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Clinical evaluation of different bacteriological profile of chronic suppurative otitis media (CSOM) in Bihar population

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Abstract
The indiscriminate, haphazard and half-hearted use of antibiotics and poor follow up of the patients have resulted in persistent changes in the bacteriological pattern of the disease, the advent of new antimicrobials, anti-inflammatory and anti-histamine agents make an evaluation of bacterial flora of CSOM important. Increasing resistance of microorganism to the drugs has been reported. This leads to development of serious complications. Hence the present study was planned to find out the predominant organisms in the locality and the antibiotic susceptibility of the bacteria.
The present study was planned in the Department of Microbiology, mata Gujri memorial medical college and Lions seva kendra Hospital from Jan 2000 to August 2000. Total 50 cases of Chronic suppurative otitis media of all age groups and both sexes attending outpatient department and those admitted in ENT wards were selected randomly for the study.
The bacteriological agent associated with CSOM has not changed significantly in our environment. However, there is a gradual decline in their sensitivity pattern to a number of antibiotics. The important factor responsible for development of resistance is inappropriate duration of treatment and dose of antibiotics. Judicial use of antibiotics is necessary for the prevention of development of antibiotic resistance.

Keywords: chronic suppurative otitis media, CSOM, bacteriological profile, etc

Introduction
Chronic suppurative otitis media (CSOM) is a major cause of acquired hearing impairment in children, especially in developing countries. Most approaches to treatment have been unsatisfactory or are very expensive and difficult; for example parenteral aminoglycosides require long hospitalization and are potentially ototoxic. This situation is reflected in the MCI recommendation only to wick the ear, but not to use any antibiotics. If the child continues to have a discharging ear on day 5 of follow-up, the consequence is to encourage further wicking. This is unsatisfactory, as the child's caretaker sees no real option for treatment, and may search for alternatives from other sources, spending money and losing trust in the health system. Recent developments in the treatment of chronic otitis media include evidence for the efficacy of antibiotics, especially with the introduction of topical quinolones, which are reported to have high effectiveness and are relatively easily administered, but remain expensive.
Several systems of nomenclature have been developed to distinguish between different types of otitis media, reflecting the lack of complete understanding of the processes responsible for the inflammation and healing of the middle ear. For the purpose of this report, the presence of a persistent tympanic perforation and middle ear discharge differentiates CSOM from other chronic forms of otitis media. CSOM is also called chronic active mucosal otitis media, chronic oto-mastoiditis, and chronic tympanomastoiditis. A subset of CSOM may have cholesteatomas or other suppurative complications. The non-CSOM group includes such entities as chronic non-suppurative otitis media, chronic otitis media with effusion (COME), chronic secretory otitis media, chronic seromucous otitis media, chronic middle ear catarrh, chronic serous otitis media, chronic mucoid otitis media, otitis media with persistent effusions, and glue ear. All these are recurrent or persistent effusions in the middle ear behind an intact tympanic membrane in which the principal symptom, if present at all, is deafness and not ear discharge.
CSOM can also be differentiated from AOM on bacteriological grounds. In AOM the bacteria found in the middle ear include Streptococcus pneumoniae, Staphylococcus aureus, Haemophilus influenzae and Micrococcus catarrhalis. These are respiratory pathogens that may have been insufflated from the nasopharynx into the middle ear through the Eustachian tube during bouts of upper respiratory infections. In CSOM the bacteria may be aerobic (e.g. Pseudomonas aeruginosa, Escherichia coli, S. aureus, Streptococcus pyogenes, Proteus mirabilis, Klebsiella species) or anaerobic (e.g. Bacteroides, Peptostreptococcus, Proprionibacterium). The bacteria are infrequently found in the skin of the external canal, but may proliferate in the presence of trauma, inflammation, lacerations or high humidity. These bacteria may then gain entry to the middle ear through a chronic perforation. Among these bacteria, P. aeruginosa has been particularly blamed for the deep-seated and progressive destruction of middle ear and mastoid structures through its toxins and enzymes [1].
Chronic suppurative otitis media (CSOM) is a chronic inflammation of the middle ear and mastoid cavity that is characterised by discharge from the middle ear through a perforated tympanic membrane for at least 6 weeks. CSOM occurs following an upper respiratory tract infection that has led to acute otitis media. This progresses to a prolonged inflammatory response causing mucosal (middle ear)

oedema, ulceration and perforation. The middle ear attempts to resolve this ulceration by production of granulation tissue and polyp formation. This can lead to increased discharge and failure to arrest the inflammation, and to development of CSOM, which is also often associated with cholesteatoma. There may be enough pus that it drains to the outside of the ear (otorrhea), or the pus may be minimal enough to be seen only on examination with an otoscope or binocular microscope. Hearing impairment often accompanies this disease.

