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Original Research Article

BACTERIOLOGICAL PROFILE AND ANTIBIOTIC SUSCEPTIBILITY IN COMMUNITY ACQUIRED AND HOSPITAL ACQUIRED CHRONIC SUPPURATIVE OTITIS MEDIA (CSOM) PATIENTS: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE CENTRE

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Abstract: One of the leading cause of avoidable hearing loss in developing nations is still chronic suppurative otitis media (CSOM). CSOM is associated with serious complications, including impaired speech development, intracranial involvement, and conductive as well as mixed types of hearing loss. Growing antibiotic resistance has made empirical treatment more difficult, requiring ongoing regional monitoring of microbial etiology and resistance trends. ***Aim***: To determine the bacteriological profile and antimicrobial susceptibility pattern of isolates from chronic suppurative otitis media (CSOM) patients. To compare the culture positivity and their association between Community acquired and Hospital acquired CSOM cases. ***Methods:*** A cross-sectional study was conducted over 12 months where a total of 115 aural discharge samples were collected from clinically diagnosed CSOM patients and were processed using standard bacteriological methods. Antimicrobial susceptibility testing was performed by the Kirby Bauer disc diffusion method following CLSI 2024 guidelines. Statistical analysis was carried out using SPSS version 23.0. The chi-square test was used to compare culture positivity between Community acquired and Hospital acquired CSOM cases, and a p-value <0.05 was considered statistically significant. ***Results:*** Of 115 samples, 70 (60.9%) were culture positive. Culture positivity was significantly higher among community acquired CSOM cases (74.7%) than hospital acquired cases (35.0%) ($\chi^2 = 17.23$, df = 1, $p < 0.001$). Gram-negative bacilli predominated (65.7%), with Pseudomonas aeruginosa as the most common isolate (38.57%), followed by MRSA (24.29%). P. aeruginosa showed high susceptibility to carbapenems and piperacillin–tazobactam, while MRSA isolates were uniformly sensitive to linezolid. ***Conclusion:*** The predominance of Pseudomonas aeruginosa and MRSA underscores the need for culture guided therapy in CSOM. High resistance to commonly used antibiotics suggests careful antibiotic stewardship and periodic updates to empirical treatment protocols.

Keywords: Chronic suppurative otitis media, bacteriological profile, antimicrobial susceptibility, Community acquired CSOM, Hospital acquired CSOM

INTRODUCTION

A persistent inflammatory disease of the middle ear and mastoid cavity, chronic suppurative otitis media (CSOM) is characterised by persistent otorrhea through a tympanic membrane that is not intact.[1]In underdeveloped nations the prevalence of CSOM is much higher because of poor cleanliness, congestion and restricted access to healthcare[1,2].

The WHO reports that the prevalence of CSOM in India is 7.8%, with rural areas being disproportionately impacted[3].Significant morbidity, such as delayed speech development, intracranial problems, and conductive and mixed hearing loss, is linked to CSOM[4,5]. *Pseudomonas aeruginosa, Staphylococcus aureus, Proteus species, Klebsiella species*, and *Escherichia coli* are among the bacteria linked to CSOM, albeit their regional distribution varies[6]. Treatment problems are posed by the rise of multidrug-resistant pathogens, including *MRSA* and resistant *Pseudomonas*[7].Resistance trends have advanced due to the abuse of antibiotics and the absence of culture-based therapy. Therefore, optimising empirical treatment and avoiding consequences need ongoing local surveillance of microbial aetiology and antibiotic susceptibility[8,9].This study aims to determine the **bacteriological profile and antimicrobial susceptibility pattern of isolates from chronic suppurative otitis media (CSOM) patients**and to **compare the culture positivity rates between Communityacquired and Hospitalacquired CSOM cases** to evaluate the statistical significance of this association.

