSOM reported in this duration was 12.9%. The results also revealed that among them, the prevalence was more in males, in adults and in individuals of lower socio-economic status. Left ears had more prevalence of CSOM than right ear and unilateral CSOM was commonly seen. The major symptoms reported in them were reduced hearing sensitivity followed by ear discharge, ear pain and tinnitus. Head ache was most common associated symptom reported and the medical history majorly observed in them was upper respiratory tract infection followed by hypertension and Diabetes Mellitus. The study also showed that the prevalence of mild and moderate conductive hearing loss with Type B tympanogram was more in CSOM cases. Thus, the high prevalence mandates the need to provide prevention and appropriate management in CSOM.

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Chapter 1

Introduction

Chronic suppurative otitis media (CSOM) is a long standing infection of a part or whole of the middle ear cleft characterized by intermittent, continuous, mucopurulent or purulent ear discharge, hearing impairment (conductive or mixed hearing loss) and tympanic membrane perforation (Dhingra & Dhingra, 2010). CSOM has two types i.e. tubotympanic which is called safe type and involves anterioinferior part of the middle ear cleft and atticofacial type which is unsafe type and involves posteriosuperior part of the cleft. The anatomic connection between middle ear and middle cranial fossa makes spreading of infection in space potentially fatal. The complications of CSOM include mastoiditis, petrositis, facial paralysis and labyrinthitis, extradural abscess, subdural abscess, meningitis, brain abscess, etc. However, with the advent of antibiotics the prevalence of CSOM has reduced (Akinpelu et al., 2007).

Berman (1995) and Bluestone (1984) reported that CSOM is more prevalent in developing countries. CSOM persists up to early and middle adulthood, and most developing countries have predominantly young populations in whom CSOM is most prevalent. The incidence of CSOM is more in people with lower socioeconomic status and race (Ologe & Nwawolo, 2003). Poverty (Akinpelu et al., 2008; Farooqui et al., 2016; Lasisi et al., 2007; Lasisi, Sulaiman, & Afolabi, 2007; Shaheen, Raquib, & Ahmad,

2012; Verma et al., 1995 & WHO, 2004), illiteracy (Shaheen, 2012; Verma et al., 1995 & WHO, 2004), crowding (Akinpelu et al., 2008; Shaheen, 2012 & Lasisi et al., 2007 & WHO, 2004) and malnutrition (WHO, 2004) are few other factors for the development of CSOM and a large group of society are suffering from it. Dhingra and Dhingra (2010) also stated that incidence of CSOM is higher in developing countries because of poor socio-economic standards, poor nutrition and lack of health education. The WHO (2004) defines populations where the childhood prevalence of CSOM is $\geq 4\%$ as having a public health emergency requiring immediate attention and is considered as high prevalence.

The prevalence of CSOM has been studied across various countries. If the WHO (2004) criteria of $\geq 4\%$ is considered, Solomon Island (Eason et al., 1986), Malaysia (Elango, Purohit, Hashim, & Hilmi, 1991), Nigeria (Ologe & Nwawolo, 2002), Australia (Morris et al., 2005), Nepal (Adhikari, Joshi, Baral, & Kharel, 2009) and Bangladesh (Shaheen et al., 2012) have high prevalence of CSOM. Whereas, UK (WHO, 2004), Israel (Podoshin et al., 1986), Saudi Arabia (Zakzouk & Hajjaj, 2002), Kenya (Hatcher et al., 1995), Korea (Kim, Jung, & Yoo, 1993), Tanzania (Bastos, Mallya, Ingvarsson, Reimer, & Andréasson, 1995), Brazil (Godinho et al., 2001), and China (Zhang et al., 2011) have comparatively low prevalence.

In Indian scenario, prevalence of CSOM has been studied in few cities. In Lucknow it was reported as 14.65% (Misra, Bhatia, & Bhatia, 1961), 15.3% in Haryana

(Verma et al., 1995), 6% in South India (Rupa, Jacob, & Joseph, 1999) and 3% in Yavatmal, Maharashtra (Wakode, Joshi and Gawarle, 2000). Thus, it can be noted that prevalence of CSOM is high across various parts of India.

The prevalence within and across countries differ since the authors have taken different populations, different regions and time. The prevalence of CSOM in India and other developing countries is high (>4%) and it needs attention to deal with massive health problems.

1.1. Need for the Study

The prevalence of CSOM as mentioned in the above studies is reported mainly in the western countries and there is a dearth of information regarding prevalence and audiological details of CSOM cases in India. In India, the few studies carried out for the prevalence of CSOM have only taken paediatric population. So, there is a need to focus on prevalence and audiological characteristics of CSOM in all age groups. The western studies, have reported differences in prevalence across age, gender, socio economic status and regional background. This needs to be evaluated in Indian population.

The evidence of high prevalence of CSOM in developing countries mandate the need for developing primary care management programs such as awareness about CSOM

and ways to prevent it. Also, it mandates the need to develop primary and secondary care management for diagnosing and treating the disease. These programs need to be carried out specifically in rural areas, slum areas and in schools for parents and teachers as the literature reports high incidence of disease occurring in these particular population. Hence, India being a developing country, it is important to determine the prevalence of CSOM in Indian context.

In All India Institute of Speech and Hearing (AIISH), Mysore, a large number of people with ear related problems report yearly and CSOM is one of the most common otological conditions. Hence, there is a need to document the prevalence and identify the risk factors and audiological characteristics related to CSOM, to take necessary rehabilitation measures.

1.2. Aim of the study

To estimate the prevalence and audiological findings in cases with chronic suppurative otitis media with conductive pathology reported at All India Institute of Speech and Hearing (AIISH), Mysore between August 2014 and July 2015.

1.3. Objectives of the Study

1. To determine the total number of CSOM cases reported at All India Institute of Speech and Hearing (AIISH), Mysore between August 2014 and July 2015.
2. To estimate age and gender predominance in CSOM cases.
3. To study the risk factors, major symptoms and various medical conditions associated with CSOM.
4. To analyse the data in terms of different audiological findings in CSOM.
5. To analyse the data according to the management advise given to CSOM cases by the Otolaryngologist and Audiologist i.e. medical, non-medical or both.

Chapter 2

Literature Review

Chronic suppurative otitis media (CSOM) is the most common otologic condition and is more prevalent in developing countries (Berman, 1995& Bluestone, 1984) and in certain high risk populations in developed nations (Bluestone, 1998). The WHO (2004) have stated that the populations with the childhood prevalence of CSOM of $\geq 4\%$ as having a public health emergency, thus requiring immediate attention.

2.1. Histopathology of CSOM

The histopathology in CSOM have been studied by Ferlito (1974) and Meyerhoff, Kim and Paparella (1978). The histopathological changes due to CSOM are seen in middle ear mucosa and the underlying bone of the middle ear, mastoid cavity and the ossicles. The changes are characterized by tympanic membrane perforation, edematous mucosa, osteoneogenesis, bony erosions and osteitis of the ossicles and the bone. Further changes would result in necrosis and ankylosis of ossicles.

2.2. Prevalence of CSOM

The prevalence of CSOM differs based on the region, the period, the population

and the differences in the method used in the study. The prevalence CSOM in western countries and in India is depicted in Table 2.1 and Table 2.2.

Table 2.1: *The prevalence of CSOM in various parts of the world*

Country	Year	Author	Subjects	Prevalence (%)
UK	1983	WHO, 2004	Adults	0.6
Solomon Island	1986	Eason et al.	3500 children	3.8 (<15years of age) 6.1 (<5years of age)
Israel	1986	Podoshin et al.	3056, ≥ 10 years children	0.95
Malaysia	1991	Elango	1307 primary school children	4.36
Saudi Arabia	1992	Zakzouk and Hajjaj	9540 children upto 6years	1.5
Kenya	1992	Hatcher et al.	5368 primary school children	1.1
Korea	1993	Kim	9321 subjects of all age	2.19
Tanzania	1995	Bastos et al.	854 school children	1.6
Brazil	2001	Godinho et al.	1119 children and adolescent of 6-18years	0.94

Country	Year	Author	Subjects	Prevalence (%)
Nigeria	2002	Ologe and Nwawolo	1135 children	7.3
Australia	2005	Morris et al.	709 Aboriginal children 6-30 months	15
Nepal	2009	Adhikari et al.	500 school children	5
China	2010	Zhang et al.	1967 children of age 2- 7years	3.71
Bangladesh	2012	Shaheen, Raquib, and Ahmad	4280 rural primary school children	5.63

Table 2.2: *The prevalence of CSOM in India*

Region/state	Year	Author	Subjects	Prevalence (%)
Lucknow	1961	Misra et al.	50,000 school children	14.65
Haryana	1995	Verma et al.	613 children	15.3
South India	1999	Rupa,et al.	914 children of 2-10years	6
Maharashtra	2006	Wakode, Joshi and Gawarle	4104 children	3

Thus, from the above studies it is evident that the prevalence of CSOM in India and other developing countries is higher ($> 4\%$).

