

Original Research Article

A prospective study on pattern of microbes in chronic suppurative otitis media

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is a common chronic ear disease causing serious local damage and complications. Irrational use of antibiotics for its management has led to the emergence of multidrug-resistant strains. This study was conducted to find out the microbial profile and their antimicrobial sensitivity patterns in CSOM patients in Garhwal belt.

Methods: A total number of 100 patients of clinically diagnosed CSOM were enrolled over the duration of 1 year. Ear discharge was collected using sterile swabs and processed for the identification of aerobes, anaerobes and fungal isolates. Antimicrobial susceptibility testing of the isolates was performed.

Results: Maximum incidence of CSOM was observed in patients of 10–20 years age group with female preponderance. Decreased hearing was the main associated symptom. Out of 100 swabs, microbial growth was obtained in 88 samples amongst which 61 had monomicrobial growth while 39 had polymicrobial growth. *Pseudomonas aeruginosa* was the most common isolate. Amikacin showed maximum activity to most of the isolates.

Conclusions: Evaluation of microbes and their antibiotic sensitivity pattern in local area becomes helpful in prescribing empirical treatment for successful cure of CSOM.

Keywords: Microbes, Amikacin, Antibiotic sensitivity, Chronic suppurative otitis media

INTRODUCTION

Chronic suppurative otitis media (CSOM) also known as chronic active mucosal otitis media, chronic otomastoiditis or chronic tympanomastoiditis, is usually a disease of childhood occurring as a sequelae of acute otitis media.¹ It is prevalent in developing countries especially among low socioeconomic strata due to malnutrition, poor hygiene, overcrowding, inadequate health care, and recurrent upper respiratory tract infection.² It is defined as a chronic inflammation of middle ear space and mastoid cavity that may present with recurrent ear discharge or otorrhoea resulting in long term or permanent changes in the tympanic membrane.³

Depending on the part of tympanic membrane affected CSOM is divided into two types, tubotympanic and attico-antral.⁴ Tubotympanic also known as mucosal or safe or benign disease. In this, the infection is limited to mucosa and anteroinferior part of the middle ear cleft. Attico-antral also known as squamosal or unsafe or dangerous disease. It is associated with complications such as mastoiditis, facial nerve paralysis, labyrinthitis, lateral sinus thrombosis, meningitis and brain abscess.⁵ Mild to moderate conductive hearing loss associated with chronic ear discharge is significant in CSOM and is more severe than any other type of otitis media.⁶ Hence, an early diagnosis and prompt effective treatment are necessary to avoid these complications.

The flora of CSOM vary according to geographical area and many other factors. However, the common isolates are *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, *Proteus mirabilis*, *Klebsiella*, *Streptococcus pyogenes*, *Aspergillus* and *Candida*.⁷ In developing countries, multidrug-resistant strains are rapidly increasing due to irrational use of antibiotics and this has further led to the development of disease complications.⁸

Hence, it is essential to know local microbiological prevalence and antibiotic sensitivity pattern to plan the general management of CSOM. Considering the emergence of bacterial resistance and the availability of newer antibiotics, this study was conducted to analyze the pattern of microbes that causes CSOM and their antibiotic sensitivity patterns amongst the patients who attended the otorhinolaryngology department of our hospital.

METHODS

After the approval from the Institutional Ethical Committee, this prospective study was conducted among the patients of CSOM who attended the Outpatient department of a tertiary care centre of Uttarakhand state for a period of 1 year from October 2019 to November 2020. In this time period of 1 year, 112 patients of CSOM came to our outpatient department. Out of which 8 patients were not willing for the study participation and 4 already received antibiotics so were excluded. So, excluding these 12 patients, our total sample size was 100 patients. These 100 patients of clinically diagnosed CSOM irrespective of age and gender who did not received antibiotics (topical or systemic) were enrolled in the study. Patients with otitis externa, otomycosis, acute suppurative otitis media, diabetes mellitus and other immune-compromised states were excluded from the study.

After taking the informed consent from the patients or parent/guardian, information regarding age, gender, nature of discharge, duration of ear discharge was noted in a proforma. Ear discharge was collected using sterile swabs which were labeled and sent to the laboratory without any delay for bacteriological and fungal culture studies. All specimens were processed for the identification of aerobes, anaerobes and fungal isolates.