MATERIALS AND METHODOLOGY:

A cross-sectional study was conducted in the Department of Microbiology, Central Laboratory, School of Medical Sciences and Research, Sharda Hospital, Greater Noida, India, over a period of 12 months. A total of 115 ear discharge samples were collected from clinically diagnosed chronic suppurative otitis media (CSOM) patients attending inpatient and outpatient departments.Ear discharge samples were collected aseptically using sterile swabs. Two swabs were obtained from each patient: one for direct Gram staining and one for culture and antimicrobial susceptibility testing. Samples were inoculated onto 5% Sheep Blood Agar, MacConkey Agar, and Nutrient Agar and incubated aerobically at 37°C for 18 to 24 hours. Bacterial isolates were identified based on colony morphology, Gram staining, motility testing, and standard biochemical tests.**Isolates that could not be conclusively identified using conventional methods were further identified using the automated identification system (VITEK® 2Compact).** Antimicrobial susceptibility testing was performed using the Kirby–Bauer disc diffusion method on Mueller–Hinton agar, and results were interpreted according to Clinical and Laboratory Standards Institute (CLSI) 2024 guidelines. As all data were obtained from the hospital Laboratory Information System (LIS) ,individual patient consent was not required for this study.

Statistical Analysis and Calculation of p-value

Data were entered into Microsoft Excel and analysed using SPSS version 23.0. Categorical variables were expressed as frequencies and percentages. To assess the association between patient setting and culture positivity, CSOM cases were categorized as community acquired (OPD) and hospital acquired (IPD). A 2×2 contingency table was constructed comparing positive and negative culture results in both groups. The chi-square (χ^2) test was applied to evaluate statistical significance. The calculated chi-square value was 17.23 with 1 degree of freedom, yielding a p-value <0.001. A p-value <0.05 was considered statistically significant.

RESULTS

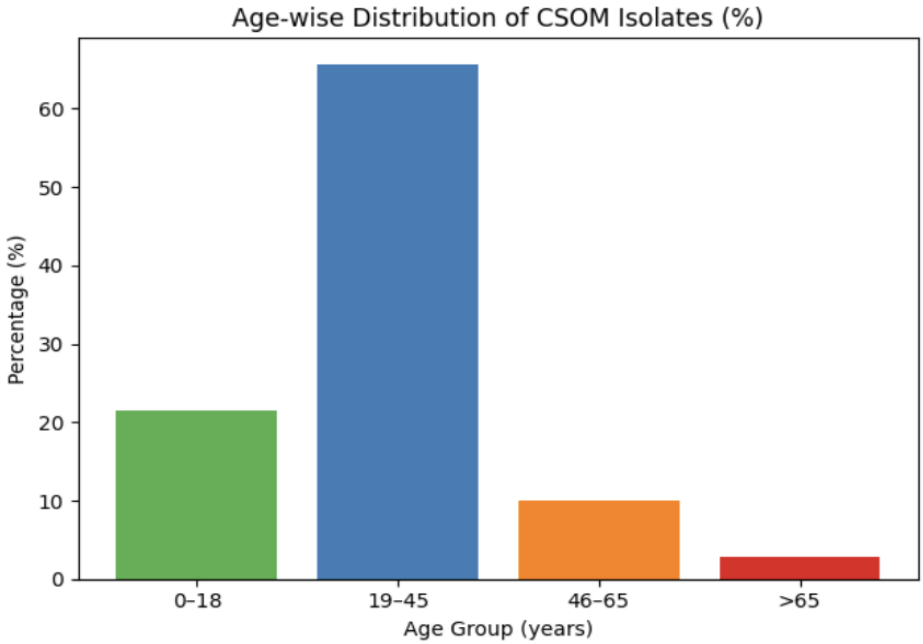
Of the 115 samples included in the study, males accounted for 59 cases (51.30%) and females for 56 cases (48.70%), with an overall male-to-female ratio of 1.05:1. Culture positivity was observed in 70 samples (60.87%). Among these culture-positive cases, 39 (55.71%) were from male patients and 31 (44.29%) from female patients, yielding a male-to-female ratio of 1.26:1. Analysis of age-wise distribution revealed that the majority of participants belonged to the 19–45-year age group, comprising 70 cases (60.87%). This was followed by the 0–18-year age group with 22 cases (19.13%), the 46–65 year age group with 14 cases (12.17%), and individuals older than 65 years accounting for 9 cases (7.83%)**[Table 01].**

