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Original Research Article

Aerobic bacterial profile and antibiotic sensitivity pattern of chronic suppurative otitis media in tertiary care hospital

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ABSTRACT

Background: Chronic suppurative otitis media(CSOM) is a chronic inflammation of the middle ear cleft characterised by persistent tympanic membrane perforation with intermittent or continuous purulent or mucopurulent discharge from the ear canal for more than 2 weeks to three months.
Materials and Methods: We collected 249 growth isolates from patients of CSOM. We isolated and identified the common organism of CSOM and studied antibiotic susceptibility patterns.
Results: In our study, patient ages range from 1 year to 75 years. Most patients were male. the maximum number of patients (69%) were from age group 1-15. The most common organisms isolated were *Pseudomonas* Spp (37%), followed by *Staphylococcus aureus* (30%) and *Escherichia coli* (14%). Majority of *Pseudomonas* Spp is were susceptible to Imepenem (100%), Piperacillin-Tazobactam (77%) and Amikacin (69%). Majority of the other Gram negative bacilli isolates were also susceptible to these antibiotics. Most of the Staphylococci were susceptible to linezolid and ofloxacin. 39% of *Pseudomonas* Spp and 34% of *Escherichia coli* were multidrug resistant (MDR).
Conclusion: *Pseudomonas* Spp. followed by Staphylococcus Spp were the two common causative organisms of CSOM. Based on this study, suggestions for empirical antibiotics are Amikacin for gram negative bacilli and ofloxacin for *Staphylococcus* Spp.

1. Introduction

Chronic suppurative otitis media is a chronic inflammation of the middle ear cleft characterises by persistent perforation of the tympanic membrane with intermittent or continuous purulent or mucopurulent discharge from the ear canal for more than 2 weeks to three months.[1]

The risk of infection is higher in malnourished people with poor living conditions and lack of hygiene. It isa prevalent infection in children and an important cause of preventable hearing loss. It leads to hearing loss of more than 30 dB in half of patients without treatment. It leads to poor scholastic performance, and delayed speech and language development.[2]

The prevalence of CSOM in school-going children is 7% in India which is more than the rest of the world. If prevalence is more than 4%, it is a public health problem. In untreated patients, the infection can spread from the middle ear to involve other deep structures like the mastoid facial nerve lateral sinuses labyrinth and meninges.[1,3]

The poor living conditions, lack of hygiene, limited access to medical facilities and recurrent upper respiratory infections are common predisposing factors for CSOM.[4] WHO recommends a four-step initiative to prevent it known

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as HEAR—Hygiene of the ear, Early management of AOM, Antibiotics, and Raising awareness.[5]

Commonly reported micro-organisms in patients of CSOM are *Pseudomonas, streptococcus, Staphylococcus Klebsiella Escherichia coli*, *proteus* and anaerobic bacteria like bacteroid, peptostreptococcus and propionibacterium.[6,7]

The aetiology of CSOM is poorly understood and causative organisms also vary according to the geographical area of studies so empirical treatment of CSOM also varies with a profile of microorganisms from CSOM of the local area is essential to establish empirical therapy in underdeveloped countries lack of hygiene poor socioeconomic condition lack of proper follow up of recurrent upper respiratory tract infection at CSOM people of having cleaning of the ear canal with ear bud match stick hair pin key wood stick nail etc.[8,9] Hence, it is mandatory to study antibiogram of each case of CSOM to formulate local antibiotic policy for appropriate use of antibiotics. This will certainly help in achieving a safe ear and controlling the organism's developing resistance to prevalent antibiotics.

2. Materials and Methods

It is a descriptive cross-sectional study, conducted in the microbiology and ENT department of Jhalawar Medical College Jhalawar Rajasthan from May 2022 to April 2023.

Inclusion criteria include all the patients present in ENT OPD and clinically diagnosed CSOM with active purulent or mucopurulent discharge from the last 2 weeks and gave the consent for study.

2.1. Exclusion criteria

Patients who prescribed antibiotic in last one month, Ear discharge within less than 2 weeks (acute cases), and patients of intact tympanic membrane plus discharge (case of otitis externa).

