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## ORIGINAL RESEARCH

# Clinico-bacteriological and antibiotic drug resistance profile of Chronic Otitis Media: Mucosal disease, at a tertiary care hospital in rural Haryana: A retrospective observational study

**Garima Yadav[1], Mayank Yadav [2], Pooja Singla [3], Nisha Sharma [4], Sulabha M Naik[5]**

[1,2]Assistant Professor, [5]Professor & Head, [4]Junior Resident, Department of ENT, SHKM Government Medical College and Hospital, Nuh, Haryana, India

[3]Associate Professor, Department of Microbiology, SHKM Government Medical College and Hospital, Nuh, Haryana, India

## ABSTRACT

**Background: Objectives:** To determine the microbiological profile and antimicrobial susceptibility pattern of bacterial isolates from aural swabs in patients with CSOM. **Materials and Methods:** A total of 142 patients of CSOM with unilateral or bilateral ear discharge who attended the outpatient department from March 2020 to November 2020 were included. **Results:** Among 142 patients included in the study, most common age group was 11-20 years. CSOM was found to be more common in females (56.33%) than in males (43.66%). The most common bacterial isolate was Pseudomonas aeruginosa (45.8%) followed by Staphylococcus aureus (30.5%), Proteus mirabilis (13.8%), Acinetobacter baumannii (2.7%), Klebsiella pneumonia, Micrococcus, E. Coli, Citrobacter and Providentia species. Pseudomonas aeruginosa was found to have maximum sensitivity to Polymyxin B (87.8%) and least sensitive to amoxicillin (15.1%). Among Staphylococcus aureus (87% MRSA and 13% MSSA) maximum isolates were sensitive to piperacillin+tazobactam (90.9%) and least sensitive to amoxicillin (13.6%).

**Conclusion:** The principle organism responsible for CSOM in the study were Pseudomonas aeruginosa followed by Staphylococcus aureus. The increase in trend towards resistance warrants culture and sensitivity testing of the aural swabs for effective management of the disease.

**Keywords:** Antibiotic resistance, CSOM, Microbiological profile, Pseudomonas

**Corresponding Author:** Dr Mayank Yadav, Room No. 136, Department of ENT, SHKM Government Medical College and Hospital, Nuh, Haryana, India 122107

## INTRODUCTION

Chronic suppurative otitis media (CSOM) is defined as chronic inflammation of middle ear cleft which consists of middle ear, eustachian tube and mastoid air cells with a permanent perforation in the tympanic membrane. Most common symptom is presence of recurrent ear discharge.[1] Incidence of this disease is higher in developing countries with low socio-economic status. The factors responsible for higher incidence are malnutrition, overcrowding, poor hygiene, inadequate health care, and recurrent upper respiratory tract infection.[2]

CSOM can be classified into two types, Tubotympanic and attico-antral. This classification depends on whether the disease process affects the pars tensa or pars flaccida of the tympanic

membrane. [2] Tubotympanic is also known as a safe type or mucosal chronic otitis media as there is lower incidence of serious complications, whereas, attico-antral is called as the unsafe or squamous chronic otitis media because of higher incidence of associated complications, which may be life threatening if there is inadequacy or delay in its management. [3]

The most common cause of Otitis media is bacterial infection of the middle ear. Acute otitis media is predominantly caused by Streptococcus pneumoniae, Haemophilus influenzae and Moraxella catarrhalis. However, Pseudomonas aeruginosa and Staphylococcus aureus are the most common aerobic bacteria in patients with Chronic suppurative otitis media (CSOM), followed by Proteus vulgaris and Klebsiella pneumoniae. [4,5]