[Table 01] Demographic distribution of the study population (n=115)

DEMOGRAPHIC VARIABLE	CATEGORY	NUMBER	PERCENTAGE (%)
GENDER (n=115)	MALE	59	51.3
	FEMALE	56	48.7
	TOTAL	115	100.0
AGE GROUP-CULTURE POSITIVE (n=115)	0-18	22	19.13
	19-45	70	60.87
	46-65	14	12.17
	>65	9	7.83
	TOTAL	115	100

The age-wise distribution among the culture positive patients showed thatthe maximumnumberofisolatesbelongstotheagegroup19-45 years(65.71%),followedby0- 18 years (21.48 %) and 46-65 years (10.00 %). In contrast, the least number of isolates belong to the age group >65 (2.86%). **[Fig 01]**

Fig 01. Age wise distribution of the study population (n=70)



Of the 115 samples processed, 70 (60.9%) were culture positive. Positivity was significantly higher among **community-acquired CSOM patients**, who in this study corresponded to **outpatient department (OPD) cases** (56/75; 74.7%), compared to **hospital-acquired CSOM patients**, represented by **inpatient department (IPD) cases** (14/40; 35.0%). A community-acquired ear infection refers to an infection developing in patients without recent exposure to healthcare facilities, in contrast to healthcare-associated or nosocomial infections, which occur during hospitalization or within a defined period following discharge or medical procedures.[10,11] **Chi-square analysis revealed a statistically significant association between patient setting and culture positivity** ($\chi^2 = 17.23$, df = 1, $p < 0.001$).**[Table 02]**

[Table 02]. P value analysis among Community acquired CSOM patients with that of Hospital acquired CSOM patients.

PATIENT TYPE	TOTAL SAMPLE(n)	POSITIVE	NEGATIVE	X^2 VALUE	P-VALUE
COMMUNITY ACQUIRED	75	56 (74.7%)	19 (25.3%)	17.23	<0.001
HOSPITAL ACQUIRD	40	14 (35.0%)	26 (65.0%)		
TOTAL	115	70 (60.9%)	45 (39.1%)		

Among the 70 culture-positive isolates, the most frequently identified organism was *Pseudomonas aeruginosa* (27 isolates; 38.57%), followed by MRSA (17; 24.29%), *Pseudomonas* spp. (12; 17.14%), and MSSA (6; 8.57%). The least common organisms, each representing 1.43% of isolates, included MR-CoNS, *Citrobacter koseri*, *Proteus vulgaris*, *Proteus mirabilis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Providencia rettgeri*, and *Acinetobacter* spp. Among gram-negative bacilli (GNB; n = 46), *Pseudomonas aeruginosa* was predominant (27; 58.70%), followed by *Pseudomonas* spp. (12; 26.09%), while *Acinetobacter* spp., *E. coli*, *Klebsiella pneumoniae*, *Citrobacter koseri*, *Proteus mirabilis*, *Proteus vulgaris*, and *Providencia rettgeri* were the least common isolates, each accounting for 2.17%). Among gram-positive cocci (GPC; n = 24), MRSA was the most common isolate (17; 70.83%), followed by MSSA (6; 25%), with MR-CoNS being the least common isolate (1; 4.17%). **[Table 03]**