2.3. Audiological and clinical findings of CSOM

Audiological findings of CSOM has been reported in literature by various authors. Liden, Peterson and Bjorkman (1970) assessed middle ear function using tympanometry in CSOM cases. They reported presence of flat tympanogram in the presence of a middle ear fluid and in cases with perforation of tympanic membrane. In cases with early otitis media, a rare possibility is to obtain positive peak (Feldman, 1976). Brooks (1969) reported that the gradient reduced to less than 10% in CSOM cases. The type of the tympanogram is said to change gradually from B to C to A as the system shifts from a pathological condition to the normal state (Jerger, 1970).

Eason et al. (1986), performed prospective microbiological, audiometric and therapeutic survey on 3500 children in Solomon Island. Results showed that 256 children had conductive hearing loss. Also, CSOM was more prevalent in children under 18 months (65%) with male preponderance and large central tubotympanic perforations. The aetiological factors were measles, respiratory infections, swimming and malnutrition. Proteus and pseudomonas were the principle aerobes identified from ear pus. Thus, the authors concluded that the parental tuition on aural hygiene is necessary.

Ologe and Nwawolo (2002) examined 1135 children with CSOM in Nigeria. The highest prevalence was noted in children of 2-5 years of age. Also, unilateral CSOM (79.5%) was most prevalent and tubotympanic type of disease was present in 99% of these children. In another study, Lasisi, Sulaiman and Afolabi (2007) studied the prevalence of hearing loss, type of hearing loss, severity of hearing loss and risk factors of CSOM in Nigeria. The study included 189 CSOM cases between 4-150 months of age. The prevalence of hearing loss in children with CSOM was 47%.

Adhikari, Joshi, Baral and Kharel (2009), studied 500 school children aged between 5-15 years from urban private schools of four districts of Nepal for the audiological symptoms of CSOM. Study showed that 72% had unilateral disease, 76.0% had a tubotympanic disease and 24.0% had atticofurcal disease. It was concluded in the study that, health education, improvement of socioeconomic status and health facilities would be helpful in reducing the prevalence of CSOM.

Elemraid et al. (2010), carried out behavioural audiometry on 75 children with CSOM. Thresholds more than 30 dBHL was termed as disabling hearing impairment. It was present in 51.5% (right ear) and 66.7% (left ear) of children with CSOM. In another study by Taipale et al (2011), they evaluated clinical characteristics, bacteriology and hearing in children with and without CSOM in Luanda, Angola. Human immunodeficiency virus (HIV) was present in 64% of children with CSOM and 0% in

children without CSOM. History of Tuberculosis was present in 36% of children with CSOM and 0% in children without CSOM. Ear pain and history of ear discharge was present in all CSOM cases. The study also showed that 43% children had bilateral CSOM. The major ear discharge pathogens were *Proteus* spp. (44%) and *Pseudomonas* (22%). Hearing impairment of greater than 25 dB was present in 52% of CSOM affected ears.

Jensen, Koch and Homoe (2013), carried out follow-up for 10-15 years in two Greenlandic population-based children cohorts. 438 individuals aged 11–24 years participated in the study. Participants underwent otologic examination and audiological evaluation. Results revealed that the prevalence of hearing loss in CSOM was 50% using the ASHA definition of hearing loss (>15dBHL threshold). Using the WHO definition of hearing loss (>25dBHL threshold) the prevalence was 2.5%. Ninety per cent of children with CSOM developed a permanent hearing loss of greater than 15 dB HL.

Farooqui et al. (2016), studied the type and degree of hearing loss in 852 CSOM cases in the age range of 10-60 years, in Mewat, Haryana. It was reported in the study that male were affected more in both unilateral and bilateral deafness and in all age groups except early age (10-18 years). Also, 78.7% patients had conductive hearing loss and 21.3% had mixed hearing loss. It was also noted that, 67.5% patients suffered from bilateral hearing loss and 32.5% had unilateral hearing loss. Also, in all age groups, in

conductive hearing loss cases, prevalence of mild hearing loss was 34.3% which was followed by moderate with 33.13% and then severe hearing loss with 11.28% . In mixed type all patients had severe hearing loss in all age groups.

2.4. Risk Factors of CSOM

Various risk factors associated with CSOM has been studied by authors. Verma et al (1995) evaluated 613 children in a village in Haryana and they found out that 61.7% children had hearing impairment due to CSOM. There was positive correlation of CSOM with literacy and socio-economic status of mothers, and with upper respiratory tract infections (URTI) in children. Literacy and socio-economic status of the mothers did not correlate significantly with knowledge about treatment seeking, and ear cleaning practices, probably due to the narrow range of incomes and literacy levels.

Rupa, Jacob and Joseph (1999) determined the prevalence of CSOM among 914 primary and preschool children in Tamil Nadu. CSOM was equally prevalent in preschool children (5.7%) and primary school children (6.2%). Major complication of CSOM, cholesteatoma was observed in 1.2% of children. In another study, Lasisi et al (2007), determined the risk factors on 189 children with CSOM in Nigeria using questionnaire. Low socioeconomic class, malnutrition, congestion from high number of people in the household and bottle feeding constituted the significant risk factors.

Parental smoking, day care attendance, upper respiratory tract infection (URTI), allergy, adenoid and malnutrition, were not found to be significant.

Akinpelu et al. (2008), did a study on 160 individuals with CSOM. Results showed that CSOM was prevalent in young children (0-16 years), followed by adolescents and adults (> 20years). Males were affected more than females and unilateral disease (67.5%) was most prevalent than bilateral. Study also showed that right ear was more affected in these individuals than left ear. Poverty-related problems (i.e. malnutrition, overcrowding and incomplete immunisation were most common predisposing factors. Adenoid inflammation was present in 41.3%, cleft palate in 2.5%, . human immunodeficiency in 4 % and nasopharyngeal carcinoma in 1% and measles in 1% of the population.

Lasisi, Sulaiman and Afolabi (2007) also studied the risk factors associated with CSOM. The study included 189 CSOM subjects from Nigeria, between 4-150 months of age. The prevalence of hearing loss in children with CSOM was 47%. Among the CSOM cases with hearing loss, maximum cases were from low social class (69%) , 35% were middle class and 24% upper class. The duration of CSOM ranged from 4 weeks to 12 years with a mean age of 4 years and from 5 to 12 years in those with sensorineural hearing loss with a mean age of 9 years. There was a significant correlation between

socio-economic background and hearing loss while no correlation was found with upper respiratory tract infection.

Jensen, Homoe, Andersson and Koch (2011), conducted a follow-up study on a cohort of children to determine the long-term consequence of CSOM and to recognize risk factors in Greenland, Denmark. 465 children between the age of 0-4 years and 236 children between the age 11-15 years participated in the study. The prevalence of CSOM was 14% in the age group 0–4 years and 9% in the age group 11–15 years. The risk factors identified in the study were maternal history of CSOM and education for children in the age range of 11-15 years. Whereas for children of 0-4 years, the risk factors were childcare centers, having smokers in the household, having a mother who reported a history of purulent ear discharge, having upper respiratory tract infections, and being Inuit community. It was also noted that girls healed significantly better than boys.

Few studies have described boys having a higher risk of developing severe course of otitis media (Vartiainen, 1998), and otitis media with effusion is also reported to have higher incidence among boys (Paradise et al., 1997). The authors attributed these finding to the larger pneumatisation area of the mastoid among girls (Tos & Stangerup, 1985) and differences in endocrine-immune interactions i.e males are more susceptibility to infections (Klein, 2000).

