Original Research Article

International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 23-09-2019; Accepted: 19-10-2019; Published: 27-10-2019
www.medicalsciencejournal.com
Volume 5; Issue 10; 2019; Page No. 226-231

Occurrence and clinical features of the chronic suppurative otitis media (CSOM) in patients admitted to NMCH

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Abstract

Whatever the cause of ear discharge, when treated correctly the condition resolves completely with full restoration of the functions of ear. If untreated or improperly treated it can lead to the complications, which may cause disability or endanger the patient's life. According to WHO survey 42 million people worldwide have hearing loss. The major cause for hearing retardation is otitis media. Therefore, diagnosis and management of every case of ear discharge is extremely important. Hence based on above reports findings the present study was planned for Occurrence and Clinical Features of the Chronic Suppurative Otitis Media (CSOM) in Patients Admitted to NMCH.

The present study was planned in Department of ENT, Nalanda Medical College and Hospital Patna, Bihar, India. The study was conducted from November 2017 to April 2018. Total 50 patients diagnosed with the chronic suppurative otitis media (CSOM) were enrolled in the present study. The clinical study includes thorough history taking, Otological examination tuning fork examination (for screening), pure tone audiometry and tympanometry. Daily detailed examinations were done by ENT surgeons, medical officer trained in audiological equipments and audiologist, using Arphi diagnostic audiometer 2001 and Amplaid 756 tympanometer.

The data generated from the present study concludes that the prevalence has been found to be high in 5 – 20 years age group, especially if members of the group studied belong to the lower socio-economic class. This could be due to enhanced risk factors inherent in children of the lower socioeconomic class. Otitis media is the main cause for deafness in this age group. Primary ear care education to teachers, students and guardians as well as early diagnosis with prompt treatment of otitis media can prevent these from developing hearing impairment and its resultant complications.

Keywords: prevalence, CSOM, hearing retardation, clinical features, etc

Introduction

Chronic suppurative otitis media (CSOM) is defined as a perforated tympanic membrane with persistent drainage from the middle ear for more than 2-6 weeks [1, 2, 3]. Chronic suppuration can occur with or without cholesteatoma, and the clinical history of both conditions can be very similar. CSOM differs from chronic serous otitis media in that chronic serous otitis media may be defined as a middle ear effusion without perforation that is reported to persist for more than 1-3 months.

CSOM is a disease process that has affected humans since prehistoric times. McKenzie and Brothwell demonstrated evidence of chronic suppurative otitis in a skull found in Norfolk, United Kingdom, which is thought to be from the Anglo-Saxon period [4]. Radiologic changes in the mastoid caused by previous infection have been seen in a number of specimens, including 417 temporal bones from South Dakota Indian burials and 15 prehistoric Iranian temporal bones [5, 6].

The chronically draining ear in CSOM can be difficult to treat [7]. The management of CSOM is complex and can involve medical and/or surgical approaches. If cholesteatoma is found, treatment always includes tympanomastoid surgery, with medical treatment as an adjunct.

A common presenting symptom is hearing loss in the affected ear. Reports of fever, vertigo, and pain should raise concern about intratemporal or intracranial complications. A history of persistent CSOM after appropriate medical treatment should alert the physician to consider cholesteatoma. The external auditory canal may or may not be edematous and is not typically tender. The discharge varies from fetid, purulent, and cheeselike to clear and serous. Granulation tissue is often seen in the medial canal or middle ear space. The middle ear mucosa visualized through the perforation may be edematous or even polypoid, pale, or erythematous. A high-resolution temporal bone computed tomography (CT) scan may provide additional valuable information in patients with CSOM that is unresponsive to medical treatment. CT scanning is universally recommended if the clinician suspects a neoplasm or anticipates intratemporal or intracranial complications.