One of the swabs was used for aerobic culture which was plated on MacConkey's agar, 5% sheep blood agar and chocolate agar and incubated aerobically at 37°C for 24 and 48 hour. Second swab was used for anaerobic culture, inoculated in Robertson's cooked meat (RCM) broth and incubated at 37°C for 72 hour. Third swab was used for mycological culture and was inoculated on Sabouraud dextrose agar with chloramphenicol (0.05%) and then incubated at 28°C and 37°C. Further, the slants were examined for gross and the microscopic morphology of the fungi. Germ tube fermentation test was done for identification of *Candida albicans*. Antimicrobial susceptibility testing of the isolates was performed on

Mueller Hinton agar using Kirby Bauer disc diffusion method. Results were interpreted in accordance with clinical laboratory standards institute (CLSI) guidelines.⁹ Treatment was started based on clinical diagnosis initially and follow up was done 1 week later with culture and sensitivity reports. The treatment was reviewed then and changed if needed according to the culture reports.

Data was entered and analysed using Microsoft excel. Results were presented in frequencies.

RESULTS

In our study, age group of patients ranged from 6 months to 72 years (mean age=30.2 years). Maximum incidence of CSOM was observed in patients of 10–20 years age group (35 %) (Table 1).

Table 1: Age wise distribution of patients of CSOM.

Age (years)	Number of patients (%)
0-10	5
10-20	35
20-30	23
30-40	18
40-50	11
50-60	4
60-70	3
70-80	1

Females (56.1%) were more commonly affected than males (43.9%). Out of the 100 patients, 65 patients were from rural area and 35 were from urban area. Decreased hearing was the main associated symptom. Other symptoms associated were pain and tinnitus (Table 2).

Table 2: Associated symptoms in patients with ear discharge.

Symptoms	Number of patients
Decreased hearing	43
Tinnitus	20
Pain	8
None	29

Amongst 100 patients, 45 patients had slight hearing loss of 26–40 dB, 37 had moderate hearing loss and rest were normal. Microbial growth was obtained in 88 samples whereas there was no growth in 12 samples. The growth was monomicrobial in 61 while polymicrobial growth was seen in 39 samples (Table 3). *Pseudomonas aeruginosa* was the most common isolate whereas *Clostridium species* and *E. coli* were the least common isolate. *Candida albicans* was the most common fungal isolate (Table 4). Antimicrobial sensitivity testing was carried out and we found that amikacin showed maximum activity to most of the isolates followed by ceftriaxone and ciprofloxacin (Table 5).

Table 3: Growth results in swabs.

Type of growth	Number
Only bacterial growth	51
Only fungal growth	15
Bacterial and fungal growth	22
No growth	12
Total	100

Table 4: Distribution of various isolates in CSOM.

Type of isolates	Frequency in number
Aerobic isolates	
<i>Staphylococcus aureus</i>	21
<i>Pseudomonas aeruginosa</i>	30
<i>Klebsiella pneumoniae</i>	12
<i>E. coli</i>	3
Anaerobic isolates	
<i>Clostridium spp</i>	2
<i>Streptococcus pyogenes</i>	5
Fungal isolates	
<i>Aspergillus fumigatus</i>	12
<i>Aspergillus flavus</i>	9
<i>Candida albicans</i>	16

Table 5: Sensitivity pattern of aerobic bacterial isolates in chronic suppurative otitis media.

Bacterial isolates	Amoxyclav	Ceftazidime	Piperacillin	Ceftriaxone	Ciprofloxacin	Amikacin	Chloramphenicol
Pseudomonas	-	8	12	-	10	17	-
Staph aureus	9	9	1	17	6	13	3
Klebsiella	2	1	2	6	1	8	3
E coli	1	1	1	3	1	4	1
Total	12	19	16	26	18	42	7

DISCUSSION

CSOM is a major public-health problem in developing countries demanding urgent attention. It is a persistent disease with risk of developing serious local damage and irreversible complications. It is a cause of preventable hearing loss, cognitive disability and scholastic backwardness. Early clinical and microbiological diagnosis ensures prompt and effective treatment to avoid such complications.

We found that CSOM was more prevalent in patients of 10-20 year age group and accounted for 35% of cases. This finding corroborates well with other authors.^{10,11} This may be due to the fact that children are more prone to upper respiratory infections. Apart from this, cold weather, poor hygiene, usage of unconventional ear drops and oil into the middle ear leads to the proliferation of pathogens further leading to eustachian tube blockage.