Table 03. Microbial profile of sample collected

Types of organism	Number of isolates	Percentage
GNB (n=46)		
Pseudomonas aeruginosa	**27**	**58.70%**
Pseudomonas spp	**12**	**26.09%**
Citrobacter koseri	**1**	**2.17%**
Proteus vulgaris	**1**	**2.17%**
Proteus mirabilis	**1**	**2.17%**
E. coli	**1**	**2.17%**
Klebsiella pneumoniae	**1**	**2.17%**
Providencia retigri	**1**	**2.17%**
Acinetobacter spp.	**1**	**2.17%**
GPC (n=24)		
MRSA	**17**	**70.83%**
MSSA	**6**	**25%**
MR CoNS	**1**	**4.17%**

Out of the 70 culture positive isolates, 14 (20.0%) were obtained from IPD patients and 56 (80.0%) from OPD patients. In both patient groups *Pseudomonasaeruginosa* was identified as the most frequently isolated organisms, indicating their predominant role in CSOM irrespective of patient setting.

Antibiotic Susceptibility Test

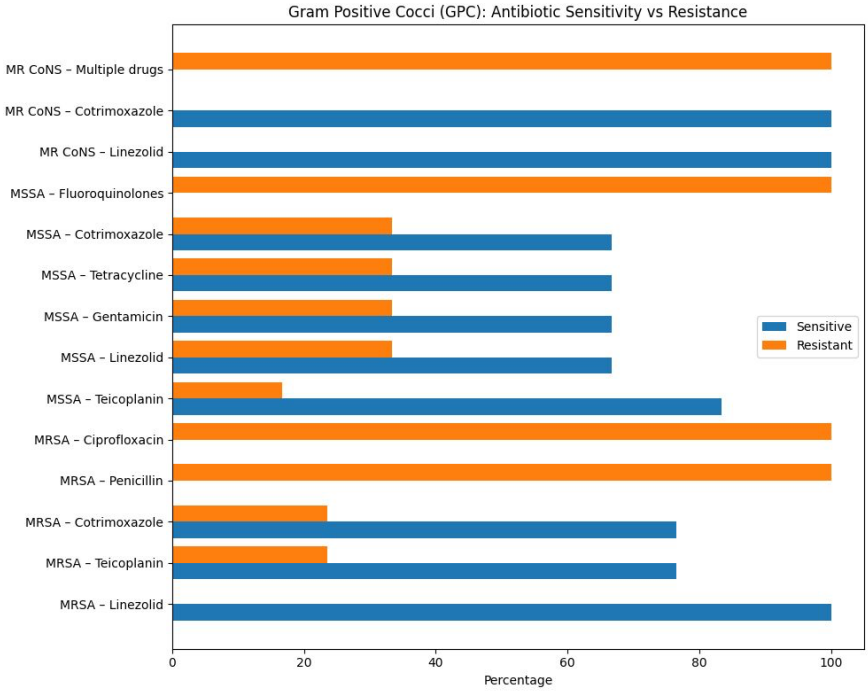
Antibiotic susceptibility testing showed that *Pseudomonas aeruginosa* was most sensitive to cefepime, meropenem, and aztreonam (81.5% each), followed by amikacin (77.8%) and piperacillin–tazobactam (74.1%), with moderate resistance to fluoroquinolones (33.3%). *Pseudomonas* spp. demonstrated highest susceptibility to piperacillin–tazobactam (83.3%) and meropenem (66.7%). All Enterobacterales isolates like *Proteus vulgaris*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Escherichia coli*, *Citrobacter koseri*, and *Providencia rettgeri* were uniformly sensitive to meropenem and amikacin (100%), while complete resistance to ceftriaxone (100%) and high resistance to ciprofloxacin were observed. The single *Acinetobacter* spp. isolate was 100% sensitive to carbapenems, cefepime, and piperacillin–tazobactam, but 100% resistant to ceftriaxone, ciprofloxacin, and amikacin. Among Gram-positive cocci, MRSA isolates showed 100% sensitivity to linezolid, followed by teicoplanin and cotrimoxazole (76.5% each), with complete resistance to penicillin and ciprofloxacin (100%). MSSA showed highest sensitivity to teicoplanin (83.3%) and to linezolid, gentamicin, tetracycline, and cotrimoxazole (66.7% each), while fluoroquinolone resistance was universal (100%). The MR CoNS isolate remained susceptible only to linezolid and cotrimoxazole (100%), exhibiting complete resistance to multiple other agents**.[Table 04][Fig 02]**