Magnetic resonance imaging (MRI) scans of the temporal bone and brain should be obtained if intratemporal or intracranial complications are suspected. An audiogram should be performed prior to any otologic surgery, except in cases in which urgent surgery is necessary as a life-preserving measure. Conductive hearing loss is expected, but mixed or sensorineural hearing loss may indicate more extensive disease and should alert the treating physician of impending complications, including labyrinthine fistula or

labyrinthitis.

Patients with chronic suppurative otitis media (CSOM) respond more frequently to topical therapy than to systemic therapy. Successful topical therapy consists of 3 important components: selection of an appropriate antibiotic drop, regular aggressive aural toilet, and control of granulation tissue. Systemic therapy should be reserved for cases of CSOM that fail to respond to topical therapy. Surgery should be considered if CSOM fails to respond to a combination of topical and systemic therapy. A tympanomastoidectomy can eliminate infection and stop otorrhea in 80% of patients.

The transmission and amplification of sound are complex phenomena, with the middle ear containing many vital structures. An understanding of the 3-dimensional relationships of anatomic structures is critical to understanding otologic pathophysiology. The middle ear cleft can be thought of as a 6-sided cube. Its lateral boundary, the tympanic membrane, separates it from the outer ear. Its medial boundary is formed by the promontory, which denotes the basal turn of the cochlea. Anteriorly, it is related to the tendon of tensor tympani superiorly and the opening of the eustachian tube inferiorly. Posteriorly, it is related superiorly to the aditus, which connects the middle ear cavity with the mastoid antrum, and inferiorly to the facial ridge. The roof of the middle ear cavity is formed by the tegmen tympani, and the floor of the middle ear cavity lies in close relation to the jugular foramen.

The anterior and posterior malleolar folds, which originate at the level of the lateral process of the malleus, form the boundary between the epitympanum and mesotympanum, which lie above and below it, respectively. Atticoantral disease predominantly affects the pars flaccida, and tubotympanic disease affects the pars tensa. The middle ear cavity also consists of the ossicular chain (malleus, incus, and stapes). The ossicular chain connects the tympanic membrane, in which the handle of the malleus is embedded, to the oval window, on which sits the footplate of the stapes. In atticoantral disease, the ossicular chain is frequently affected by cholesteatoma, thereby causing hearing loss. Removal of the malleus and or incus may be necessary if they are extensively involved by cholesteatoma. In these cases, a planned second-stage reconstruction is often appropriate. The bones of the middle ear are the smallest in the body.

The pathophysiology of CSOM is complex and multifactorial. Current theories suggest that CSOM is initiated by an episode of acute infection. The pathophysiology of CSOM begins with irritation and subsequent inflammation of the middle ear mucosa. The inflammatory response creates mucosal edema. Ongoing inflammation eventually leads to mucosal ulceration and consequent breakdown of the epithelial lining. The host's attempt at resolving the infection or inflammatory insult manifests as granulation tissue, which can develop into polyps within the middle ear space. (A study by Wang *et al* suggested that in CSOM, T-cell–mediated cellular immunity plays a role in the formation of granulation tissue [8]. The cycle of inflammation, ulceration, infection, and granulation tissue formation may continue, eventually destroying the surrounding bony margins and ultimately leading to the various complications of CSOM [9, 10].

Pseudomonas aeruginosa, Staphylococcus aureus, Proteus species, Klebsiella pneumoniae, and diphtheroids are the most common bacteria cultured from chronically draining ears. Anaerobes and fungi may grow concurrently with the aerobes in a symbiotic relationship. The clinical significance of this relationship, although unproven, is theorized to be an increased virulence of the infection. Understanding the microbiology of this disease enables the clinician to create a treatment plan with the greatest efficacy and least morbidity.