When we observed the gender ratio, similar to Prakash et al we also observed that the cases of CSOM were more

common in females (56.1%).¹¹ This may be due to predominance of female patients in the study. Maximum patients were from rural area. This was similar to Sharma et al who observed that 51.5% were rural population.¹⁰ Lack of education, poor socioeconomic condition, lack of awareness about CSOM and inadequate knowledge about modes of treatment are thought to be responsible for the persistence of the disease in rural areas. CSOM affects hearing to a large extent and our finding also suggest this as decreased hearing was the main associated symptom in our study similar to Sharma et al who noted decreased hearing in 49% patient.¹⁰

In microbiological study of CSOM, we found that bacterial culture was positive for 51 swabs, fungal culture was positive for 15 swabs and combined growth of bacteria and fungi obtained from 22 swabs. Balan et al found that fungal culture was positive for 28 swabs, while combined growth of fungi and bacteria obtained from 24 swabs, only bacteria from 62 and no culture from 10 swabs and Gupta et al results were 24.8%, 13.6%, 11.2%, 66.4% and 8.6% respectively.^{12,13} Both of them had results consistent with

our study. Slight difference in the results of various studies could be due to the difference in the patient population studied and geographical variations. The reason for no growth in the swabs could be due to viral agents like respiratory syncytial virus, adenovirus and influenza virus.

In the present study, *Pseudomonas aeruginosa* was the most common isolate followed by *Staphylococcus aureus* whereas *Clostridium species* and *E. coli* were the least common isolate. Sharma et al and Balan et al also concluded the similar finding whereas Prakash et al showed that *Staphylococcus aureus* was the predominant organism in CSOM.¹⁰⁻¹² *Pseudomonas aeruginosa* requires minimum nutrition for survival and are relative resistant to antibiotics and its antibacterial products so this makes it favorable for its colonization. Also, they have the capability of surviving and persisting by creating a niche for themselves through necrotizing activities of its extracellular enzymes. Besides these, the organism acts as an opportunistic pathogen, flourishes in the external auditory canal, and may cause suppurative disease in contiguous sites.¹⁴ It is also considered to be a secondary invader gaining access to the middle-ear via defect in tympanic membrane.¹¹ Anaerobes in CSOM are mostly detected in cases with extensive cholesteatoma or granulation tissue.¹¹ Out of 100 samples anaerobic etiology was found in 7 swabs. This was similar to Maji et al.¹⁵

Fungal infections of the middle ear are common as fungi thrive well in moist pus. *Candida species* and *Aspergillus species* are the two most common fungi isolated in CSOM. On contrary to Balan et al and Prakash et al who had predominance of *Aspergillus species* (57.14% and (70.83% respectively), our study showed predominance of *Candida albicans*. Sharma et al also observed the predominance of *Candida species* (9.45%).¹⁰⁻¹²

Antimicrobial susceptibility test was carried out for all the aerobic isolates. Amikacin was found to be the most effective drug followed by ceftriaxone against all isolated bacteriological species. These findings were parallel to the studies of Balan et al and Prakash et al.^{11,12}

Isolation of aerobic, anaerobic and fungal isolates shows that different conditions of CSOM could be differentiated on microbiological grounds. Thus, for better management of CSOM, microbiological classification of infection as well as drug sensitivity testing are essential for making appropriate decision of antimicrobials that will effectively eradicate the pathogen and halt the progression of complication.

Limitations

The limitation of our study was that it was conducted at a tertiary referral hospital; it does not represent the entire community, so the actual incidence may be higher. Age wise distribution of various microbes in chronic suppurative otitis media and antifungal susceptibility

pattern was not assessed in this study. Despite the limitation, we tried to increase the awareness of this disease which may lead to irreversible complications if not managed promptly and effectively.

CONCLUSION

This study is beneficial for the practitioners to know the microbial pattern of CSOM in the Garhwal belt and also helps in tackling the growing multidrug resistance. To conclude, CSOM is major cause of acquired hearing impairment that limits individual's quality of life. Poorly treated or untreated CSOM can lead to many complications. With the development and widespread use of antibiotics, the types of pathogens and their resistance to antibiotics have changed. *Pseudomonas aeruginosa* is the major offending pathogen in CSOM and amikacin is found to be the most effective antibiotic with low resistance rate. Continuous and periodic evaluation of microbiological pattern and antibiotic sensitivity of isolates is necessary to decrease the potential risk of complications by early institution of empirical treatment.

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