[Table 04] Antibiotic Susceptibility of the isolates

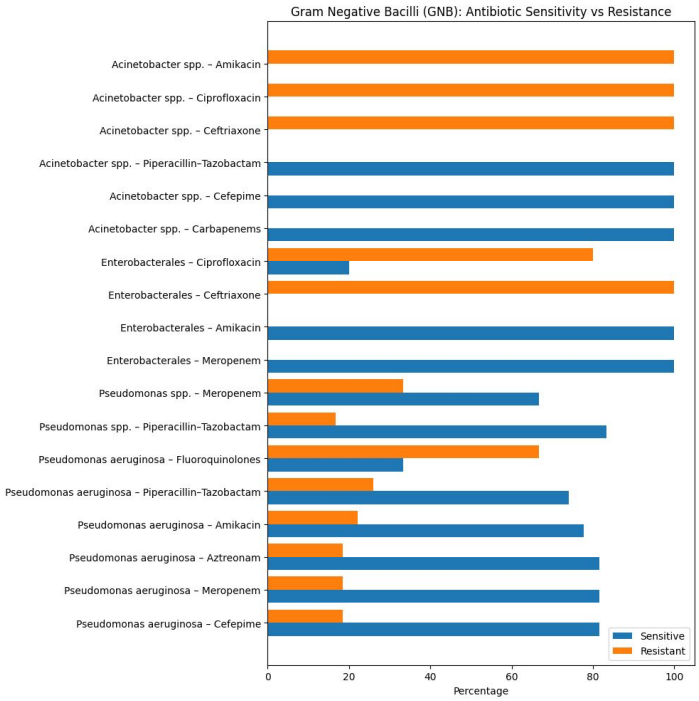
ORGANISM	MOST EFFECTIVE ANTIBIOTICS	MOST RESISTANCE NOTED
Pseudomonas aeruginosa	Cefepime, Meropenem, Aztreonam (81.5%); Amikacin (77.8%); Piperacillin-Tazobactam (74.1%)	Fluoroquinolones (33.3% R), Tobramycin (37.0% R)
Pseudomonas spp. (n=12)	Piperacillin-Tazobactam (83.3%), Meropenem (66.7%)	Imipenem (41.7% R)
Enterobacterales (n=6)	Meropenem, Amikacin (100% in all isolates)	Ceftriaxone (100% R in all isolates), Ciprofloxacin (predominantly resistant)
Acinetobacter spp. (n=1)	Carbapenems, Cefepime, Piperacillin-Tazobactam (100%)	Ceftriaxone, Ciprofloxacin, Amikacin (100% R)
MRSA (n=17)	Linezolid (100%), Teicoplanin & Cotrimoxazole (76.5%)	Penicillin& Ciprofloxacin (100% R)
MSSA (*n*=6)	Teicoplanin (83,3%); Linezolid, Gentamicin, Cotrimoxazole (66.7%)	Ciprofloxacin & Levofloxacin (100% R)

MR CONS (n=1)	Linezolid, Cotrimoxazole (100%)	Penicillin, Fluoroquinolones, Macrolides, Tetracycline (100% R)

Fig 02]. Antibiotic susceptibility of Gram Positive Cocci (GPC) and Gram Negative Bacilli (GNB) isolates



(A)



(B)

DISCUSSION

Chronic suppurative otitis media (CSOM) continues to represent a major public health challenge in developing countries, including India, where delayed healthcare access, poor hygiene, and irrational antibiotic use contribute to persistent infection and escalating antimicrobial resistance. In the present study, bacterial growth was detected in 60.9% of samples, a finding comparable to earlier Indian reports by Prakash et al. and Borah et al., reaffirming the chronic infectious nature of CSOM[3,8].This study also identified a slight male predominance in both the overall study population and culture-positive cases, along with a high rate of culture positivity. Males showed a greater proportion of positive cultures than females, which may be influenced by increased exposure risks or behavioral and occupational factors. Age-wise analysis revealed that the highest number of cases and isolates occurred in the 19–45-year age group, indicating increased vulnerability among young and middle-aged adults.