P aeruginosa is the most commonly recovered organism from the chronically draining ear. Various researchers over the past few decades have recovered pseudomonads from 48-98% of patients with CSOM. P aeruginosa uses pili to attach to necrotic or diseased epithelium of the middle ear. Once attached, the organism produces proteases, lipopolysaccharide, and other enzymes to prevent normal immunologic defense mechanisms from fighting the infection. The ensuing damage from bacterial and inflammatory enzymes creates further damage, necrosis, and, eventually, bone erosion leading to some of the complications of CSOM. Fortunately, in the immunocompetent individual, the infection rarely causes serious complications or disseminated disease. Pseudomonal infections commonly resist macrolides, extended-spectrum penicillins, and first- and second-generation cephalosporins. This can complicate treatment plans, especially in children.

S aureus is the second most common organism isolated from chronically diseased middle ears. Reported data estimate infection rates from 15-30% of culture-positive draining ears. The remainder of infections are caused by a large variety of gram-negative organisms. Klebsiella (10-21%) and Proteus (10-15%) species are slightly more common than other gram-negative organisms.

Polymicrobial infections are seen in 5-10% of cases, often demonstrating a combination of gram-negative organisms and S aureus. Anaerobes (Bacteroides, Peptostreptococcus, Peptococcus) and fungi (Aspergillus, Candida) complete the spectrum of colonizing organisms responsible for this disease. The anaerobes make up 20-50% of the isolates in CSOM and tend to be associated with cholesteatoma. The assertion that a healthy individual will have a sterile middle ear has been disputed in a study in which bacteria were detected in 45% of healthy mastoids and middle ears [11]. Fungi have been reported in up to 25% of cases, but again, their pathogenic contribution to CSOM is unclear.

Biofilms are communities of microorganisms that are codependent, and they can form on various surfaces [12]. Multiple studies have shown that biofilms occupy a major role in many chronic otolaryngologic infections, including cholesteatoma, chronic otitis media, chronic tonsillitis, and chronic sinusitis [13].

Several studies have evaluated the role of biofilms in the pathophysiology of CSOM. A study by Kaya *et al* found a significantly higher percentage of biofilm formation in patients with CSOM than in individuals with chronic nonsuppurative otitis media [14]. Another study, by Gu *et al*, detected the presence of bacterial biofilms in 85% of patients with middle ear cholesteatoma and in 92% of patients with chronic otitis suppurative media, but in only 16% of patients with dry tympanic membrane perforation [15].

The diagnosis of CSOM requires a perforated tympanic membrane. These perforations may arise traumatically, iatrogenically with tube placement, or after an episode of acute otitis media, which decompresses through a tympanic perforation [7, 16, 17, 18, 19]. The mechanism of infection of the

middle ear cleft is postulated to be translocation of bacteria from the external auditory canal through a perforation into the middle ear. Some authors suggest that the pathogenic organisms may enter through reflux of the eustachian tube. The data supporting this theory are inconclusive. Most of the pathogenic bacteria are those common to the external auditory canal. The risk of developing otorrhea (but not necessarily CSOM) through a ventilation tube is reportedly 21-50%. Annually, more than a million tubes are placed in the United States for recurrent otitis media and otitis media with effusion. Studies have reported that 1-3% of patients with ventilation tubes develop this disease.

The risk of developing CSOM increases with the following circumstances [20]: A history of multiple episodes of acute otitis media; Living in crowded conditions; Day care facility attendance; Being a member of a large family. Studies trying to correlate the frequency of the disease with parental education, passive smoke, breastfeeding, socioeconomic status, and the annual number of upper respiratory tract infections are inconclusive.

Patients with craniofacial anomalies are special populations at risk for CSOM. Cleft palate, Down syndrome, cri du chat syndrome, choanal atresia, DiGeorge syndrome, cleft lip, and microcephaly are other diagnoses that increase the risk of CSOM, presumably from altered eustachian tube anatomy and function. The larger the tympanic membrane perforation, the more likely the patient is to develop CSOM. Some studies estimate the yearly incidence of CSOM to be 39 cases per 100,000 persons in children and adolescents aged 15 years and younger. In Britain, 0.9% of children and 0.5% of adults have CSOM. In Israel, only 0.039% of children are affected [21].