Shaheen, Raquib and Ahmad (2012), studied prevalence of CSOM and relationship with certain socio-demographic factors among 4280 rural primary school children of Bangladesh. The prevalence of CSOM stated was 5.63%. Among the 241 CSOM cases reported, 53.95% had left ear CSOM, 39.83% had right ear CSOM and 6.22% had bilateral CSOM. Among 4280 children, it was also noted that girls were affected more than boys (3.4% vs 2.2%). Also, out of 4280 children, low income of the guardians, mothers who were uneducated, large family size, and unsafe/poor sanitation of children was significantly related to CSOM. Poor housing though an important risk factor of CSOM but it was not evident in this study.

Farooqui et al. (2016), studied the socio-demographic status of 852 CSOM cases in the age range of 10-60 years, in Mewat, Haryana. The CSOM was reported in 53.3% males and 46.7 % females, with male to female ratios of 1:0.8. Maximum patients were from age group of 10 to 18 years (39%) followed by group 19 to 45 years (32%). Among them, 60% of patients had history of recurrent upper respiratory tract infection and 29% patients were regularly using unhygienic water for cleaning and bathing. Many patients had dirty habits of ear pricking, putting oil drop and then cleaning ear with cloth wrapped on wooden stick and using cotton buds. 11% patient had history of trauma either of ear canal or head and neck. Maximum patients (82%) were from low socioeconomic strata. 85.8% patients lived in katcha house resided in rural area and with poor hygienic conditions.

Thus, from the above studies it is evident that CSOM is more common in people who reside in poor living condition, lower socioeconomic group and in children. Most of the studies report of males having more prevalence of CSOM than females. Other factors like recurrent URTI and maternal education also correlated with the presence of CSOM. Conductive hearing loss was most common followed by mixed hearing loss in CSOM.

2.5. Complications of CSOM

CSOM can also lead to various complications if not treated properly. Rupa and Raman (1991), performed a retrospective study to determine the prognostic factors in patients with CSOM with complications and without complications. The extracranial and intracranial complications were included in the study. Mastoid abscess occurred in more than half of the patients in the complicated group. Brain abscess (57.4%) was the most frequent intracranial complication.

Kangsarak, Fooanant, Ruckphaopunt, Navacharoen and Teotrakul, (1993), reviewed 102 cases of intracranial (IC) and extracranial (EC) complications from suppurative otitis media. The prevalence of IC complication was 0.24% and 0.45% for EC complications. Facial paralysis (58%), subperiosteal abscess (40%) and labyrinthitis (34%) were the common complications among the EC group, while meningitis (51%) and brain abscess (42%) were common in the IC group. Fever, headache, earache, vestibular

symptoms, meningeal signs and impairment of consciousness were common signs and symptoms for IC complications. *Proteus* spp., *Pseudomonas aeruginosa* and *Staphylococcus* spp. were the commonest organisms identified in both the groups. Cholesteatoma and granulation/polyp in the middle ear mastoid were also present in majority of the patients in both the groups. Mortality rate in the IC group was 18.6% and morbidity rate in each group was 14.3 % (EC) and 27.9 % (IC) respectively.

Thus, CSOM can lead to various complications. Mortality and disabilities due to otitis media are primarily related to the complications of CSOM.

2.6. Management of CSOM

Kenna, Bluestone, Reilly and Lusk (1986) studied management in children with CSOM, with and without cholesteatoma. 36 children with CSOM were included in the study. All were on antimicrobial oral or topical therapy and daily aural toilet was also performed. In 89% of children antimicrobial therapy was effective against CSOM. Other 11% underwent surgery.

Kenna, Rosane and Bluestone (1993) followed up 51 children with CSOM alone who underwent antimicrobial therapy. Resolution of CSOM was reported in 78% children and 22% required surgery. The authors stated that surgery should be considered

on suspicion of cholesteatoma. However, Indudharan, Haq, and Aiyar (1999) reported that antibiotics are useful in treating CSOM.

Thus, it can be concluded that in CSOM cases the first line of management is antimicrobial therapy/ antibiotics. Surgery is only done if the medications do not improve the condition or if there are complications like cholesteotoma.

Chapter 3

Method

A retrospective cohort study was carried out to find out the prevalence of chronic suppurative otitis media (CSOM) and audiological findings in cases with CSOM, reported at All India Institute of Speech and Hearing, between August 2014 and May 2015. The OPD register was reviewed for total number of cases reported, during the above mentioned period of 10 months. The total number of CSOM cases reported was noted from Out Patient Department (OPD) register in Department of Audiology and Department of Ear, Nose and Throat (ENT). The case numbers of CSOM cases were recorded for reviewing the case files.

The case files were reviewed for the following details:

- Demographic details i.e the age, gender and socioeconomic status.
- The ear specific complaints of the individuals such as complaint of reduced hearing sensitivity, ear pain, ear discharge, tinnitus, blocking sensation, itching, vertigo/giddiness.
- Medical history like frequent Upper respiratory tract infection (URTI) and associated problems (Diabetes, hypertension, cardiac issues, etc.).
- Provisional diagnosis for the degree and type of hearing loss. Diagnosis of unilateral or bilateral CSOM by Otolaryngologist.
- Results of tympanometry.

- Treatment and management advice/recommendation by Otolaryngologist and Audiologist including medical (surgery and/or pharmacological), non-medical management (fitted with hearing aid) and/or both i.e medical and non-medical management.

The audiological information was taken from the case-files and the following criteria was used for the diagnosis and analysis of the data.

3.1. Degree of hearing loss

The degree of hearing loss was classified using Goodman's classification (1965) modified by Clarke (1981). In this study, the classification was made based on pure tone average (PTA) and its correlation with speech audiometry. The degree of hearing loss was categorized as hearing sensitivity within normal limits, slight/minimal, mild, moderate, moderately severe, severe and profound.

3.2. Type of hearing loss

The type of hearing loss was determined using air conduction threshold, bone conduction threshold, and air bone gap and was categorized as conductive hearing loss, mixed hearing loss and sensorineural hearing loss.

3.3. Tympanometry

The type of tympanogram was classified based on tympanometric peak pressure and the static admittance as Type A, As, Ad, C and B.

Based on the data collected as mentioned above the data of CSOM was analysed for CSOM in different age groups, gender, socio-economic status, unilateral vs bilateral CSOM, different symptoms of CSOM, other associated complaints, medical history, different complications, degree of hearing loss, type of hearing loss, and type of tympanogram. The data was categorized and analysed in terms of the number of individuals and percentage of individuals with CSOM using Statistical Package for Social Sciences (SPSS, version 20.0) software.

Chapter 4

Results

The study was conducted with the aim of determining the prevalence and audiological findings in individuals with chronic suppurative otitis media (CSOM) reported at All India Institute of Speech and Hearing (AIISH), Mysore between August 2014 and May 2015. The collected data was tabulated and was subjected to statistical analysis using Statistical Package for Social Sciences (SPSS, version 20.0) software. The results of the study are discussed below.

4.1. Prevalence of CSOM

A total number of 1652 individuals diagnosed as CSOM when reported to AIISH. Out of these 1652 cases, data of 1558 cases could be collected as the few case-files were not available for review. The demographic details and audiological findings are documented for these 1558 cases. The total number of cases registered in audiology OPD between August 2014 and May 2015 were 12,836. Hence, the prevalence of CSOM in the present study is 12.9%.

4.2. The age and gender wise analysis of CSOM cases

4.2.1. CSOM in different age groups

The data was analyzed in seven age groups namely infants (0-1year), toddlers (1.1-3 years), pre-schoolers (3.1-5 years), school going children (5.1-12 years), adolescents (12.1-18 years), adults (18.1-55 years) and older adults (>55 years). Results revealed that maximum number of adults (62.2%) reported with CSOM followed by older adults (18.7%) and adolescents (8%) as shown in Table 4.1 and Figure 4.1. The prevalence of CSOM in children of 0 to 12 years was 4.8%.

