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Bacteriological Profile of Chronic Suppurative Otitis Media and Antibiotic Susceptibility in a Tertiary Care Hospital Vizianagaram

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ABSTRACT

Background: Chronic Suppurative Otitis Media (CSOM) is a persistent infection of the middle ear characterized by recurrent or persistent ear discharge through a perforated tympanic membrane. It remains a significant public health problem in developing countries, particularly among individuals with poor socioeconomic conditions and limited access to healthcare. The emergence of antimicrobial resistance among bacterial pathogens causing CSOM has further complicated its management, making periodic surveillance of bacterial isolates and their antimicrobial susceptibility patterns essential for effective treatment.

Aim: To study the bacteriological profile and antibiotic susceptibility pattern among patients with Chronic Suppurative Otitis Media attending a tertiary care hospital in Vizianagaram.

Materials and Methods: A retrospective cross-sectional observational study was conducted in the Department of Microbiology, Government Medical College, Vizianagaram, from January 2025 to June 2025. Laboratory records of patients presenting with ear discharge suggestive of CSOM were reviewed. Bacterial isolates were identified using standard microbiological techniques, and antimicrobial susceptibility testing was performed according to the Clinical and Laboratory Standards Institute (CLSI) guidelines. Data was analyzed using appropriate descriptive and inferential statistical methods.

Results: A total of 46 patients with clinically diagnosed CSOM were included in the study. Culture positivity was observed in 38 (82.6%) cases, while 8 (17.4%) showed no bacterial growth. Pseudomonas aeruginosa was the predominant isolate (32.6%), followed by Proteus species (17.4%), Staphylococcus aureus (17.4%), and Klebsiella species (15.2%). Meropenem demonstrated the highest antimicrobial susceptibility (86.7%), followed by ceftazidime-sulbactam (82.6%) and amikacin (75.0%). A statistically significant association was observed between age group and culture positivity ($p = 0.048$), whereas no significant association was noted with gender.

Conclusion: Pseudomonas aeruginosa remains the predominant pathogen associated with CSOM in the present study. The observed antimicrobial susceptibility pattern underscores the importance of culture-guided antibiotic therapy to optimize treatment outcomes and limit the emergence of antimicrobial resistance. Periodic monitoring of bacterial isolates and their susceptibility profiles is essential for developing effective empirical treatment guidelines.

Keywords: Chronic Suppurative Otitis Media; Bacterial pathogens; Pseudomonas aeruginosa; Antimicrobial susceptibility; Antibiotic resistance; Culture-guided therapy; Antimicrobial stewardship.

INTRODUCTION

Chronic Suppurative Otitis Media (CSOM) is one of the most common chronic infectious diseases encountered in otorhinolaryngology practice and continues to be a major public health concern, particularly in low- and middle-income countries. It is characterized by chronic inflammation of the middle ear and mastoid cavity associated with a persistent perforation of the tympanic membrane and recurrent or persistent ear discharge (otorrhoea) that lasts for more than six weeks. Despite advances in antimicrobial therapy and healthcare services, CSOM remains an important cause of preventable hearing impairment and contributes substantially to morbidity among both children and adults. (1).

The burden of CSOM is disproportionately higher in developing countries because of overcrowding, poor personal hygiene, malnutrition, recurrent upper respiratory tract infections, inadequate healthcare facilities, and inappropriate or indiscriminate use of antibiotics. (2) If left untreated, CSOM may lead to conductive hearing loss, delayed speech and language development in children, poor academic performance, and serious extracranial and intracranial complications including mastoiditis, facial nerve palsy, meningitis, and brain abscess. These complications significantly affect the quality of life of affected individuals and impose considerable socioeconomic and healthcare burdens (3).

The microbiological profile of CSOM varies across different geographical regions and healthcare settings. The spectrum of causative organisms is influenced by environmental conditions, socioeconomic status, local antimicrobial prescribing practices, and the emergence of antimicrobial resistance. Among the commonly isolated pathogens, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus* species, *Klebsiella* species, and *Escherichia coli* have consistently been reported as the predominant bacterial agents. The increasing prevalence of multidrug-resistant organisms has complicated the empirical management of CSOM and emphasizes the need for periodic surveillance of local bacterial isolates and their antimicrobial susceptibility patterns (4).