In the absence of proper and adequate management, this disease can spread from middle-ear to adjacent vital structures such as mastoid cortex, facial nerve, lateral semi-circular canal, sigmoid sinus, meninges and brain. This leads to complications such as mastoid abscess, facial nerve paralysis, deafness, sigmoid sinus thrombosis, meningitis and intracranial abscess [6,7] Hearing loss associated with chronic ear discharge is the sequalae and is nearly always significant, reported in 50% of cases. [8] The primary management of CSOM is aural toilet and topical aural antibiotics. Systemic oral or parenteral antibiotics are not used commonly because topical antibiotics achieve higher tissue concentrations when compared with the systemic formulations. [9] Complications associated with CSOM were frequent in pre-antibiotic era, however, the introduction of antibiotics brought significant reduction in incidence of complications. Since the introduction of antibiotics, its irrational use to treat various infections was seen among practitioners, and this irrational use of antibiotics led to the emergence of multi-drug resistant bacterial strains, which led to rise in incidence of disease complications, and non-responsiveness to commonly used antibiotics for the medical management of CSOM.

The prevalence and antibiotic sensitivity pattern of the micro-organisms has been reported to vary with time and geographical areas. This is probably due to indiscriminate use of the antibiotics. [8] Due to misuse of antibiotics, there is an increase in incidence of antibiotic drug resistance (ADR) among the bacteria causing CSOM. Thus, periodic surveillance of microbiological and antibiotic sensitivity profile of CSOM becomes important to do effective medical management in CSOM. [10]

The objective of this study was to determine the common microbes responsible for CSOM and the antibiotic sensitivity pattern of the microbial isolates among the patients suffering from CSOM who attended ENT OPD of our hospital, a tertiary care center located in rural Haryana.

## MATERIALS & METHODS

A prospective observational study was conducted in the department of otolaryngology of a tertiary care centre in rural Haryana for a period of 12 months (from March 2020 to November 2020). Aural swab reports of 142 patients who were clinically diagnosed with CSOM were enrolled for this study. Informed consent was taken. Patients with clinical diagnosis of Tubotympanic CSOM of more than 6 months duration, of any age and sex, were included in the study. Patients who had received antibiotics one week prior to consultation, history of prior middle ear surgery, complicated CSOM, unsafe CSOM, traumatic perforation, otitis externa, diabetes mellitus and tuberculosis were excluded from the study. The approval of the study was taken from institutional ethical committee prior to conducting the study.

Collection of aural swab: After cleaning the external auditory canal with sterile cotton swab, a specimen for aerobic culture and anti- microbial sensitivity test, was collected from the

middle ear using a sterile ear speculum. Aural swabs were kept in sterile glass test tubes and were sent immediately to the microbiology laboratory. Blood agar and Mackonkey's agar media were used for bacterial isolation. Any bacterial growth that occurred after 24 hours was identified by colonial, microscopic, morphology and culture characteristics, and biochemical reactions according to standard bacteriological methods. Grown bacteria were tested for antimicrobial sensitivity pattern to ten commonly used antimicrobial agents (amoxicillin, co-trimoxazole, ciprofloxacin, cefipime, cefagolin, imipenem, linezolid, piperacillin-tazobactam, polymyxin-B and tigacycline) using the disc diffusion method.

**RESULTS**

A total of 142 patients swabs were studied, out of which 62(43.66%) were males and 80(56.33%) were females. Patients were ranging from age groups 1 to 70 years, out of which maximum number of patients were from age group of 11-20 years (42.25%) followed by 1-10 years (18.3%). Disease was seen in left ear in 46.47% patients, right ear in 46.47% patients and 8.4% had bilateral disease.

Most common organisms isolated was Pseudomonas aeruginosa (45.8%) followed by Staphylococcus aureus (30.5%), Proteus mirabilis (13.8%), Acinetobacter baumannii (2.7%), Klebsiella pneumonie, Micrococcus, E. Coli, Citerobacter and Providentia species. (Figure 1) Proteus mirabilis, Acinetobacter, Klebsiella pneumonie, Micrococcus, E. Coli, Citerobacter and Providentia species (Figure 1)