Table 4.1: *Number of individuals with CSOM in different age groups*

Age groups	Number of individuals with CSOM
Infants	14
Toddlers	26
Pre-schoolers	36
Adolescents	124
Adults	969
Older Adults	292
Total	1558

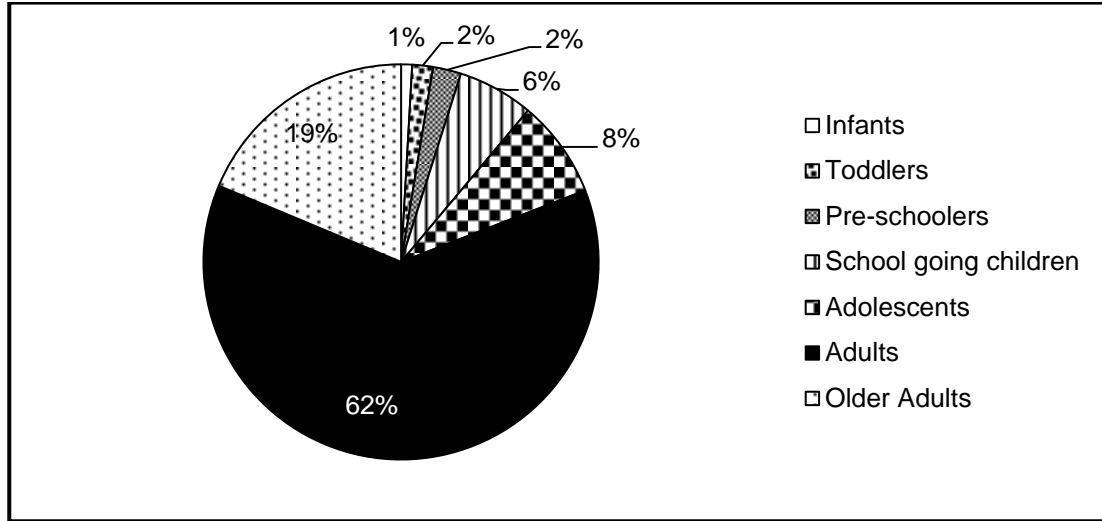


Figure 4.1: Percentage of individuals with CSOM in different age groups

4.2.2. Gender wise analysis

The prevalence of tinnitus on 1558 individuals with CSOM across gender revealed that more number of males reported to have CSOM than females as shown in the Table 4.2 and Figure 4.2.

Table 4.2: Number of males and females with CSOM

Gender	Number of individuals with CSOM
Males	859
Females	699
Total	1558

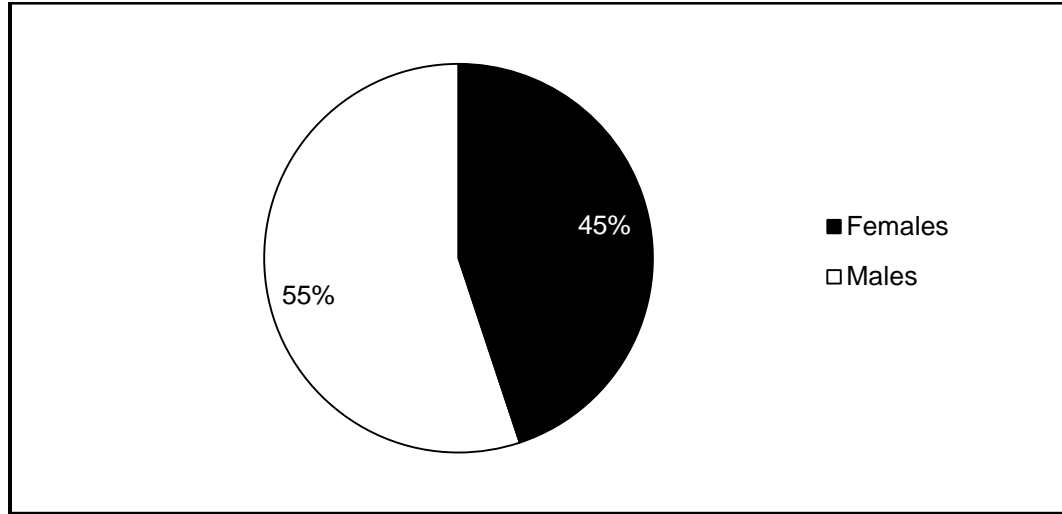


Figure 4:2: Percentage of CSOM across males and females

4.3. Analysis in terms of risk factors, various symptoms and medical history of CSOM

4.3.1. Analysis based on socio-economic status

The data of CSOM was analyzed in terms of socio-economic status and were divided into three income slabs namely, slab I with income less than ₹10,000/-, slab II with the income of ₹10,000/- to ₹20,000/- and slab III with the income of more than ₹20,000/-. Results showed that the prevalence of CSOM was maximum in slab I and was least in slab III, as shown in the Table 4.3 and Figure 4.3. Thus, lower socio-economic status was one of the risk factors of CSOM.

Table 4.3: *Number of individuals with CSOM in different income slabs*

Slab	Number of individuals with CSOM
I	1358
II	127
III	73
Total	1558

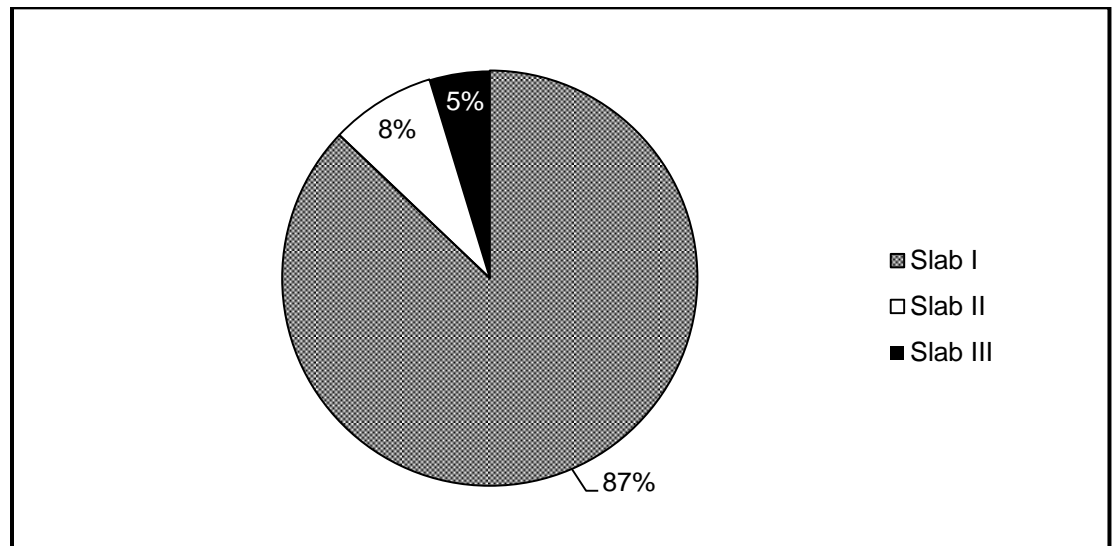


Figure 4.3: *Percentage of individuals with CSOM in different income slabs*

4.3.2. Analysis based on complications of CSOM

Among 1558 individuals, 52 (3.3%) individuals had complications such as aural polyp, otomycosis, cholesteatoma, deviated nasal septum (DNS), facial palsy and tympanosclerosis. Out of these 52 individuals, prevalence of otomycosis was more compared to the other complications as presented in the Table 4.4 and Figure 4.4.

Table 4.4: *Number of individuals with different complications of CSOM*

Complications of CSOM	Number of individuals
Aural Polyp	8
Otomycosis	25
Cholesteatoma	3
Deviated nasal septum (DNS)	7
Facial palsy	6
Tympanosclerosis	3
Total	52

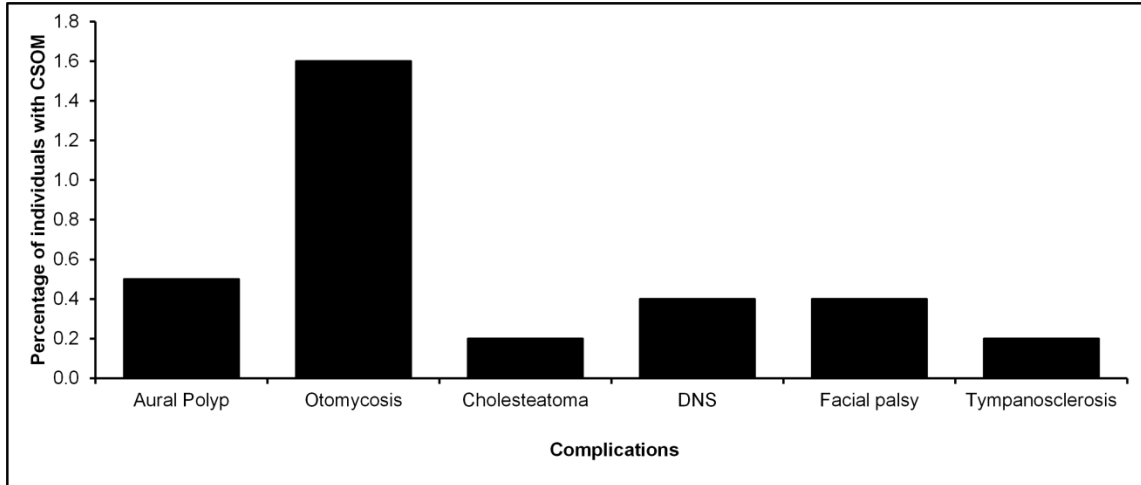


Figure 4:4: Percentage of individual with different complications of CSOM

4.3.3. Analysis based on symptoms of CSOM

The data was also analyzed with respect to various common symptoms reported by CSOM cases. It was noted that the symptoms reported were mainly reduced hearing sensitivity, ear pain, ear discharge, tinnitus, itching and blocking sensation in 1558 individuals. Among these, the major complaints reported were reduced hearing sensitivity followed by ear discharge, ear pain and tinnitus. Very few individuals reported complaints of itching and blocking sensations, as shown in the Table 4.5 and Figure 4.5.