People are at increased risk of developing CSOM when they have poor eustachian tube function, a history of multiple episodes of acute otitis media, live in crowded conditions, and attend paediatric day care facilities. Those with craniofacial malformations such as cleft lip and palate, Down syndrome, and microcephaly are at higher risk. Worldwide approximately 11% of the human population is affected by AOM every year, or 709 million cases [2, 3]. About 4.4% of the population develop CSOM [3].

According to the World Health Organization, CSOM is a primary cause of hearing loss in children. Adults with recurrent episodes of CSOM have a higher risk of developing permanent conductive and sensorineural hearing loss. In Britain, 0.9% of children and 0.5% of adults have CSOM, with no difference between the sexes. The incidence of CSOM across the world varies dramatically where high income countries have a relatively low prevalence while in low income countries the prevalence may be up to three times as great. Each year 21,000 people worldwide die due to complications of CSOM [4].

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) [5] 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 [6-7].

Pseudomonas aeruginosa, Staphylococcus aureus, Proteusspecies, 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. The 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. Fungi have been reported in up to 25% of cases, but their pathogenic contribution to this disease is unclear.

The indiscriminate, haphazard and half-hearted use of antibiotics and poor follow up of the patients have resulted in persistent changes in the bacteriological pattern of the disease, the advent of new antimicrobials, anti-inflammatory and anti-histamine agents make an evaluation of bacterial flora of CSOM important. Increasing resistance of microorganism to the drugs has been reported. This leads to development of serious complications. Hence the present study was planned to find out the predominant organisms in the locality and the antibiotic susceptibility of the bacteria.

Methodology

The present study was planned in the Department of Microbiology, mata Gujri memorial medical college and Lions seva kendra Hospital from Jan 2000 to August 2000 Total 50 cases of Chronic suppurative otitis media of all age groups and both sexes attending outpatient department and those admitted in ENT wards were selected randomly for the study.

Direct culture material was seeded on Blood agar, Mac Conkey's agar and on Chocolate agar plates. All plates were incubated aerobically at 37^0C and evaluated at 24 hours, 48 hours and 72 hours and the plates were discarded if there was no growth. The specific identification of bacterial pathogens was done based on microscopic morphology, staining characteristics, cultural and biochemical properties using standard laboratory [8-9].

A proforma was filled for each patient documenting age, sex, address and clinical information, including chief complaints, duration of symptoms, predisposing factors and any previous history of treatment. Other medical history like diabetes mellitus, hypertension and tuberculosis, etc. was noted.

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

The CSOM is defined as a longstanding infection of a part of whole of middle ear cleft characterized by ear discharge and a permanent perforation [10]. Aerobes, anaerobes, and fungi are all potential pathogens in CSOM. Knowledge of the true frequency of polymicrobial infection, particularly the extent of anaerobic involvement, is limited by differences in collection and culture techniques [11-12]. Traditional swab specimen collection has been associated with contamination with normal skin flora like Staphylococcus epidermidis, diphtheroids and anaerobic organisms, such as Propionibacterium acnes [13].

Otitis media is one of the most common ear diseases which is encountered in day-to-day practice. If left untreated, it may cause destruction of middle ear structures leading to hearing loss and may also cause complications like mastoiditis, periostitis, facial paralysis, labyrinthitis, brain abscess, meningitis, lateral sinus thrombophlebitits etc. Aural toileting with meticulous antimicrobial treatment is essential to prevent complications. . Children are more prone to the development of Otitis media because their Eustachian tubes are shorter and more horizontal than adults and are made of more flaccid cartilage which causes impaired opening of the tube. It is also related to forced feeding, improper positioning of infants during breast feeding and bottle feeding. In the present study, unilateral infection was predominant. Left ear was more commonly affected than right ear.