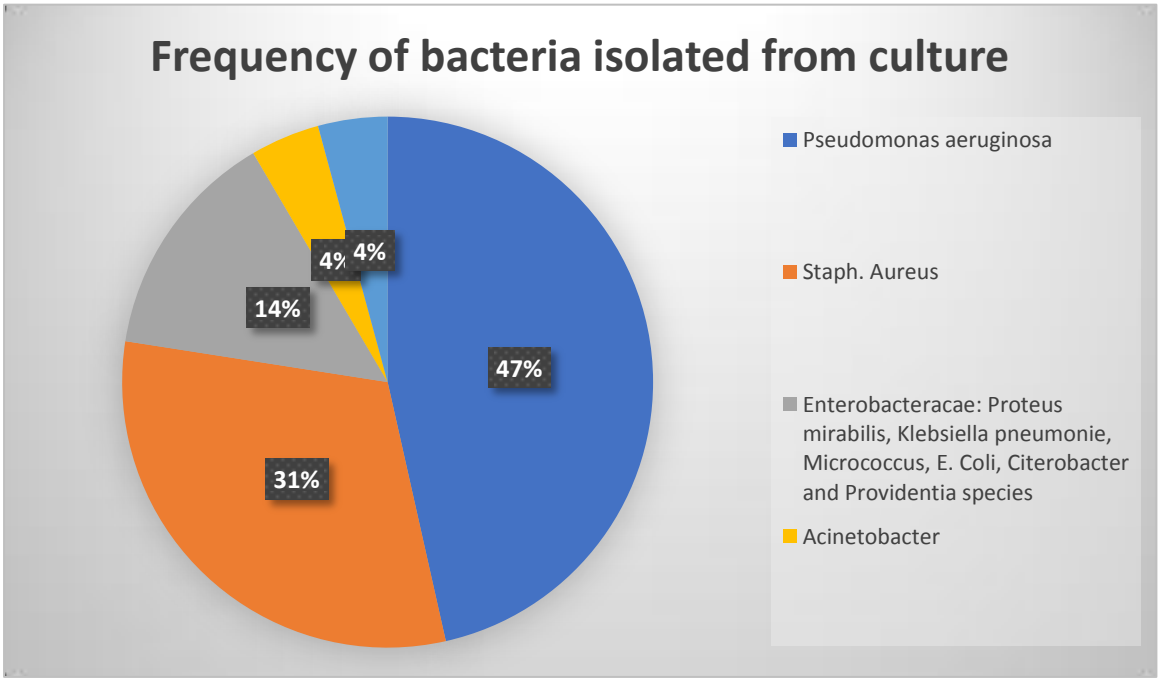


Figure 1: Frequency of various bacterial isolates

In Pseudomonas aeruginosa maximum isolates were sensitive to Polymyxin B (87.8%) followed by Imipenem (78.8%), Tigacycline (66.66%), Linezolid (66.66%), Piperacillin +Tazobactam (60.6%). Low susceptibility was seen to Cefagolin (51.55%), Ciprofloxacin (45.45%), Cefipime (36.36%), very poor sensitivity was seen to Cotrimoxazole (24.24%) and

Amoxicillin (15.1%). (Figure 2)