Table 4.5: *Different symptoms in individuals with CSOM across ears.*

Complaints	Right ear	Left ear
Reduced hearing sensitivity	874	898
Ear pain	528	587
Ear discharge	729	823
Tinnitus	420	462
Itching	181	199
Blocking sensation	268	296

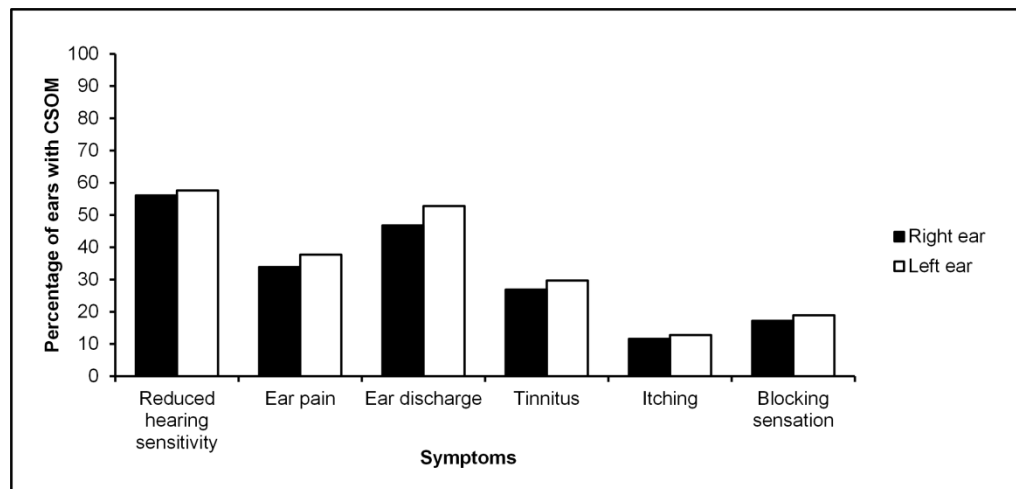


Figure 4:5: Percentage of different symptoms seen in CSOM cases for right and left ear

4.3.4. Analysis based on other associated complaints in CSOM

The data was analyzed for associated complaints namely, vertigo, giddiness and headache seen in individuals with CSOM. Out of 1558 individuals, 461 (29.6%) subjects had associated complaints and results revealed that prevalence of headache was maximum (16.9%) followed by vertigo and giddiness as shown in Table 4.6 and Figure 4.6.

Table 4.6: *Number of individuals with associated complaints in CSOM*

Complaints	Number of individuals with CSOM
Vertigo	91
Headache	264
Giddiness	106
No associated complaints	1097
Total	1558

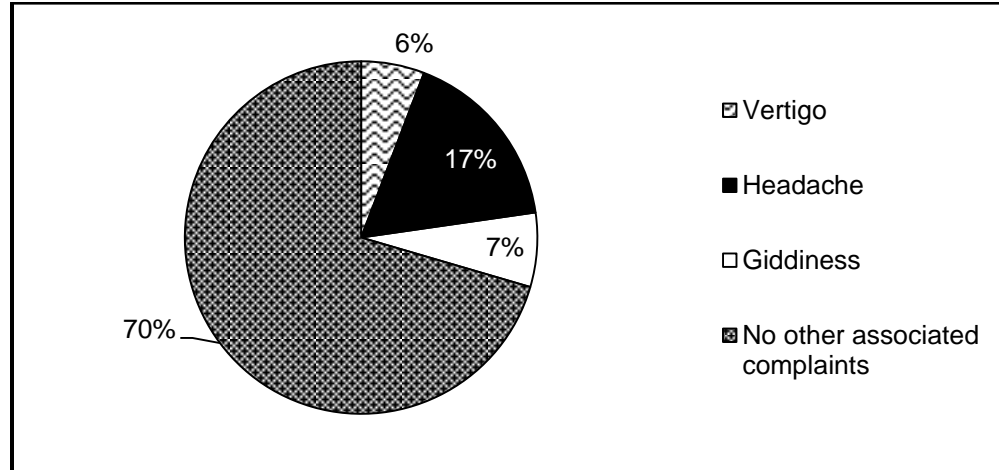


Figure 4:6: Percentage of other associated complaints in CSOM cases

4.3.5. Analysis based on medical history

The data was analyzed in terms of various medical history present in individuals with CSOM. The different medical history which were noted in CSOM cases were Upper respiratory tract infection (URTI), history of ear surgery, trauma, fever, hypertension (HTN), diabetes mellitus (DM), hypotension, thyroid related problems, cardiac issues, asthma, Human immunodeficiency virus (HIV), tuberculosis (TB), seizures and repaired cleft lip palate (CLP). Total 385 (24.7%) number of cases had different medical history. Results showed that the prevalence of URTI was more followed by hypertension and diabetes mellitus, as shown in the Table 4.7 and Figure 4.7.

Table 4.7: *Number of individuals with different medical history in CSOM*

Medical history	Number of individuals
Upper respiratory tract infection	123
Ear surgery	41
Trauma	29
Fever	6
Hypertension	90
Diabetes mellitus	60
Hypotension	5
Thyroid related problems	5
Cardiac issues	9
Asthama	4
Human immunodeficiency virus	1
Tuberculosis	3
Seizures	1
Total	385

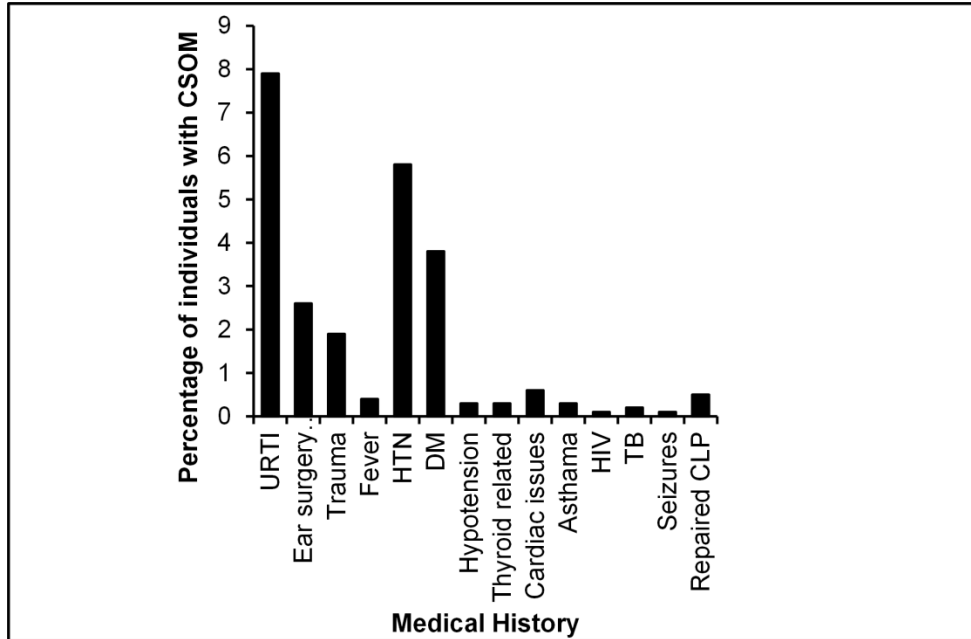


Figure 4:7: Percentage of individuals with different medical history in CSOM

4.4. Analysis based on different audiological findings in CSOM

4.4.1. Analysis based on right vs. left CSOM and unilateral vs. bilateral

CSOM

As reported earlier, total 1558 cases reported to have CSOM. Among these 1558 cases, ear wise analysis showed that, 2071 ears had CSOM. Out of these 2071 ears with CSOM, data was analyzed for right vs left ear. Results revealed left ear had more prevalence of CSOM compared to right ear as depicted in Table 4.8 and Figure 4.8.