Knowledge of the prevailing bacteriological profile and antibiotic susceptibility pattern is essential for selecting appropriate empirical therapy before culture reports become available. Regular monitoring of resistance trends not only facilitates evidence-based clinical management but also supports antimicrobial stewardship programs aimed at minimizing inappropriate antibiotic use and preventing the further emergence of resistant bacterial strains (5).

Several studies from different regions of India have demonstrated variations in the prevalence of bacterial pathogens and their susceptibility patterns, reflecting changing epidemiological trends and regional differences in antimicrobial resistance. Consequently, periodic local surveillance studies are necessary to generate institution-specific antibiograms that can guide clinicians in selecting the most effective antimicrobial agents for the treatment of CSOM (6).

Vizianagaram district serves a predominantly rural and semi-urban population in northern Andhra Pradesh, where data regarding the bacteriological profile and antimicrobial susceptibility pattern of CSOM remain limited. Establishing local microbiological evidence is therefore important for optimizing patient management and strengthening antimicrobial stewardship initiatives in this region.

Against this background, the present study was undertaken to determine the bacteriological profile of Chronic Suppurative Otitis Media and evaluate the antibiotic susceptibility patterns of bacterial isolates obtained from patients attending a tertiary care hospital in Vizianagaram, Andhra Pradesh.

MATERIALS AND METHODS

Study Design and Setting

A retrospective cross-sectional observational study was conducted in the Department of Microbiology, Government Medical College, Vizianagaram, Andhra Pradesh. The study included patients clinically diagnosed with Chronic Suppurative Otitis Media (CSOM) who attended the Outpatient and Inpatient Departments of Government General Hospital, Vizianagaram, between January 2025 and June 2025. Ethical approval was obtained from the Institutional Ethics Committee, Government Medical College, Vizianagaram, before commencement of the study.

Study Population

All patients with clinically diagnosed CSOM whose ear discharge specimens were received in the Bacteriology Laboratory during the study period and fulfilled the inclusion criteria were included in the study. A total of 46 patients were analyzed.

Inclusion Criteria

- Patients of all age groups with clinically diagnosed Chronic Suppurative Otitis Media.
- Ear discharge specimens received for bacteriological culture and antibiotic susceptibility testing during the study period.

Exclusion Criteria

- Patients who are receiving systemic or topical antibiotics before specimen collection.
- Patients who have undergone recent ear surgery or other invasive otological procedures.

- Inadequate or improperly labelled specimens.
- Duplicate specimens collected from the same patient during the study period.

Specimen Collection and Processing
Ear discharge specimens were collected aseptically by the treating otorhinolaryngologist using sterile swabs before the initiation of antibiotic therapy and transported promptly to the Department of Microbiology for bacteriological analysis.

The specimens were inoculated onto Blood agar and MacConkey agar and incubated aerobically at 37°C for 18–24 hours. Bacterial isolates were identified based on colony morphology, Gram staining characteristics, conventional biochemical tests, and confirmed using the VITEK® 2 Compact automated identification system (bioMérieux, France), wherever applicable (17-20).

Antibiotic Susceptibility Testing
Antimicrobial susceptibility testing was performed by the Kirby–Bauer disc diffusion method on Mueller–Hinton agar. The results were interpreted according to the Clinical and Laboratory Standards Institute (CLSI) 2024 guidelines. The antibiotics tested included meropenem, ceftazidime-sulbactam, amikacin, colistin, doxycycline, ciprofloxacin, gentamicin, amoxicillin-clavulanic acid, ofloxacin, and amoxicillin (2).

Data Collection and Statistical Analysis
Demographic characteristics, bacteriological findings, culture results, and antimicrobial susceptibility patterns were retrieved from laboratory records using a structured data collection format. Data was entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 29.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages. The association between categorical variables was analyzed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

Ethical Considerations
The study was approved by the Institutional Ethics Committee, Government Medical College, Vizianagaram, and was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. As this was a retrospective record-based study, patient confidentiality and anonymity were strictly maintained throughout the study.