A key and clinically relevant observation in this study was the significant difference in culture positivity between community-acquired (OPD) and hospital-acquired (IPD) CSOM cases. Culture positivity was markedly higher among OPD patients (74.7%) than IPD patients (35.0%), and this association was statistically highly significant ($\chi^2 = 17.23$, $p < 0.001$). This suggests that patients presenting from the community are more likely to harbour active, untreated infections, whereas hospitalized patients may have received prior antimicrobial therapy, leading to reduced bacterial recovery. The strong statistical significance confirms that this difference is unlikely to be incidental and highlights the importance of early microbiological evaluation and culture-guided therapy, particularly in outpatient settings. Of the 70 culture-positive isolates, 14 (20.0%) were from IPD and 56 (80.0%) from OPD patients. Pseudomonas aeruginosa was the predominant isolate in both groups, highlighting its central role in CSOM regardless of clinical setting. Its prevalence is likely due to its ability to thrive in moist environments, form biofilms, and exhibit intrinsic multidrug resistance, facilitating persistence despite prior therapy.

Hwang et al. reported Staphylococcus aureus as the predominant pathogen in discharging ears, with community-acquired MRSA accounting for 25.0% of S. aureus isolates and an overall prevalence of 12.2%, particularly in chronic otitis media.[12] In contrast, the present study identified Pseudomonas aeruginosa as the most common isolate in both OPD and IPD CSOM cases, irrespective of patient setting. Of the 70 culture-positive isolates, 80.0% were from OPD patients and 20.0% from IPD patients, with P. aeruginosa predominance likely related to its biofilm-forming ability, survival in moist environments, and intrinsic antimicrobial resistance. The observed differences may reflect regional variation, patient characteristics, and antibiotic exposure patterns, emphasizing the need for local microbiological surveillance to guide empirical therapy.

Pseudomonas aeruginosa emerged as the most frequently isolated pathogen, consistent with findings from Borah et al., Prakash et al., and by Khairkaret al.[2,3,8]

An alarming finding was the very high prevalence of methicillin-resistant Staphylococcus aureus (MRSA), accounting for 70.83% of Gram-positive isolates. Inappropriate antibiotic use, incomplete treatment courses, recurrent infections, and limited access to culturebased diagnostics likely contribute to this rising burden. Adamu Abubakar et al. reported an overall MRSA prevalence of 6.5% in CSOM, with MRSA constituting 17.1% of Staphylococcus aureusisolates[13]. In contrast, the present study observed a substantially higher MRSA burden, accounting for 70.83% of Gram-positive isolates. This disparity likely reflects regional differences, recurrent disease, and patterns of antibiotic misuse, underscoring the need for routine culture-guided management of CSOM. The presence of additional pathogens such as Klebsiella pneumoniae, Escherichia coli, Proteus spp., Citrobacterkoseri, Providencia rettgeri, and Acinetobacter spp., though less frequent, further underscores the polymicrobial nature of CSOM.

Considering the emergence of bacterial resistance and the availability of wide spectrum of newer antimicrobial agents, it is important to know the pattern of infections and the antimicrobial sensitivity of the isolates[9-11].