Results also showed that 1045 number of cases had unilateral hearing loss and 513 numbers of cases had bilateral hearing loss as depicted in Table 4.9 and Figure 4.9.

Table 4.8: *Number of right and left ears with CSOM*

Ear	Number of ears
Right	967
Left	1104
Total	2071

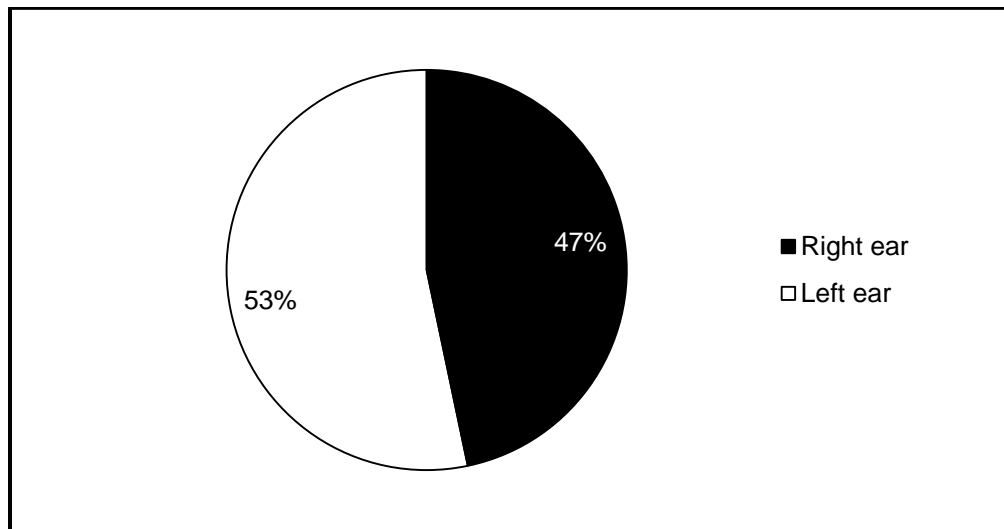


Figure 4:8: *Percentage of individuals with right and left CSOM*

Table 4.9: *Number of individuals with unilateral vs. bilateral CSOM*

Unilateral Vs. Bilateral	Number of individuals
Unilateral	1045
Bilateral	513
Total	1558

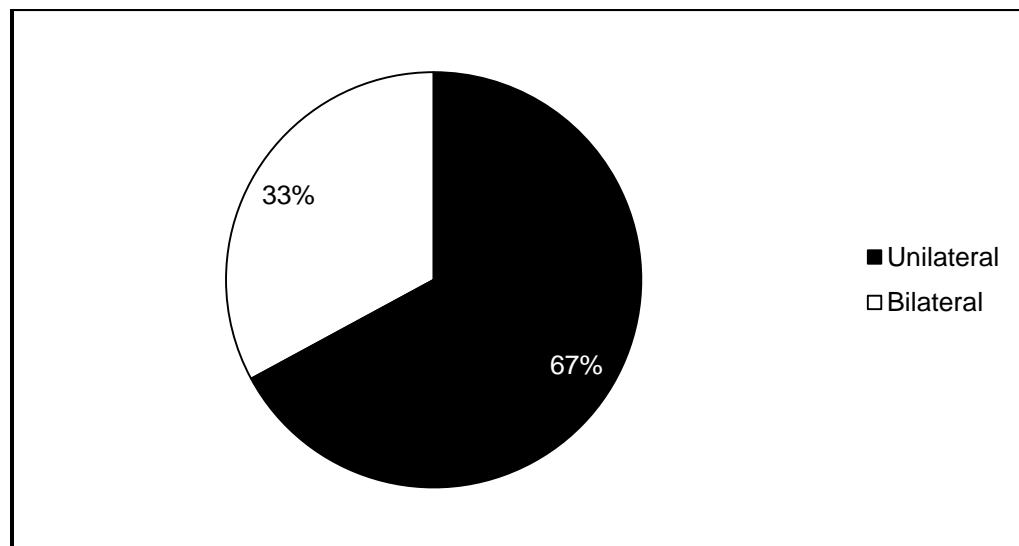


Figure 4.9: *Percentage of individuals with unilateral vs. bilateral CSOM*

4.4.2. Analysis based on degree of hearing loss

Analysis was also done for the degree and type of hearing loss in CSOM. Out of 1558 (3116 ears) individuals with CSOM, 728 (46.7%) individuals underwent

audiological evaluation. Out of these 1009 ears (32.4%) had hearing loss due to CSOM, accounting to 487 (48.3%) right ears and 522 (51.7%) left ears. Thus, hearing loss due to CSOM was more in right ears than left ears. The degree of hearing loss was categorized as normal, slight/minimal, mild, moderate, moderately severe, severe and profound hearing loss, based on Goodman's classification (1965) modified by Clarke (1981). Results showed that the prevalence of mild and moderate hearing loss was more compared to the other degree in both ears as shown in the Table 4.10 and Figure 4.10.

Table 4.10: *Number of right and left ears with different degree of hearing loss in CSOM.*

Degree of hearing loss	Right ear	Left ear
Normal	15	15
Minimal	40	52
Mild	117	110
Moderate	120	109
Moderately severe	72	94
Severe	71	89
Profound	52	53
Total	487	522

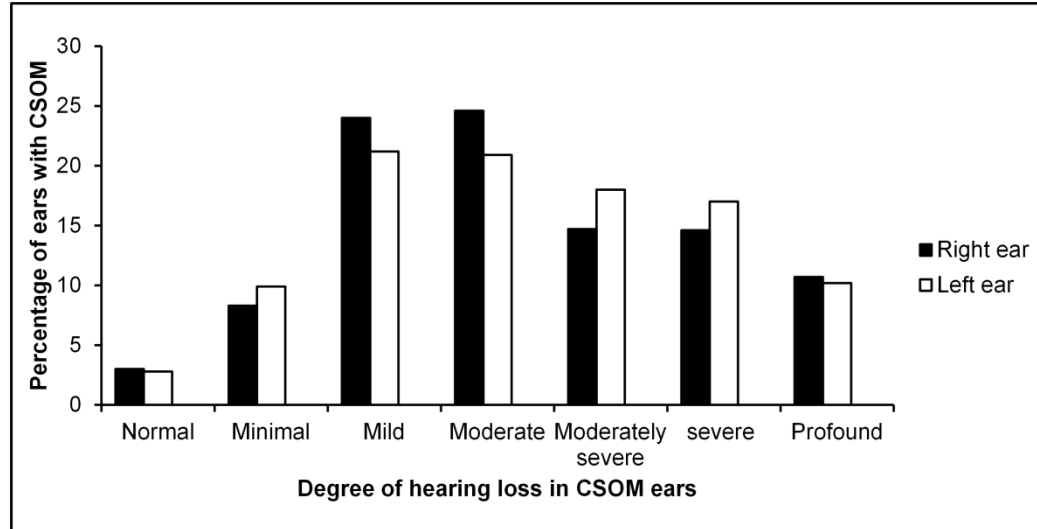


Figure 4:10: Percentage of different degrees of hearing loss in right and left ear

4.4.3. Analysis based on type of hearing loss in CSOM

The data was analyzed based on types of hearing loss identified in individuals with CSOM as conductive, sensorineural and mixed hearing loss. The data of only those cases were further reviewed who had conductive pathology. Results showed that more number of ears had conductive hearing loss than mixed hearing loss and hearing sensitivity within normal limits with ABG type of loss (ABG loss) as shown in Table 4.11 and Figure 4.11. Results also showed that both ears had similar findings.