2.2. Methodology

The sample was collected from all the CSOM patients who attended ENT OPD in study duration and fulfilled inclusion criteria. Samples were collected after cleaning of ear with normal saline with proper aseptic measures. A sterile ear swab was used. With the help of aural speculum. After collection, the sample was put in transport media and sent to the bacteriology laboratory. Samples were collected before taking antibiotics and in the case of bilateral CSOM, samples were collected separately from both the ears.[10]

Collected samples were sub-cultured in Nutrient Agar media, Blood agar media and Mac Conkey Agar medium. All the samples that showed positive growth followed the antibiotic sensitivity test. Identification of bacteria is based on colony morphology, Microscopic examination and biochemical reactions. AST put on Muller Hinton agar by Kirby Bauer disc diffusion method according to CLSI 2022 (clinical laboratory standard institute) guideline. The isolate was considered multidrug-resistant (MDR) when non-susceptible to at least one agent in more than three antimicrobial categories/groups.[11]

Data was analysed by using the Microsoft SPSS software version and for comparison chi-square testall clinical history names age gender unique identification numbers durations of symptoms were noted down in predetermined proforma.

3. Result

We conducted a cross-sectional descriptive study. We collected 310 samples out of which 249 (80%) showed positive growth in aerobic bacterial culture. Age-wise distribution of participants (Table 1), distribution of isolates from CSOM samples (Table 2), susceptibility patterns of gram negative bacilli (Table 3) and Gram positive cocci (Table 4) are mentioned below.

Table 1: Age wise distribution of participants

Age group		%
1-15	171	68.6
16-30	37	14.8
31-45	8	3
46-60	3	1
>60	30	12
Total	249	

In the present study, 59% of patients have kachcha ghar (made up of clay and brick) indicating low socioeconomic living conditions. Unilateral ear infections are present in 91% of cases. *Pseudomonas* was the most common bacteria isolated from patients.

Table 2: List of isolated bacteria

Organism		**Percentage**
Pseudomonas aeruginosa	92	37%
Staphylococcus aureus	75	30%
Escherichia coli	35	14%
Proteus mirabilis	21	8.5%
Coagulase negative Staphylococcus Spp	7	2.8%
Klebsiella Spp	5	2%
Citrobacter Spp	3	1.2%
Pneumococci	11	4.4%
Total	249	

In our study, patient ages range from 1 year to 75 years. Most patients were male. the maximum number of patients (69%) were from age group 1-15. Male were 51% and female were 49% there was no statistically significant difference between age and gender (p-value<0.05). The most common organism is *Pseudomonas* 37%, followed by *Staphylococcus aureus* 30% and *Escherichia coli* 14%.

Table 3: Antibiotic susceptibility pattern of Gram-negative Bacilli

	Pseudomonas	*E coli*	*Proteus*
Ciprofloxacin	25(27%)	9(25%)	7 (33%)
Cephalexin	-	9(25%)	-
Amoxycillin Clavulanic acid	-	17(48%)	14(66%)
Ceftriaxone	-	15(42%)	7 (33%)
Ceftazidime	56(61%)	28(80%)	14 (66%)
Gentamicin	14(15%)	9(25%)	7 (33%)
Amikacin	64(69%)	25 (71.4%)	19 (90.4%)
Piperacillin Tazobactam	71(77%)	30 (85%)	14 (66%)
Imipenem	92(100%)	32 (91%)	19 (90.4%)

Table 4: Antibiotic susceptibility pattern for Gram-positive cocci

	Ofloxacin	Erythromycin	Ciprofloxacin	Linezolid	Cotrimoxazole
MSSA 64	85%	34%	71%	96%	39%
MRSA 11	63%	36%	36%	81%	45%

MSSA: Methicillin susceptible staphylococcus aureus, MRSA: Methicillin resistant *staphylococcus aureus*

4. Discussion

In a country like India, a large proportion of people are from below the poverty line and have limited access to health facilities. Poor hygiene and orthodox approach to treat CSOM with use of honey or oil- based concoctions leads to the proliferation of opportunistic bacteria and blockade of Eustachian tube.[2]

In our study, 59% of patients have kachhaghar which indicates they belong to a poor socioeconomic group. Isolation of coliform bacteria like *Escherichia coli*, and *Klebsiella pneumoniae* which are common faecal bacteria and water bacteria like *Pseudomonas aeruginosa* suggests possibility of people being at high risk of infection due to poor hygienic environment.[2]