Certain population subsets are at increased risk for developing CSOM. The Native American and Eskimo populations demonstrate an increased risk of infection. Eight percent of Native Americans and up to 12% of Eskimos are affected by CSOM. The anatomy and function of the eustachian tube play a significant role in this increased risk. The eustachian tube is wider and more open in these populations than in others, thus placing them at increased risk for nasal reflux of bacteria common to acute otitis media and recurrent acute otitis media and leading to more frequent development of CSOM.

Other populations at increased risk include children from Guam, Hong Kong, South Africa, and the Solomon Islands. The prevalence of CSOM appears to be distributed equally between males and females. Exact prevalence in different age groups is unknown; however, some studies estimate the yearly incidence of CSOM to be 39 cases per 100,000 in children and adolescents aged 15 years and younger [20]. Patients with CSOM have a good prognosis with respect to control of infection. The recovery of associated hearing loss varies depending on the cause. Conductive hearing loss can often be partially corrected with surgery. The goal of treatment is to provide the patient a safe ear.

Much of the morbidity of CSOM comes from the associated conductive hearing loss and the social stigma of an often-fetid fluid draining from the affected ear. The mortality of CSOM arises from associated intracranial complications. CSOM itself is not a fatal disease. Although some studies report sensorineural hearing loss as a morbid complication of CSOM, other evidence conflicts with this claim [22, 23].

A study by Jensen *et al* of two groups of children in Greenland found that among those children with CSOM, 91% suffered permanent hearing loss of greater than 15 dB HL (decibel hearing level). The groups were followed up for 10 and 15 years [24]. A study by Aarhus *et al* of hearing loss in various types of otitis media found that childhood hearing loss from CSOM is associated with adult hearing loss, with the effect on hearing thresholds being greater in middle age (age 40-56 years) than in young adulthood (age 20-40 years). The same held true for recurrent acute otitis media [25].

Suppurative infection of the external auditory canal may result in formation of a furuncle. As there is a lack of connective tissue in the external, relieved only when it bursts open, resulting in ear discharge. The infection of the skin of the auditory canal may result in serous discharge if there is eczematous dermatitis. Viral infection of the external canal is usually seen in Herpes zoster infection where the rupture of vesicle is responsible for the serous discharge from the ear.

Studies show that the most common fungal agent is Aspergillus species, which is nearly 83% of all fungal causes of CSOM. The second most common cause is Candida spp [26]. Following blockage of the eustachian tube, there is an infection in the middle ear cavity resulting in acute otitis media. To begin with, there is collection of exudate in the middle ear cavity, which becomes purulent if not treated in time and exits through a small perforation in the tympanic membrane. There is a pulsatile discharge and with it the pain and the ear block is relieved. If the infection persists then it goes into chronic suppurative otitis media [27]. Studies shows that the most common organisms isolated from cases of CSOM are Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella species and Proteus species While the common causative organism for acute otitis media it is Haemophilus influenzae, Moraxella catarrhalis and Streptococcus pneumonia.

In neonates and infants, another form of otitis media known as acute necrotising otitis media is prevalent in which the perforation is large. This perforation and a large perforation due to long standing acute chronic suppurative otitis media may go into secondary acquired cholesteatoma [28]. Another common cause of blood-stained discharge is granuloma of the external Auditory canal and granular myringitis. Repeated cleaning with ear buds is responsible for injury to the epithelial layer of tympanic membrane. Granulations form on the drum resulting in discharge. Rarely, blood stained discharge may be due to glomus jugularis or a vascular anomaly. Lastly blood-stained discharge with a mass in the ear may be due to malignancy of the external or middle ear [29].

Whatever the cause of ear discharge, when treated correctly the condition resolves completely with full restoration of the functions of ear. If untreated or improperly treated it can lead to the complications, which may cause disability or endanger the patient's life. According to WHO survey 42 million people worldwide have hearing loss. The major cause for hearing retardation is otitis media. Therefore, diagnosis and management of every case of ear discharge is extremely important. Hence based on above reports findings the present study was planned for Occurrence and Clinical Features of the Chronic Suppurative Otitis Media (CSOM) in Patients Admitted to NMCH.