Table 4.11: *Type of hearing loss in CSOM cases for right and left ear*

Type of hearing loss	Right ear	Left ear
Normal hearing sensitivity with air bone gap	15	15
Conductive	261	262
Mixed	211	245
Total	487	522

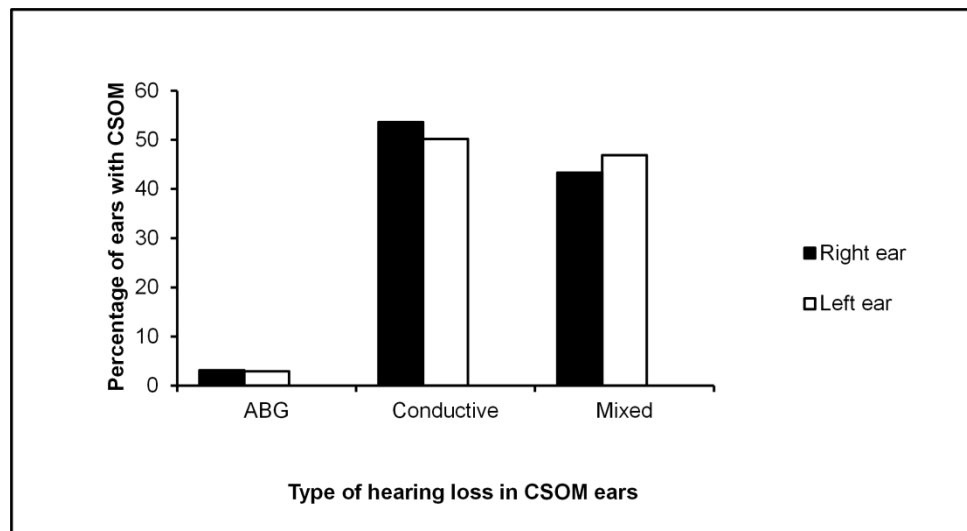


Figure 4:11: Percentage of different types of hearing loss in CSOM for right and left ear

4.4.4. Analysis based on tympanogram

Analysis was also done based on the type of tympanogram seen in CSOM cases. Out of 1009 ears tested, a total of 966 ears were tested for tympanometry since few ears had ear discharge or the seal could not be obtained. Hence, tympanometry findings of 966 ears out of which 466 right ear and 500 left ear is documented. The type of tympanogram was categorized as Type A, As, Ad, B and C. It was noted that maximum number of individuals with CSOM had Type B tympanogram in both ears, as shown in the Table 4.12 and the Figure 4.12.

Table 4.12: *Different types of Tymapnogram seen in CSOM cases.*

Tympanogram	Right ears	Left ears
A	29	20
As	34	37
Ad	8	8
B	361	400
C	34	35
Total	466	500

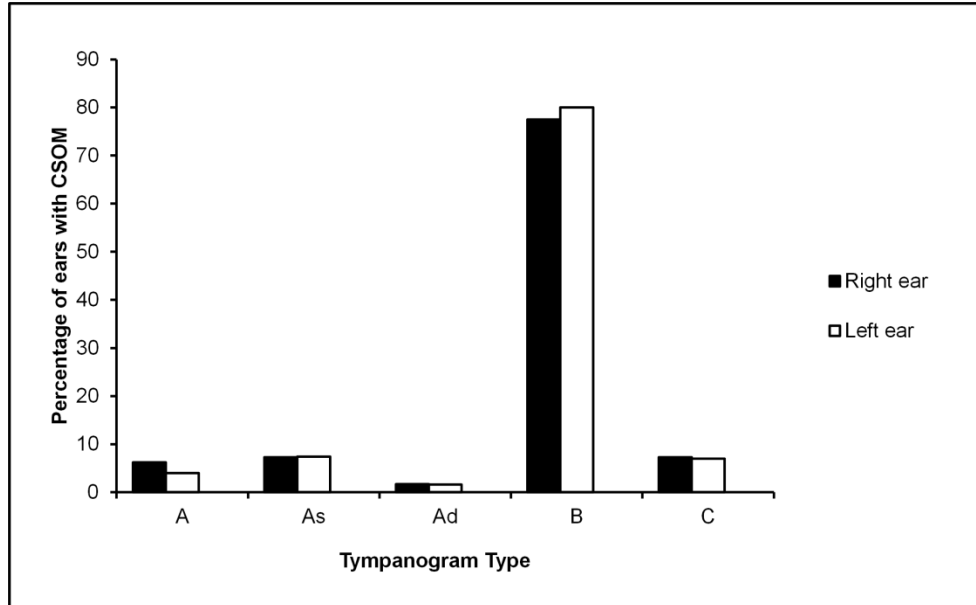


Figure 4:12: Percentage of different types of tympanogram seen in individuals with CSOM

4.5: Analysis based on management recommended in CSOM

The data was categorized according to the management recommended to the individuals with CSOM as medication given, hearing aid trial (HAT), or surgery, by the professionals. It was noted that all the cases were recommended for medications. Very few cases were referred for surgery, as depicted in the Table 4.13 and Figure 4.13.

Table 4.13: *Number of individuals with CSOM according to different management options given.*

Management	Number of individuals
Medication	1187
Medication and HAT	330
Medication and surgery	35
Medication, surgery and HAT	3
Total	1558

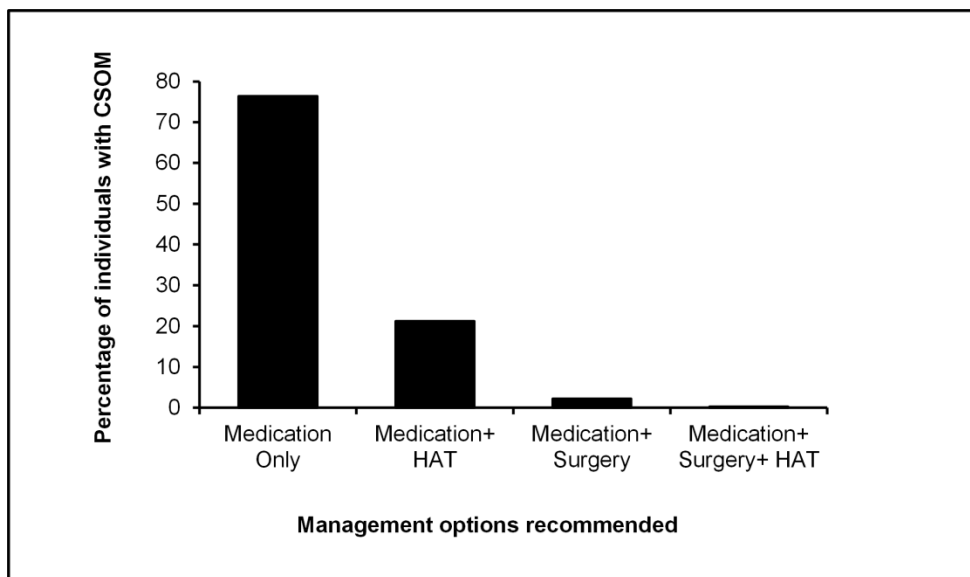


Figure 4:13: *Percentage of individuals with CSOM, recommended for different management options by the professionals*

Thus to conclude, prevalence of CSOM was reported to be more in males, in adults and in individuals with lower socioeconomic status. Also the prevalence was more for left ear compared to right ear and unilateral CSOM was more than bilateral CSOM. The major complaints reported in CSOM cases were reduced hearing sensitivity, ear pain, ear discharge and tinnitus. Headache was the common associated complaint seen in these individuals. Majority of the cases had medical history of URTI, or were known case of Diabetes Mellitus and hypertension. Out of the 1009 ears tested, more number of ears had mild and moderate conductive hearing loss with Type B tympanogram.

Chapter 5

Discussion

The present study was conducted with the aim to determine the prevalence and audiological characteristics in individuals with chronic suppurative otitis media (CSOM) reported at All India Institute of Speech and Hearing (AIISH), Mysore during the period August 2014 to May 2015. The data of 1558 cases was analyzed based on the age, gender, socioeconomic status, different symptoms reported, various associated complaints, complications, medical history, laterality of the disease, type of hearing loss, degree of hearing loss, type of tympanogram and management options recommended. The data was analyzed to determine the number of individuals and percentage of individuals with CSOM in each of the domains. Discussion of obtained results is discussed below:

5.1 Prevalence of CSOM

The prevalence of CSOM reported to AIISH from August 2014 to July 2015 was 12.9% and the prevalence of CSOM in children between 0 to 12 years was 4.8% among 1558 cases reported. This prevalence is high as per WHO (2004) which states that prevalence of >4% is considered as high prevalence. This is in consensus with other prevalence studies done across various parts of India (Misra et al., 1961; Rupa et al.,

1999 & Verma et al., 1995). Also, Berman (1995) and Bluestone (1998) have stated that developing countries have high prevalence of CSOM is in consensus. The possible reason for high prevalence of CSOM seen in the current study could be attributed to various factors like poverty, crowding and lack of awareness of CSOM and its sequel.

