International Journal of Science Academic Research
Vol. 06, Issue 08, pp.10510-10512, August 2025
Available online at http://www.scienceijsar.com

ISSN: 2582-6425

Research Article

BACTERIOLOGICAL PROFILE AND ANTIBIOTIC SENSITIVITY PATTERNS OF ENT PUS SWAB SAMPLES: A CROSS-SECTIONAL STUDY

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Received 14th June 2025; **Accepted** 18th July 2025; **Published online** 29th August 2025

Abstract

Background: Ear, nose, and throat (ENT) infections are prevalent in developing countries and often necessitate microbiological evaluation for effective treatment. The emergence of antimicrobial resistance underscores the importance of local surveillance. **Objective:** To assess the bacteriological profile and antimicrobial susceptibility patterns of pus swabs collected from ENT infections in a tertiary care hospital. **Methods:** This retrospective study analyzed 100 pus swabs from ENT patients (April–July 2024). Standard microbiological methods were used for isolation and identification of pathogens. Antibiotic susceptibility testing was conducted using the Kirby-Bauer disk diffusion method, interpreted as per CLSI guidelines. **Results:** The majority of patients were adults (74%), with a slight male predominance (55%). *Staphylococcus aureus* (29%) and *Pseudomonas spp.* (25%) were the most common isolates. *S. aureus* showed 100% sensitivity to Linezolid, while *Pseudomonas* exhibited high sensitivity to Ciprofloxacin (88%) and Ceftazidime (92%). Gram-negative bacilli demonstrated variable resistance patterns. No major multidrug resistance was observed, though emerging resistance in non-fermenters and Proteus was noted. **Conclusion:** The study highlights *S. aureus* and *Pseudomonas* as predominant ENT pathogens with generally favorable sensitivity patterns. Continuous monitoring and judicious antibiotic use are essential to guide empirical therapy and curb resistance.

Keywords: ENT infections, Pus swabs, Bacteriological profile, Antimicrobial resistance, Antibiotic susceptibility.

INTRODUCTION

Ear, nose, and throat (ENT) infections represent a significant portion of outpatient and inpatient consultations, particularly in developing countries where poor hygiene, pollution, overcrowding, and suboptimal antibiotic practices contribute to increased disease burden and recurrence rates. These infections range from superficial skin and soft tissue involvement to deep-seated abscesses and chronic suppurative otitis media (CSOM), often necessitating microbiological investigations to guide effective therapy. Among these, the presence of pus indicates active infection and mandates culture and sensitivity analysis to determine the causative pathogen and appropriate antimicrobial treatment. Pus swabs from ENT infections yield a wide range of bacterial flora, both aerobic and anaerobic, with the predominant organisms varying across age groups, anatomical sites, geographic regions, and healthcare settings. Commonly implicated bacteria include *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella* spp., *Escherichia coli*, coagulase-negative *Staphylococcus* (CONS), and non-fermenting Gram-negative bacilli (NFGNB).[1,2] Fungal pathogens, particularly *Candida* species, are occasionally encountered, especially in immunocompromised patients or those on prolonged antibiotic therapy.[3] An alarming trend in recent years is the growing resistance of these organisms to first-line antibiotics. The misuse and overuse of antibiotics in community and hospital settings have fueled this resistance, rendering conventional treatment regimens ineffective and increasing the risk of complications, prolonged illness, and healthcare costs.[4,5] Multidrug-resistant (MDR) strains of *Pseudomonas* and *Staphylococcus aureus*, including methicillin-resistant *Staphylococcus aureus* (MRSA), are being reported with increasing frequency in ENT practice.[6,7]

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Surveillance of bacterial isolates and their antimicrobial susceptibility patterns is crucial not only for individual patient management but also for the formulation of institutional antibiotic policies and empirical therapy guidelines. Several regional and hospital-based studies across India have highlighted significant variation in the prevalence of organisms and resistance profiles in ENT infections[8]. These differences emphasize the need for regular, localized microbiological audits to ensure the most effective therapeutic strategies. Despite the importance of such surveillance, microbiological data specifically focusing on ENT pus swabs remain underreported in the literature, especially in resource-constrained settings. This study was thus conducted to evaluate the bacteriological profile and antimicrobial susceptibility patterns of 100 pus swab samples obtained from patients presenting with ENT infections in a tertiary care hospital from April to July 2024. By analyzing the prevalent pathogens and their resistance trends, the study aims to contribute to evidence-based recommendations for empirical antibiotic therapy in ENT clinical practice.

MATERIALS AND METHODS

This was a retrospective, record based study conducted in the Microbiology department of a tertiary care hospital, analyzing pus swab samples collected from the ENT outpatient and inpatient departments between April and July 2024.A total of 100 pus swabs were received. Pus was inoculated onto blood agar and MacConkey agar media. The culture plates were incubated at 37°C for 24 hours and identified using standard microbiological procedures, including culture characteristics and a series of biochemical tests. Identification involved the application of the catalase test (using 3% hydrogen peroxide), coagulase test and the oxidase test. Additional biochemical

analyses included the indole test citrate utilization, urease activity and the triple sugar iron (TSI) agar test.