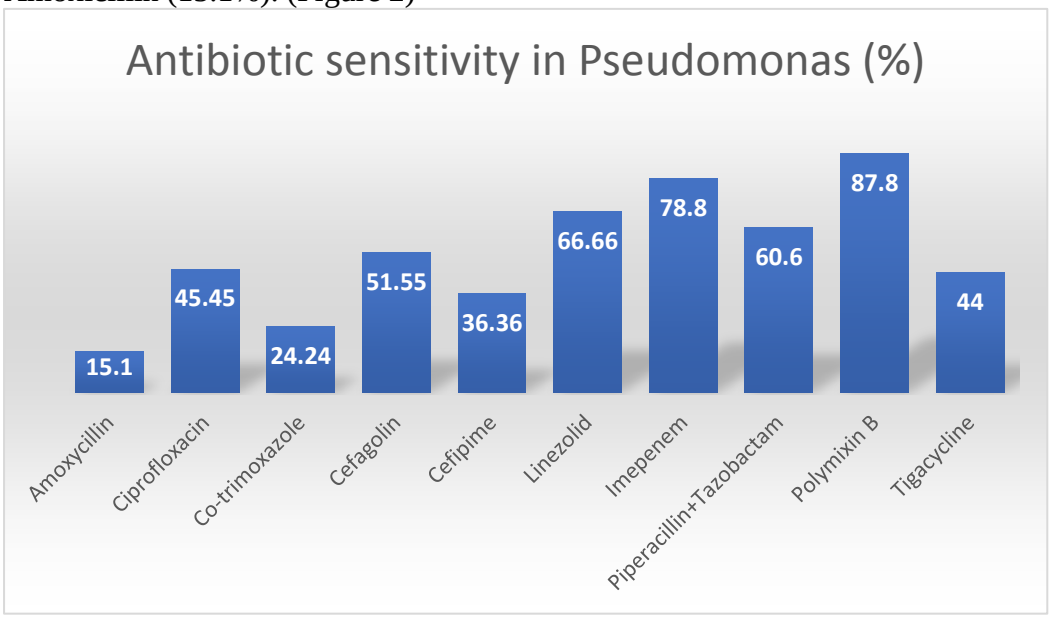


Figure 2

Among Staphylococcus aureus (81.9% MRSA and 18.1% MSSA) maximum isolates were sensitive to piperacillin+tazobactam, polymyxin B, tigacycline and linezolid, 90.9% each, followed by cefagolin and cefipime 81.8% each, imipenem 86.36%,ciprofloxacin 72.7%, cotrimoxazole 68.1 %, and amoxicillin 13.6% being least sensitive.(Figure 3)

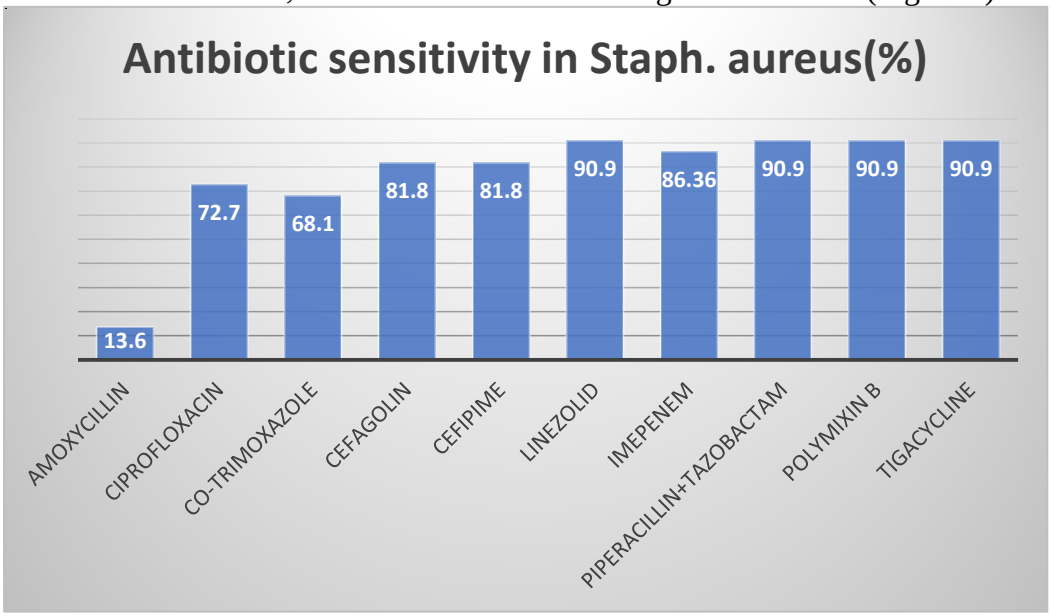


Figure 3

The overall pattern of antibiotic sensitivity including all the organisms, maximum sensitivity was seen to imipenem and polymyxin 85.7% each, followed by linezolid 80%, tigacycline 77.14,piperacillin+tazobactam 70%. Low sensitivity was seen to, cefagolin 58.57% cefipime 52.8% and ciprofloxacin 51.4%. Least sensitivity was seen to co-trimoxazole 44.28% and amoxicillin 18.57%. (Figure 4)