RESULTS
A total of 46 patients clinically diagnosed with Chronic Suppurative Otitis Media (CSOM) were included in the study. The study population comprised an equal number of males and females, with 23 (50.0%) patients in each group. Most patients belonged to the 21–60-year age group (36, 78.3%), followed by those aged >60 years (6, 13.0%) and ≤20 years (4, 8.7%) (Table 1).

Aerobic culture yielded bacterial growth in 38 (82.6%) specimens, whereas 8 (17.4%) specimens showed no bacterial growth. Among the culture-positive cases, *Pseudomonas aeruginosa* was the predominant isolate, accounting for 15 (32.6%) cases. This was followed by *Proteus* species and *Staphylococcus aureus*, each isolated in 8 (17.4%) cases, while *Klebsiella* species and *Escherichia coli* were isolated in 6 (13.0%) and 1 (2.2%) cases, respectively (Table 2).

The antimicrobial susceptibility pattern demonstrated that meropenem exhibited the highest sensitivity (86.7%), followed by ceftazidime-sulbactam (82.6%) and amikacin (75.0%). Moderate susceptibility was observed with colistin (70.0%), doxycycline (64.3%), and ciprofloxacin (55.0%). Gentamicin and amoxicillin-clavulanic acid each demonstrated 50.0% sensitivity, whereas ofloxacin showed a sensitivity of 42.9%. Amoxicillin exhibited the lowest sensitivity (7.1%) among the antibiotics tested (Table 3).

Analysis of demographic factors revealed a statistically significant association between age group and culture positivity (Chi-square test, $p = 0.048$). The highest culture positivity was observed among patients aged 41–60 years (94.1%), whereas patients aged ≤20 years demonstrated the lowest culture positivity (40.0%). Although culture positivity was higher among female patients (87.0%) than male patients (78.3%), the association between gender and culture positivity was not statistically significant (Table 4).

DISCUSSION
Chronic Suppurative Otitis Media (CSOM) remains one of the most common chronic infectious diseases encountered in otorhinolaryngology practice and continues to be an important cause of preventable hearing impairment, particularly in developing countries. The emergence of antimicrobial resistance among the common bacterial pathogens has made periodic evaluation of the bacteriological profile and antibiotic susceptibility pattern essential for guiding empirical therapy. The present study evaluated the bacteriological profile and antimicrobial susceptibility pattern of CSOM patients attending a tertiary care hospital in Vizianagaram, Andhra Pradesh (1,3,25).

In the present study, most patients belonged to the 21–60-year age group, with an equal distribution of males and females. Similar demographic patterns have been reported in several hospital-based studies from India, although some investigators have observed a slight male predominance. These differences are likely attributable to regional variations in healthcare-seeking behavior, occupational exposure, and study population characteristics rather than true biological differences. The statistically significant association observed between age and culture positivity in the present study suggests that middle-aged adults constituted the group most frequently affected by active bacterial infection (7,11).

The culture positivity rate of 82.6% observed in this study is comparable to that reported in other Indian studies, where aerobic culture positivity has generally ranged from approximately 70% to 90%. Variations in culture yield may be explained by prior antibiotic exposure, differences in specimen collection techniques, transportation time, microbiological methods, and the exclusion of anaerobic and fungal cultures. Sterile cultures in the present study may similarly be attributed to previous antimicrobial therapy, fastidious organisms, low bacterial load, or pathogens not recoverable by routine aerobic culture (9,10).

The present study demonstrated that *Pseudomonas aeruginosa* was the predominant bacterial isolate, accounting for 32.6% of all cases. This finding agrees with several studies from India, including those from Karnataka, Uttar Pradesh, and other tertiary care centers, where *P. aeruginosa* has consistently been reported as the leading pathogen causing CSOM. The predominance of this organism is biologically plausible because of its remarkable ability to colonize moist environments, adhere to damaged epithelium, form biofilms, and express multiple virulence factors that facilitate persistence within the chronically infected middle ear. In addition, its intrinsic and acquired resistance mechanisms contribute to recurrent infection and therapeutic failure when empirical antibiotics are used indiscriminately (11,12).