Methodology

The present study was planned in Department of ENT,

Nalanda Medical College and Hospital Patna, Bihar, India. The study was conducted from November 2017 to April 2018. Total 50 patients diagnosed with the chronic suppurative otitis media (CSOM) were enrolled in the present study. The clinical study includes thorough history taking, Otological examination tuning fork examination (for screening), pure tone audiometry and tympanometry. Daily detailed examinations were done by ENT surgeons, medical officer trained in audiological equipments and audiologist, using Arphi diagnostic audiometer2001 and Amplaid 756 tympanometer.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion Criteria

- Patients diagnosed as CSOM-discharge for more than 4 weeks (safe/ Tubotympanic type).
- Age: All ages and both sex.
- Residual or Recurrence of Disease.
- Patient not underwent any surgical treatment for CSOM.

Exclusion Criteria

- CSOM with co-morbid conditions like diabetes, chronic drug intake previous ear surgeries
- Patients with complications of CSOM (facial palsy, brain abscess, lateral sinus thrombosis, cavernous sinus thrombosis and profound hearing loss).
- Antibiotic intake (oral/ intravenous/ topical) more than 5 days prior to clinical presentation.

Results & Discussion

WHO (World Health Organization) defines chronic suppurative otitis media as a stage in ear disease in which there is a chronic infection of the middle ear cleft in the presence of persistent tympanic membrane perforation [30]. Chronic suppurative otitis media is typically a persistent disease, insidious in onset, often capable of causing severe destruction and irreversible sequelae and clinically manifests with deafness and discharge. According to Mawson's textbook of Ear disease, it is persistent otorrhea through a non-intact tympanic membrane [31]. The global burden of chronic suppurative otitis media is estimated around 65-330 million of which 60% suffer from significant hearing impairment. It accounts for 28,000 deaths and a disease burden of more than 2 million DALYs. Incidence of CSOM is higher in developing countries because of poor socio-economic standards, poor nutrition and lack of health education. It affects both sexes and all age groups. In India, the overall prevalence rate is 46 and 16 persons per thousand in rural and urban population respectively. It is also the single most important cause of hearing impairment in rural population.

Table 1: Demographic Details

Parameters	No. of Cases
Sex	
Male	28
Females	22
Age	
Less than 5 years	9
5 – 20 years	21
21 – 30 years	10
31 – 40 years	10
Total	50

Table 2: Otoscopic findings

Otoscopic findings	No. of Cases
Otitis media with effusion	3
Healed otitis media	4
Retracted tympanic membrane	13
CSOM with safe perforation	20
CSOM with unsafe perforation	8
Bilateral CSOM with safe and unsafe perforation	2

Table 3: Clinical features

Clinical features	No. of Cases
Ottorhoea	35
Hearing retardation	22
Otalgia	16
Odor ful discharge	8
Itchy ear	12
Tinnitus	10
Vertigo	6

Table 4: Audiological examination (after wax and pus cleaning)

Nature of hearing loss	No. Ears affected
Conductive hearing loss (in 1/both ears)	43
Mild to moderate hearing loss	40
Mixed hearing loss	2
Sensorineural hearing loss	1

Table 5: Impedance profile of patients with intact tympanic membrane

Impedance	No. of Cases
Type'a' jerger's	1
Type'b' jerger's	3
Absence of any peak pressure	9

Otitis media can present itself in different forms because of large variations in the nature of the disease. This could range from silent otitis media with clinically undetectable middle ear pathology to late stage intracranial life-threatening complications like meningitis, brain abscess etc. It is a recognized cause of mild to moderate hearing loss [32]. CSOM with and without complication continues to affect a large number of patients. 8 Poor living conditions, overcrowding, poor hygiene and nutrition have been suggested as a basis for the widespread prevalence of CSOM in developing countries [33]. Poverty is a major risk factor in developing countries and certain neglected population.