5.2. CSOM in different age groups and across gender

In the present study the prevalence of CSOM across age showed that the prevalence was more in adults followed by older adults and least prevalence was reported in infants. However, the result of the present study is not in agreement with the study done in the past (Akinpelu et al., 2008 & Farooqui et al., 2016). Farooqui et al. (2016) reported that CSOM was more prevalent in adolescents followed by adults. The difference noted in the present study with previous literature could be because, most of the earlier prevalence studies have been done on children, as CSOM is said to be more prevalent in children (WHO, 2004).

The prevalence of CSOM across gender showed that it was more in males than females in the current study. This finding is consistent with the study done by Akinpelu et al. (2008), Farooqui et al. (2016), Jensen et al. (2011) and Vartiainen (1998). Similarly, otitis media with effusion is also found with higher incidences among boys (Paradise et al., 1997). This could be attributed to the larger pneumatisation area of the

mastoid among girls (Tos & Stangerup, 1985) and differences in endocrine-immune interactions i.e males are more susceptible to infections (Klein, 2000). However, Shaheen et al. (2012), in his study reported that girls were more affected than boys. The author attributed this result to social and familial insignificance towards girls in Bangladesh.

5.3. Prevalence of CSOM in terms of risk factors, various symptoms and medical history

5.3.1. Socio-economic status

In the present study, the prevalence of CSOM was more for lower socio-economic status that is for individuals from slab I with an income of less than ₹10, 000/-. Lower socio-economic status has been shown as one of the major risk factor in several studies (Akinpelu et al., 2008; Farooqui et al., 2016; Lasisi et al., 2007; Lasisi, Sulaiman, & Afolabi, 2007; Shaheen, Raquib, & Ahmad, 2012; Verma et al., 1995 & WHO, 2004). This could be because of poor hygienic conditions seen in lower socioeconomic groups.

5.3.2. Complications of CSOM

The major complication of CSOM noted in the present study was mainly otomycosis followed by cholesteatoma. Several studies have reported that extra cranial complications are common than intra cranial complications and cholesteatoma was most common extra cranial complications (Kangsanarak et al., 1993). Facial palsy was also reported as a complication in the present study which is also reported in the previous literature (Kangsanarak et al., 1993).

5.3.3. Symptoms of CSOM

The major symptoms reported in the present study were reduced hearing sensitivity followed by ear discharge, ear pain and tinnitus. Complaints of itching and blocking sensations were least reported. Similar results have been reported by Taipale et al. (2011) where they found that ear pain and history of ear discharge was present in all CSOM cases in their study. However, in the present study ear discharge was not present in all the cases as all of them did not have active CSOM.

5.3.4. Other associated complaints of CSOM

In the present study prevalence of headache was more prevalent than vertigo and giddiness in CSOM cases. The presence of headache could be an early indicator of possibility of intracranial complications in CSOM cases (Chotmongkol & Sangsaard, 1992 & Schwaber, Pensak, & Bartels, 1989).

5.3.5. Medical history

Result of the current study showed that URTI was more prevalent followed by known cases of hypertension (HTN) and diabetes mellitus (DM). Eason et al. (1986), Farooqui et al. (2016), Jensen et al. (2011), Verma et al. (1995) and WHO (2004) also reported that URTI was most commonly associated with CSOM and was one of the major risk factors. The possible reason of maximum prevalence of URTI could be that there is a relationship between bacterial colonization in nasopharynx and development of otitis media (Faden et al., 1997; Lasisi et al., 2007 & Ruggeri et al., 1990).

5.4. Audiological findings in CSOM

5.4.1. Right ear vs. left ear CSOM and Unilateral vs. bilateral CSOM

CSOM was more prevalent in left ear and was mainly unilateral in the current study. Shaheen et al., (2012) also reported that CSOM was more prevalent in the left ear than right ear. However, Akinpelu et al. (2008) reported that CSOM was prevalent in right ear than left ear. Unilateral CSOM was common in the present study. This finding was consistent with study done by Adhikari et al. (2009); Hatcher et al. (1995); Ologe and Nwawolo (2002) and Shaheen et al (2012). However, the possible reason as to why it is more prevalent in left ear is unknown.

5.4.2. Degree of hearing loss

Mild and moderate hearing loss in CSOM cases was more prevalent in the current study. This finding is consistent with the study done by Farooqui et al., 2016). This could be because CSOM impedes the conduction of sound which leads to loss of not more than 55 dBHL. If the CSOM affects the inner ear than loss of more than 55dBHL is possible.

5.4.3. Type of hearing loss

Conductive hearing loss more was more prevalent than mixed hearing loss in the present study. Similar findings have been reported by Farooqui et al. (2016) in their study. This could be because CSOM is an inflammation of middle ear cleft which causes conductive hearing loss. If the inflammation of CSOM progresses to inner ear also then it can lead to mixed hearing loss.

5.4.4. Tympanogram

Type B tympanogram was more prevalent followed by As and C type of tympanogram in the present study. Liden et al. (1970) also reported flat tympanogram in the presence of a middle ear fluid and perforation of eardrum. CSOM is a condition with mass dominant pathology which leads to presence of middle ear fluid and perforation and thus B Type of tympanogram is most prevalent.

5.5. Management of CSOM

In the present study all the cases were recommended medications. Very few cases were referred for hearing aid trial and surgery. This could be because CSOM is a condition with middle ear fluid and thus antibiotics would be very affective in this

condition. Previous studies also report use of antimicrobial therapy/ antibiotics for management of CSOM (Indudharan et al., 1999; Kenna et al., 1986 & Kenna et al.,1993). However, if the complication increases than surgery can be recommended.

Chapter 6

Summary and Conclusion

Chronic suppurative otitis media (CSOM) is chronic inflammation of the middle ear, if not treated appropriately, can lead to complications and disabling hearing loss. Thus, a retrospective study on prevalence and audiological characteristics in individuals with CSOM was conducted. A total of 12,836 cases with ear related problems reported to Audiology OPD at All India Institute of Speech and Hearing from August 2014 to May 2015. Out of these, 1652 cases were diagnosed with CSOM. However, data of 1558 individuals with CSOM was available for review. Thus, the prevalence of individual with CSOM reported in this duration was 12.9%. The prevalence of CSOM in children in the age of 0-12 years was 4.9% which is high (>4%) as per WHO (2004) criteria.

The salient results of the present study were:

- Prevalence of CSOM was more in males than females.
- CSOM was found to be more prevalent in adults followed by older adults.
- CSOM was most prevalent for individuals in lower socio-economic status.
- Left ear CSOM was more prevalent than right ear CSOM and unilateral CSOM was common than bilateral CSOM.
- The prevalence of symptom reduced hearing sensitivity was more followed by ear discharge, ear pain and tinnitus. Symptoms of itching and blocking sensations

were least reported. Headache was mainly reported as an associated symptoms in individuals with CSOM.

- The medical history reported majorly were URTI followed by hypertension and Diabetes Mellitus.
- Prevalence of mild and moderate hearing loss was more in CSOM cases.
- Conductive hearing loss was predominantly reported followed by mixed hearing loss in CSOM cases.
- Prevalence of Type B tympanogram was maximum compared to other types.

6.1. Clinical Implications

- The study provides the information regarding the different audiological findings seen in individuals with CSOM.
- The study provides an insight about the vulnerable population who can get affected with CSOM (eg. Males or people from lower socio-economic background) and the risk factors (eg. URTI) that lead to CSOM.
- It provides necessary information about the major symptoms, medical history and associated problems seen in CSOM, so that appropriate management or referral can be made.
- Thus, the study highlights the need to make people aware about the diseased condition, its consequences and need to improve hygiene. Also, it is necessary to

carry out immunization programs and provide better secondary care management to reduce the prevalence of the disease.

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