Antimicrobial susceptibility tests

Antimicrobial susceptibility testing was conducted using Mueller-Hinton agar plates, following the guidelines established by the Clinical and Laboratory Standards Institute (CLSI). The Kirby-Bauer disk diffusion method was employed to assess the antibiotic resistance patterns of all bacterial isolates.The isolates were tested against the antibiotics and the diameters of the zones of inhibition were measured and interpreted according to CLSI standards. Demographic details, organism types, and antibiotic resistance patterns were analyzed using Microsoft Excel and summarized descriptively.

RESULTS

Demographic characteristics: The demographic characteristics of the 100 ENT patients whose pus swabs were analyzed from April to July 2024. The majority of patients were adults aged 13–60 years (74%), with a slight male predominance (55%). Most samples were collected from outpatients (88%), and May accounted for the highest number of cases (42%). (Table 1)

Microbiological profile

The distribution of bacterial isolates obtained from ENT pus swab cultures shows that the most frequently isolated organism was *Staphylococcus aureus* (29 cases), followed by *Pseudomonas* species (25 cases) and coagulase-negative staphylococci (CONS) (8 cases). Less commonly isolated organisms included *Klebsiella*, *Proteus*, *E. coli*, *Citrobacter*, and *Enterococcus* species.

Table 1. Demographic Profile of patients

Demographic Variable	Category	Number of Patients (n)
Age Group	≤12 years (children)	8
	13–60 years (adults)	74
	>60 years (elderly)	18
Gender	Male (M + MCH)	55 (47 M + 8 MCH)
	Female (F + FCH)	45 (44 F + 1 FCH)
Patient Type	Outpatient Department (OPD)	88
	Inpatient Department (IPD)	12
Month wisesample Collected	April 2024	17
	May 2024	42
	June 2024	29
	July 2024	12

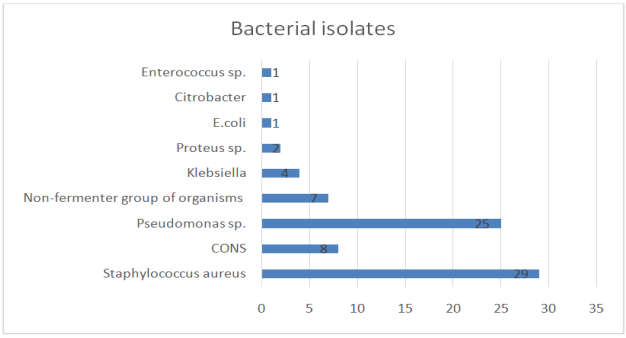

Figure 1. Distribution of organisms Isolated from ENT pus swabs

Antibiotic Sensitivity Pattern of ENT Isolates

Sensitivity Pattern of ENT Isolates demonstrated that the *Staphylococcus aureus* showed 100% sensitivity to Linezolid and 57.1% to Clindamycin. *Pseudomonas* was highly sensitive to Ciprofloxacin (88%) and Ceftazidime (92%). *Klebsiella* and *E. coli* showed 100% sensitivity to Levofloxacin and Gentamicin. *Enterococcus* was fully sensitive to Linezolid and Vancomycin. (Table 2, 3).

Table 2. Percentage sensitivity of Gram-positive bacterial Isolates to common antibiotics

Drug	*Staph spp. (n=29)*	*CONS (n=8)*	*Enterococcus sp. n=1*
Erythromycin	20.7% (6/29)	25% (2/8)	NT
Trimeth-Sulfa)	12.5% (1/8)	NT	100% (1/1)
Ampicillin	31.03% (9/29)	37.5% (3/8)	0%
Clindamycin	57.1% (15/29)	62.8% (5/8)	NT
Tetracycline	NT	NT	100% (1/1)
Tobramycin/Gentamicin	NT	NT	NT
Ceftazidime	NT	NT	100% (1/1)
Linezolid	100%	100% (8/8)	NT
Vancomycin	NT	100% (8/8)	100% (1/1)
High-Level GEN	NT	75% (6/8)	100% (1/1)
Minocyclin	87.5% (21/24)	87.5% (7/8)	NT
Moxifloxacin	28.5% (6/21)	50% (4/8)	NT
Azetronem	NT	NT	100% (1/1)
Amikacin	NT	NT	100% (1/1)

Table 3. Percentage Sensitivity of Gram-negative bacterial Isolates to Common Antibiotics