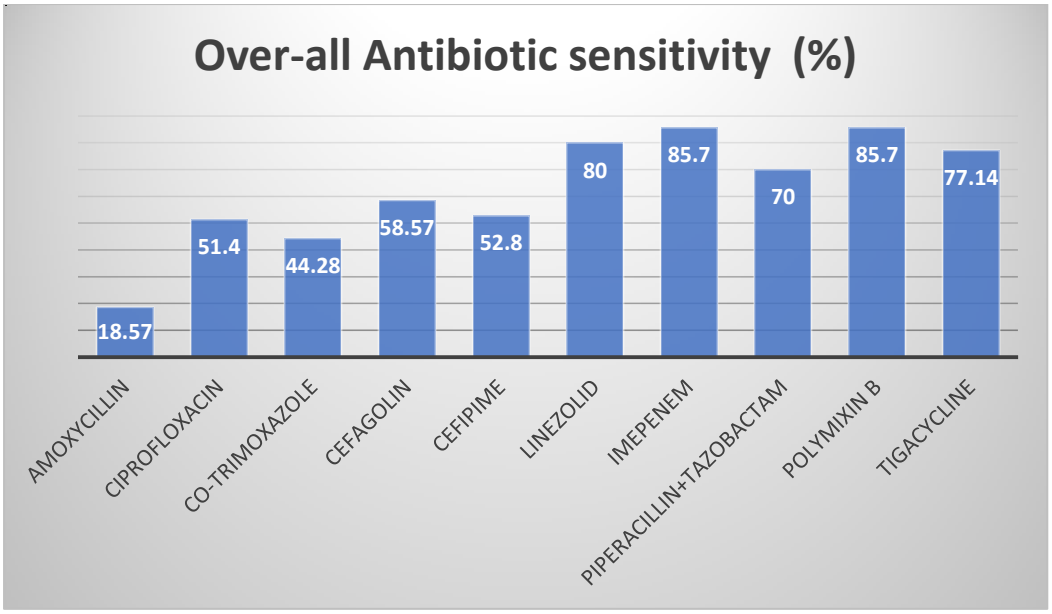


Figure 4

**DISCUSSION**

CSOM is a major public health problem in poor and developing countries like India. According to a report by WHO, India belongs to the highest (>4%) CSOM-prevalent countries.[10] Hence, early diagnosis, knowledge of regional causative organisms and their drug sensitivity patterns necessary to form effective antibiotic policy, which can help to prevent the development of complications in cases of CSOM.

In the present study, females were predominantly (52.3%) affected as compared to males (47.7%).This was in agreement with various studies by Shrestha et al, Mansoor et al and Loy et al.[11,12,13] however, other studies reported male predominance.[14,15,19]This difference may be attributed to different geographical conditions and difference in the socio-cultural practices prevailing in different areas. Maximum number of patients were in the age group 11-20 years(42.25%) followed by 1-10 years (18.3%). Young children may develop CSOM due to unhygienic condition and over gathering in school premises. This age distribution pattern of cases might be due to neglect towards health and lack of awareness of the population. Maximum population gets its primary treatment at village level from unqualified practitioners, which leads to delay in seeking treatment from tertiary care hospital. Similar findings were reported by Agarwal R, *et al*.[19] and Rathi S[15] *et al*. Kombade et al reported most common patients in age group of 21-30 years.[14]

Out of 142 samples cultured, bacterial growth was obtained in 136 (95.7%) and 6 samples(4.3%) showed no growth. Culture positivity rate varying from 84% to 91.18% have been reported by different authors.[14,15,16,19]

The most common isolate found in the present study was Pseudomonas aeruginosa (45.8%) followed by Staphylococcus aureus (30.5%). Similar pattern of organisms were also isolated in various studies by different authors. [19,20,21] However the other studies by Shreshtha et al,Prakash et al, Agarwal A et al and Rathi S et al.[11,18,16,15]documented Staph. aureus as most common organism involved in CSOM. The variation in incidence of various causative organisms can be explained by geographical distribution and patient population and different climatic conditions in different areas. Pseudomonas is the predominant cause of CSOM in

tropical region. It is not a usual inhabitant of the upper respiratory tract, so it cannot invade the middle ear through Eustachian tube. The presence of this organism in middle ear may be the result of invasion through a perforated ear drum.[23] The predominance of pseudomonas in study population may be attributed to the habit of using pond water for bathing and washing purposes and the climatic conditions favorable to its proliferation.