Okafor *et al* study showed that there were only a few cases where CSOM affected patients from the higher socioeconomic ladder and even then the pathology started before the patient moved up the socio-economic ladder. The only exceptions to this finding were a few children born in good circumstances but with special problems such as cleft palate. Unfortunately, the two factors very often co-exist.

Minja and Machemba [34] found the prevalence of CSOM to be 9.4% among rural schoolchildren and 1.3% among urban schoolchildren in Dar es Salaam, Tanzania, the difference being statistically significant. Rupa *et al*. [35] found the overall prevalence rate to be 6% among rural South Indian children. Ologe and Nwawolo [36] in their study of CSOM in schoolchildren in Nigeria found the prevalence to be 6.0% in a rural government primary school whereas that of 0% in a urban private school. Kamal *et al*. [37] in their study of children of slum dwellers in Dhaka city found the prevalence of CSOM to be 7.39%. Adhikari*et al*. [38] in their cross-sectional study among schoolchildren of Kathmandu valley found the prevalence to be 5.7% in a government school and 4.8% in a urban school.

Children from lower socioeconomic groups, being more vulnerable to otitis media, should be given special care to prevent hearing retardation. Swimming in polluted water of a pond or river regularly may be a factor responsible for discharging ear. Untreated acute suppurative otitis media can also persist as CSOM. Malnutrition and poor living conditions are more likely to prevail among rural schoolchildren. Poor housing was recognised as a risk factor for CSOM by WHO/CIBA Foundation Workshop conducted in 1996. Potential hearing loss because of otitis media has significant consequences on the development of speech and cognitive abilities, including academic performance of children. Thus, the gap between the fortunate and the less privileged is further widened by an innate difficulty in learning occasioned by CSOM.

According to a World Health Organization survey, 42 million people worldwide (older than 3 years) have hearing loss. The major cause for hearing retardation is otitis media, 16 which is second only to common cold as a cause of infection in childhood. It is estimated that about 90% of people have at least one episode of otitis media by their 2nd birthday. For children less than 15 years old, the most frequent diagnosis made in clinical practice is otitis media. 15 Children from developing countries having unfavorable environments witness an extraordinarily high incidence of severe episodes of otitis media with frequent perforation of tympanic membrane and persistent suppurative discharge and necrotizing process in the middle ear, including destruction of ossicles. Children from lower socioeconomic groups being more vulnerable to otitis media, they have to be given special care to prevent hearing retardation. Otitis media gradually and silently affects the hearing process, which, in turn, adversely affects mental status, socialization and education in such children. After every episode of otitis media in children, fluid persists in the middle ear for weeks to months. This leads to conductive hearing loss. Poor hearing retards development of speech and impacts adversely upon mental ability and selfconfidence resulting into social burden

As clinicians in developed countries recognize that episodes of otitis media often do not require treatment, there is a need to identify the clinical features of otitis media associated with poor outcome. A better understanding of otitis media in populations with higher rates of perforation of the tympanic membrane is likely to be helpful. The primary health care priorities in remote communities should be: i) support strategies that reduce the transmission of bacterial infections to infants and toddlers; ii) encourage timely immunization; iii) advice on effective communication strategies for hearing impaired children; iv) provide frequent and accurate assessment of middle ear disease in the first 18 months of life; v) educate families about the appropriate management for different types of ear disease; and vi) help families give prolonged antibiotic treatment to their children with persistent suppurative otitis media.

Conclusion

The data generated from the present study concludes that the prevalence has been found to be high in 5 – 20 years age group, especially if members of the group studied belong to the lower socio-economic class. This could be due to enhanced risk factors inherent in children of the lower socioeconomic class. Otitis media is the main cause for deafness in this age group. Primary ear care education to teachers, students and guardians as well as early diagnosis with prompt treatment of otitis media can prevent these from developing hearing impairment and its resultant complications.

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