Table 1: Culture pattern in various age groups

Age group	Single bacteria isolated	Multiple bacteria isolated	Sterile culture	Total
1-15	11	0	2	13
16-30	9	0	2	11
31-45	12	2	2	16
46-60	5	0	1	6
61-75	3	1	0	4
Total	40	3	7	50

Table 2: Predominant Side of Ear discharge

Side of Ear	No. of Cases
Left Ear	30
Right Ear	16
Both Ears	4
Total	50

Table 3: Organisms isolated in the study (M =multiple organisms)

Organism	Frequency
Acinetobacter	3
Acinetobacter, CONS (M)	1
Citrobacter	2
CONS	3
E.coli	2
E.coli, CONS (M)	1
E.coli, Pseudomonas (M)	1
Enterococci	1
Klebsiella	1
MRSA	3
No growth	8
Pneumococci	1
Proteus mirabilis	1
Proteus vulgaris	1
Pseudomonas	14
Pseudomonas, Staph. aureus (M)	1
Schwanella species, CONS (M)	1
Schwanella	2
Staph. aureus	9
Staph. aureus, Pseudomonas (M)	1
Total Staphylococcus	11
Total Pseudomonas	14

Table 4: Incidence of Complications

Sr. No.	Complications	No. of patients (%)
1	Pyogenic meningitis	2
2	Post-auricular fistula	1
3	Mastoiditis	1
4	Post-auricular abscess	1
5	Temporal lobe abscess	1
6	Facial nerve palsy	1
7	Attico antral type of CSOM	1
	Total	8

The frequency of Staphylococcus aureus in the middle ear infections can be attributed to their ubiquitous nature and high carriage of resistant strains in the external auditory canal and upper respiratory tract. The organisms like Pseudomonas spp. And Proteus spp. were considered mostly as secondary invaders from external auditory canal gaining access to the middle ear via a defect in tympanic membrane resulting from an acute episode of otitis media. Organisms like E. coli and Klebsiella spp. Become opportunistic pathogens in the middle ear when resistance is low.

CSOM is an important cause of preventable hearing loss and is of serious concern in paediatric age group because it may have long-term effects on early communication, language development, educational process, auditory processing and physiological and cognitive development [14]. Pseudomonas is the predominant cause of CSOM in tropical region and does not usually inhabit the upper respiratory tract. It's presence in the middle ear cannot be ascribed to an invasion through Eustachian tube (ET) and it should be considered as a secondary invader gaining access to the middle ear through defect in TM [15]. Poor hygiene and unorthodox approach to treatment like use of unconventional ear drops and concoctions such as oil and honey into the middle ear should be avoided [16].

Early microbiological diagnosis ensures prompt and effective treatment to avoid such complications. The mainstay of treatment for uncomplicated CSOM is twofold: meticulous aural toilet and instillation of a topical and systemic antimicrobial agent. The therapeutic use of antibiotics is usually started empirically prior to results of microbiological culture. Selection of any antibiotic is influenced by its efficacy, resistance of bacteria, safety, risk of toxicity and cost. Knowledge of the local microorganism pattern and their antibiotic sensitivity is thus essential to allow for effective and cost-saving treatment. Microbiology cultures yield many, frequently multiple organisms and these vary depending on climate, patient population and whether antibiotics have or have not been recently used. Several studies have reported different organisms in different proportions [17].

On the other hand, limited availability and high cost make the latter group of drugs more sensitive till date. Although still sensitive, the sensitivity is declining. Thus, there is a need to quickly check the menace of inappropriate treatment of CSOM by quacks and intensify campaign against self-medication.

Future studies should focus on the bacterial profile of multidrug-resistant strains resulting from indiscriminate use of antibacterial agents. So formation of empirical antibiotic policy of a specified geographical region is of vital importance. This will have a huge positive impact by avoiding surgical procedure, minimizing the health care expenditure and more importantly preserving the quality hearing, to lead a normal social life.

Continuous and periodic evaluation of microbiological pattern and antibiotic sensitivity of isolates is necessary to initiate effective treatment protocols for the study population. It also decreases the potential risk of complications by early institution of appropriate treatment. Untreated cases of CSOM can result in a broad range of complications like persistent otorrhoea, mastoiditis, labyrinthitis, meningitis and facial nerve palsy. Some patients may develop life threatening complications like lateral sinus thrombosis or brain abscess also. Hence treatment has to be initiated early and effectively.

Conclusion

The bacteriological agent associated with CSOM has not changed significantly in our environment. However, there is a gradual decline in their sensitivity pattern to a number of antibiotics. The important factor responsible for development of resistance is inappropriate duration of treatment and dose of antibiotics. Judicial use of antibiotics is necessary for the prevention of development of antibiotic resistance.

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