Pseudomonas aeruginosa was found to be highly sensitive to polymyxin B (87.8%), Imipenem (78.8%) linezolid (66.66%) tigacycline (66.66%) and piperacillin+tazobactam (60.6%). The study by Kombade et al [14] shows good sensitivity to ceftazidime, colistin (100%), piperacillin+tazobactam (95.5%) and ceftazidime-tazobactam (92.9%); and good sensitivity for cefepime (81.8%), amikacin (77.8%), gentamicin (74.2%) and levofloxacin (76.9%). Similarly, Agrawal A et al found 100% sensitivity of pseudomonas to polymyxin B, imipenem, meropenem, and 85.4% sensitivity to Piperacillin +Tazobactam. When compared with the findings by these authors and Soumya *et al* [24], we observe a trend towards increasing resistance not only to commonly prescribed antibiotics such as amoxicillin and ciprofloxacin but also to the reserve antibiotics such as imipenem, polymyxin b, linezolid and piperacillin+tazobactam.

In gram positive bacterial isolates, methicillin sensitive staph. aureus (MSSA)was found in 18.1% cases and 81.9% were methicillin resistant staph. Aureus (MRSA). The maximum resistance was seen towards amoxicillin, only 13.6% samples were sensitive. Sensitivity to fluroquinolones was 72.7%, and sensitivity to cotrimoxazole was 68.1%. These results were comparable with the studies done by Kombade et al, Samanth, *et al*.[14,25]and Kaur p, *et al*.[26]Sensitivity pattern to reserve antibiotics like imipenem, linezolid, tigacycline, polymyxin and linezolid was fairly good.

On comparison of overall antibiotic sensitivity pattern of gram positive and gram-negative bacteria including the enterobacterace family, maximum resistance was seen towards amoxicillin, 81.43% samples were resistant, followed by cotrimoxazole to which 55.3% samples were resistant. The most empirically prescribed topical antibiotics such as fluroquinolones also show the increasing trend towards resistance, only 51.4% samples were sensitive to ciprofloxacin. This trend towards resistance to major empirically prescribed antibiotics is of concern. The important factor which should be considered as impact of inadvertent use of antibiotics at the community level. The antibiotics such as imipenem, polymyxin b, linezolid which were used as reserve drugs for resistant infections are also showing slight decrease in sensitivity patterns. This inclination towards the sensitivity to reserve antibiotics and resistance to commonly prescribed antibiotics is worrisome as antibiotics like imipenem and piperacillin+tazobactam are available only in intravenous formulations which increases the cost factor and duration to treat the persistent ear discharge in such cases.

This study has highlighted the fact that use of antibiotics for the treatment of CSOM at primary health care centers should be directed only after culture and sensitivity report of aural swabs. Failure to do so will result in wastage of drugs and resources. This will further increase the financial burden on the health budget. This will also prolong the treatment duration and may lead to development of serious complications.

The limitation of this study is that sensitivity to amikacin and gentamycin was not done. The fungal culture and anaerobic culture were not included in the study.

## CONCLUSION

The principle organisms responsible for CSOM in the study were Pseudomonas aeruginosa followed by Staphylococcus aureus. Detailed knowledge of the spectrum of microorganisms causing ear discharge is important for the treatment of patients with CSOM. The increasing trend of resistance to commonly prescribed antibiotics warrants the rationale use of reserve drugs. The knowledge of causative organisms and their antibiotic sensitivity is the important step towards effective management which is necessary to prevent the development of further complications.

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