Drug	*Klebsiella (n=7)*	*E. coli n=1*	*Citrobacter n=1*	*Pseudomonas n=25*	*Proteus (n=1)*	*Non-fermenters n=4*
Ciprofloxacin	NT	NT	NT	88% (22/25)	NT	NT
Levofloxacin	100% (7/7)	100% (1/1)	100% (1/1)		0%	100% (4/4)
Tetracycline	NT	NT	NT	57.1% (4/7)	NT	NT
Tobramycin/Gentamicin	100% (7/7)	100% (1/1)	100% (1/1)	NT	0%	100% (4/4)
Ceftazidime	NT	NT	100% (1/1)	92% (23/25)	0%	NT
Cefuroxime	50% (3/6)	0% (0/1)	NT	NT	NT	NT
Ceftriaxone	40% (2/5)	NT	100% (1/1)	NT	100%	75% (3/4)
Cefepime	71.4% 5/7	NT	100% (1/1)	84% (21/25)	NT	NT
Imipenem	71.4%	100% (1/1)	100% (1/1)	NT	100% (1/1)	100% (4/4)
Meropenem	NT	0% (0)	100% (1/1)	100% (16/16)	NT	100% (3/3)
Amox-Clavulanic	20% (1/5)	NT	NT	NT	NT	NT
Piperacillin-Tazo	NT	NT	NT	100% (22/22)	NT	100% (3/3)
Azetronem	50% (2/4)	NT	0%	92% (23/25)	NT	50% (2/4)
Amikacin	NT	NT	NT	100% (20/20)	0%	NT

DISCUSSION

In this study, we analyzed pus swab cultures from 100 ENT patients between April and July 2024, revealing important demographic and microbiological trends. A predominance of adult patients (13–60 years, 74%) was observed, with a slight male majority (55%). Similar age and gender distributions have been reported in other Indian studies on ENT infections, suggesting a higher burden in the working-age population due to increased exposure and outdoor activities.[9,10] The majority of patients (88%) were managed on an outpatient basis, indicating that ENT infections are commonly treated without hospitalization. May showed the highest number of samples (42%), which may reflect seasonal variation in ENT infection rates, possibly linked to humidity and pollen levels.[11] The most frequently isolated organism was *Staphylococcus aureus* (29%), followed by *Pseudomonas* spp. (25%) and Coagulase-Negative *Staphylococci* (CONS) (8%). These findings are consistent with prior studies, where *S. aureus* and *Pseudomonas* have been recognized as dominant pathogens in otitis externa and chronic suppurative otitis media (CSOM).[12,13] The isolation of Gram-negative organisms such as *Klebsiella*, *E. coli*, *Proteus*, *Citrobacter*, and *Enterococcus*though in lower numbersindicates a polymicrobial profile, especially in chronic and nosocomial infections.[14] The antibiotic sensitivity patterns observed in this study reveal both reassuring and concerning trends. *Staphylococcus aureus* demonstrated 100% sensitivity to Linezolid and high susceptibility to Clindamycin (57.1%), indicating that these remain effective agents against Gram-positive cocci. Similar sensitivity to Linezolid has been observed in other regional studies, reinforcing its role in treating resistant Gram-positive infections.[15] CONS isolates also showed high sensitivity to Linezolid (100%) and Minocycline (87.5%), although variable resistance to Erythromycin (25%) and Trimethoprim-sulfamethoxazole (12.5%) was seen. This highlights the increasing role of CONS as opportunistic pathogens and their evolving resistance profile.[16] Among Gram-negative organisms, *Pseudomonas* spp. showed excellent sensitivity to Ciprofloxacin (88%), Ceftazidime (92%), and Amikacin (100%). These findings are in agreement with previous studies that emphasize fluoroquinolones and third-generation cephalosporins as first-line choices in pseudomonal infections.[17] *Klebsiella* and *E. coli* isolates were uniformly sensitive to Levofloxacin and Gentamicin (100%), but *Klebsiella* showed reduced susceptibility to third-generation cephalosporins such as Cefuroxime (50%) and Ceftriaxone (40%). This resistance trend may be attributed to widespread beta-lactam use in the community.[18] *Enterococcus* showed full susceptibility to Vancomycin and Linezolid, both considered last-resort drugs for Gram-positive cocci. Notably, high-level Gentamicin resistance was not observed in this isolate (100% sensitivity), which is encouraging.[19] The emergence of multidrug-resistant (MDR) strains warrants continuous surveillance and strict antibiotic stewardship.

Conclusion

This study underlines the predominance of *S. aureus* and *Pseudomonas* in ENT infections and highlights significant sensitivity patterns that can guide empirical therapy. The universal sensitivity of Gram-positive organisms to Linezolid and of *Pseudomonas* to Ciprofloxacin and Ceftazidime suggests these antibiotics remain reliable. However, variable resistance among Gram-negative bacilli emphasizes the need for regular antibiogram updates and rational antibiotic usage.

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