Antimicrobial susceptibility patterns in this study highlight the growing challenge of multidrug resistance. P. aeruginosaretained good susceptibility to carbapenems, cefepime, aztreonam, piperacillintazobactam, and amikacin, while showing increasing resistance to fluoroquinolones. This trend mirrors national reports indicating declining quinolone efficacy due to widespread misuse[14,15]. MRSA isolates demonstrated universal sensitivity to linezolid but complete resistance to penicillin and ciprofloxacin, with high resistance to macrolides, suggesting limited empirical treatment options for Gram-positive infections. These findings emphasize the diminishing effectiveness of commonly prescribed antibiotics and reinforce the necessity of routine culture-guided therapy.

Overall, the results of this study indicate that while the microbial profile of CSOM remains largely predictable, the resistance landscape has evolved considerably. The statistically significant OPD and IPD difference in culture positivity, coupled with the high prevalence of multidrug-resistant organisms, underscores the urgent need for regular microbiological surveillance, rational antibiotic prescribing, and robust antibiotic stewardship programs. Strengthening early diagnosis and ensuring access to evidence-based treatment strategies are essential to reduce CSOM-related morbidity and prevent serious complications.

SUMMARY AND CONCLUSION

This cross-sectional study provides a comprehensive overview of the bacteriological profile and antimicrobial susceptibility patterns of chronic suppurative otitis media (CSOM) among patients attending a tertiary care teaching hospital in Western Uttar Pradesh. The findings confirm that CSOM remains a significant public health concern, predominantly affecting males and individuals aged 19–45 years due to increased occupational exposure, higher levels of outdoor activity, and greater interaction with potential sources of infection. The lower number of isolates observed in older age groups could be due to limited sample representation, reduced exposure, or the early initiation of empirical therapy prior to microbiological investigation.

More than half of the clinical samples (60.9%) yielded bacterial growth, with Gram-negative bacilli predominating over Gram-positive cocci. Pseudomonas aeruginosa emerged as the principal pathogen, reaffirming its central role in the pathogenesis of CSOM. The notably high proportion of methicillin-resistant Staphylococcus aureus (MRSA) among Gram-positive isolates represents a concerning shift in resistance trends and indicates a substantial increase in community circulation of resistant staphylococcal strains.

A major strength of this study is the demonstration of a highly significant association between patient setting and culture positivity, with community-acquired CSOM cases showing a significantly higher culture yield than hospital-acquired cases ($p < 0.001$). This finding highlights the likelihood of delayed presentation and untreated infection at the community level and underscores the importance of early diagnosis and microbiological evaluation, particularly in outpatient settings.

The antimicrobial susceptibility patterns observed reveal a diminishing effectiveness of commonly prescribed antibiotics, especially fluoroquinolones and cephalosporins. In contrast, higher-generation agents such as meropenem, piperacillin–tazobactam, cefepime, aztreonam, and linezolid continue to demonstrate good activity against major pathogens. However, reliance on these agents must be carefully regulated, as indiscriminate use could accelerate resistance to last-line therapies.

In conclusion, although the overall microbial etiology of CSOM remains relatively predictable, the antimicrobial resistance landscape has evolved considerably, posing serious challenges to empirical treatment. Overall, the findings of this study have direct implications for both empirical therapy and antimicrobial stewardship in CSOM. The predominance of Pseudomonas aeruginosa and the high burden of MRSA indicate that empirical treatment should be guided by local resistance patterns rather than routine broad-spectrum prescribing. Early culture sampling, particularly in outpatient cases, and timely modification of therapy based on susceptibility results are essential to optimize clinical outcomes. Furthermore, judicious use of higher-generation antibiotics and avoidance of unnecessary fluoroquinolone exposure are critical to limiting the further emergence of resistance. These measures underscore the need for sustained microbiological surveillance and structured antimicrobial stewardship programs in the management of CSOM.

Limitations of this study

The study did not investigate the underlying factors or molecular mechanisms contributing to antimicrobial resistance among the isolates.

Anaerobic bacteria and fungal pathogens were not evaluated, potentially underestimating the complete microbial spectrum involved in chronic suppurative otitis media.

DECLARATIONS

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this paper.

Authors' contributions: Author equally contributed the work.

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