In this study most of the patients were from the age group 1-15 years similar to Farooqui et al. & Sahu et al that reported, CSOM is most common in the first and second decades. There are some predisposing factors for the high prevalence of CSOM in children like small Eustachian tube with a more horizontal position and more flaccid cartilage and recurrent upper respiratory infection rate.[2,4,12,13]

In the present study, 51% of patients are male similar to Basavaraj et al (55% male), and Abraham et alreported 54% male from Tanzania. While another study reported female patients were more than male patients (59%).[8,10]

The difference of genders in the prevalence of CSOM is unclear some studies reported a high prevalence in females and some reported a high males, the reason for this might be related to the difference in propensity to seek medical attention between two genders and different geographical areas, rural/ urban site as CSOM has been reported equally prevalent in both gender.[8,10]

In our study the most common isolate was *Pseudomonas aeruginosa* (37%), Similarly to Farooqui et al 41%, Sharma et al 50%, Raid M Al-ani et al 57% and Basavaraj et al 38%. however Abraham et al reported *Klebsiella* as the most common isolate in Tanzania Udden et al reported *Proteus* sp as the most common isolate.[9,13–15]

The survival rate of *pseudomonas* is high among competition with other gram-negative bacilli due to minimum nutritional requirements relevant to high antibiotic resistance rate, ability to make biofilm, secretion of antibacterial substances like pyocyanin and bacteriocin that kill other bacteria, and even survive in many disinfectants.[7]

Pseudomonas has a pilli which has ability to attach to the diseased and dead epithelium of the middle ear in case of acute suppurative otitis media and can lead to CSOM. *Pseudomonas* is more sensitive to Amkacin, Piperacilline-tazobactam Imipenem as compared to Ceftazidime (61%) & ciprofloxacin (27%).[14]

Staphylococcus aureus is the second most common isolate recovered in patients of CSOM; it is similar to Prakash et al and Sharma et al. In the current study, *Staphylococcus aureus* showed susceptibility to linezolid (96%) and Ofloxacin (85%) and least sensitive to erythromycin.[13,16]

A systematic review by Colemen reported that *Pseudomonas* Spp and *Staphylococcus aureus* are the most prevalent microorganisms in CSOM the difference in various studies is due to different geographical locations it is difficult to have common empirical therapy to eradicate the infection therefore local continuous periodic surveillance is essential; step in management of CSOM.[17,18]

In our study, Imipenem Piperacillin tazobactam and amikacin appear to be most effective against gram-negative bacilli isolated from ear discharge but unable to achieve effective concentrations of systemic antibiotic in the infected tissues of the middle ear.[6,19] GNBs are least susceptible to cefazolin, ceftriaxone. An investigator from Nigeria reported that *Klebsiella pneumoniae* as the

commonest isolated bacteria from CSOM and most of the people were from low socioeconomic groups.[20]

Ciprofloxacin and gentamycin is a very commonly used economical topical preparation although resistance is common against them among common gram negative bacteria and *Staphylococcus* Spp. Recent studies show emerging resistance to ciprofloxacin Deb et al reported 50% resistance to ciprofloxacin while Sharma et al reported high susceptibility to ciprofloxacin and erythromycin.[13,17]

Ciprofloxacin was the most prescribed topical agent showing an increase in resistance to common organisms of CSOM. Hence it is mandatory to study the antibiotic sensitivity pattern of each case of CSOM to formulate local antibiotic policy. This will help in achieving a 'Safe ear' and also control the developing resistance to common antibiotics.[20]

5. Limitation

This is a cross-sectional study so difficult to determine the duration of the disease and the beginning of the disease at the actual age of infection. The middle ear aspiration suction technique is a more sensitive method to collect the sample. But it is an invasive procedure, has its side effects and less convenient to the patients as compare to Ear swab.

6. Conclusion

When we analyse result of present study and other studies it is clear that the microbiological profile and AST pattern has been changing with due courses of time. *Pseudomonas* Spp. followed by *Staphylococcus* Spp were the two common causative organisms of CSOM. Based on this study, suggestions for empirical antibiotics are Amikacin for gram negative bacilli and ofloxacin for *Staphylococcus* Spp. The result of this study should be undertaken to formulate local antibiotic policy and to determine bacteriological profile. This will help to achieve Safe Ear and reduce the the incidence of drug incidence.

7. Ethical

This study was conducted after taking ethical clearance from the institutional committee IECJMC 16 dated 19/10/22.

8. Source of Funding

None.

9. Conflict of Interest

None.

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