Proteus species and *Staphylococcus aureus* were the second most frequently isolated organisms, followed by *Klebsiella* species and *Escherichia coli*. This predominance of Gram-negative bacilli over Gram-positive organisms has also been described in several Indian studies and highlights the regional variability in the microbiological spectrum of CSOM. Such differences reinforce the importance of maintaining institution-specific surveillance data rather than relying solely on published reports from other geographic regions (9-11).

Antimicrobial susceptibility testing revealed that meropenem demonstrated the highest in vitro activity against bacterial isolates, followed by ceftazidime-sulbactam and amikacin. Similar susceptibility patterns have been reported in recent Indian studies, which have shown that carbapenems and selected antipseudomonal agents retain excellent activity against multidrug-resistant Gram-negative organisms, whereas resistance to commonly prescribed antibiotics such as amoxicillin and fluoroquinolones has increased. The very low susceptibility to amoxicillin observed in the present study suggests that this antibiotic should not be considered for empirical treatment of CSOM in our setting. Instead, empirical therapy should be guided by local antibiograms and subsequently modified according to culture and susceptibility reports to improve treatment outcomes and reduce unnecessary antibiotic exposure (12,13).

The findings of the present study have important clinical implications. Periodic surveillance of bacterial pathogens and antimicrobial susceptibility patterns is essential for updating institutional antibiotic policies and promoting antimicrobial stewardship. Culture-guided therapy not only improves clinical outcomes but also helps limit the emergence and spread of antimicrobial resistance by reducing inappropriate empirical antibiotic use (26-28).

The strengths of this study include the use of standardized microbiological techniques, confirmation of bacterial identification using the VITEK® 2 Compact automated identification system, interpretation of antimicrobial susceptibility according to the CLSI 2024 guidelines, and statistical analysis using SPSS version 29.0. Furthermore, the study provides recent microbiological data from North Coastal Andhra Pradesh, a region where published evidence on CSOM remains limited (17-20).

However, certain limitations should be acknowledged. This was a single-center retrospective study with a relatively small sample size, which may limit the generalizability of the findings. Only aerobic bacterial cultures were performed; therefore, anaerobic bacteria and fungal pathogens were not evaluated. In addition, molecular characterization of antimicrobial resistance mechanisms was beyond the scope of the study. Future multicenter studies involving larger sample sizes and molecular diagnostic techniques would provide a more comprehensive understanding of the microbiological epidemiology of CSOM in this region.

Overall, the present study confirms that *Pseudomonas aeruginosa* remains the predominant pathogen causing CSOM in our institution and demonstrates that meropenem, ceftazidime-sulbactam, and amikacin retain good in vitro activity against most bacterial isolates. These findings reinforce the importance of culture-guided antimicrobial therapy and continuous surveillance of local antimicrobial susceptibility patterns to optimize patient management and support rational antibiotic use.

CONCLUSION

The present study demonstrated that *Pseudomonas aeruginosa* was the predominant bacterial pathogen isolated from patients with Chronic Suppurative Otitis Media (CSOM), followed by *Proteus* species, *Staphylococcus aureus*, and *Klebsiella* species. Meropenem, ceftazidime-sulbactam, and amikacin exhibited the highest antimicrobial susceptibility, whereas amoxicillin showed poor activity against the bacterial isolates. These findings highlight the changing antimicrobial susceptibility patterns among CSOM pathogens and emphasize the need for periodic microbiological surveillance.

The study underscores the importance of culture and antibiotic susceptibility testing in guiding appropriate antimicrobial therapy, thereby improving treatment outcomes and supporting antimicrobial stewardship. As bacterial epidemiology and resistance patterns vary across geographical regions, institution-specific antibiograms are essential for formulating evidence-based empirical treatment protocols. Further multicentric studies with larger sample sizes, including anaerobic and fungal pathogens, are recommended to better understand the microbiological profile of CSOM and monitor evolving antimicrobial resistance trends (26-28).

Declarations

Ethical Approval

The study was approved by the Institutional Ethics Committee (IEC), Government Medical College, Vizianagaram, Andhra Pradesh, before commencement of the study. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Informed Consent

As this was a retrospective record-based observational study using anonymized laboratory data, the requirement for informed consent was waived by the Institutional Ethics Committee.

Source of Funding

The authors received no specific funding for this study.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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