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MICROBIOLOGICAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY OF PUS CULTURE ISOLATES FROM OTITIS MEDIA AT A TERTIARY CARE CENTRE IN JAIPUR, RAJASTHAN: A DESCRIPTIVE STUDY

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ABSTRACT

Background: Chronic and active otitis media are associated with a changing microbial spectrum and local antimicrobial resistance patterns. Local culture data are needed to guide treatment and antimicrobial stewardship.

Methods: We performed a descriptive analysis of 119 anonymized pus culture and antimicrobial susceptibility reports from patients evaluated at Sawai Man Singh Medical College and Hospital, Jaipur, Rajasthan. Exact repeated reports were removed during data preparation; repeat cultures with different dates or results were retained. Organisms from polymicrobial reports were counted separately. Susceptibility results were summarized using the report-specific S, I and R categories, with antibiotic-specific denominators.

Results: Of 119 reports, 116 (97.5%; 95% CI 92.9–99.1) were culture-positive, two (1.7%) were labelled contaminated and one (0.8%) showed no growth. The 116 positive reports yielded 126 isolates; ten reports were polymicrobial. Gram-negative organisms accounted for 91 (72.2%) isolates, Gram-positive organisms for 33 (26.2%) and Candida spp. for two (1.6%). Pseudomonas spp. was predominant (69/126, 54.8%), followed by Staphylococcus aureus (17/126, 13.5%), Klebsiella spp. (7/126, 5.6%) and Escherichia coli (6/126, 4.8%). Among Pseudomonas spp. isolates, susceptibility was highest to piperacillin–tazobactam (63/65, 96.9%) and imipenem (59/67, 88.1%); ciprofloxacin susceptibility was 32/69 (46.4%). Among S. aureus isolates, susceptibility was 16/17 (94.1%) for linezolid, doxycycline and co-trimoxazole, and 16/16 (100%) for vancomycin; 10/17 (58.8%) were resistant to cefoxitin, but this was not independently reclassified as MRSA.

Conclusion: Pseudomonas spp. dominated the Jaipur pus culture reports and showed substantial variation across tested agents. Culture-directed treatment and periodic local antibiograms are warranted. The findings should be interpreted at the culture-report level because patient-level uniqueness and several laboratory method details were not available in the master chart.

KEYWORDS: otitis media; chronic suppurative otitis media; pus culture; antimicrobial susceptibility; Pseudomonas; Staphylococcus aureus; Jaipur

INTRODUCTION

Chronic suppurative otitis media (CSOM) is a persistent inflammatory and infectious disorder of the middle-ear cleft associated with a non-intact tympanic membrane and chronic otorrhoea. It can produce conductive hearing loss, ossicular damage, granulation tissue and, in advanced cases, extracranial or intracranial complications. The condition is particularly important in low- and middle-income settings, where delayed presentation, recurrent upper-respiratory infection, overcrowding, limited access to specialist care and inappropriate antimicrobial use can prolong disease. Recent reviews also emphasize that definitions of CSOM and the boundaries between active, inactive and healed disease are not fully consistent between studies, making local microbiological surveillance essential. [1,2]

The microbiology of a draining ear is shaped by several interacting factors. These include the duration and character of discharge, the site and depth of sampling, the presence of a central perforation or cholesteatoma, prior topical or systemic therapy, biofilm formation and the culture methods used by the laboratory. Pseudomonas aeruginosa and Staphylococcus aureus are frequently recovered, but Enterobacterales, other non-fermenting Gram-negative bacilli, enterococci and fungi may also be present. A culture report can therefore provide more than an organism name: it can identify mixed infection, reveal resistance patterns and support a decision to narrow or change empirical treatment. [2,3]

Antimicrobial resistance in CSOM is clinically relevant because repeated exposure to topical quinolones, aminoglycosides, beta-lactams and broad-spectrum systemic drugs may select organisms with limited remaining options.

Studies from India have shown substantial regional differences in both the relative frequency of Pseudomonas and the activity of commonly used agents. Reports from western Rajasthan, southern Rajasthan and other Indian tertiary centres have each demonstrated a predominant role for Pseudomonas, but their susceptibility estimates are not interchangeable because the patient populations, drug panels, laboratory standards and inclusion criteria differ. [3-6]

A local antibiogram is useful only when its denominators and laboratory methods are clear. Antimicrobial susceptibility should be summarized separately for each organism and agent, because not every isolate is tested against every drug. Intermediate results should remain visible, missing values should not be treated as resistance and polymicrobial cultures should be distinguished from reports containing a single isolate. The CLSI M39 framework provides a practical basis for organizing cumulative susceptibility data, while current guidance also cautions against overinterpreting methods that are unreliable for particular drug-organism combinations. [7,10]

The clinical value of culture is greatest when the laboratory result is integrated with the otoscopic phenotype and the patient's treatment history. A swab from superficial debris may recover colonizing flora, whereas carefully collected material from the middle-ear cleft may better represent organisms contributing to active disease. Prior topical drops can suppress susceptible organisms and enrich resistant subpopulations, while a cholesteatoma or granulation tissue may support persistent polymicrobial infection. These factors mean that a susceptibility result should inform treatment together with examination findings, hearing assessment, disease duration and the presence or absence of complications.

In addition to guiding an individual prescription, a well-constructed local dataset can support antimicrobial stewardship at the institutional level. It can identify drugs with declining activity, highlight organisms that require confirmatory testing and provide a baseline against which future changes can be measured. A report-level analysis is particularly useful during the initial stage of surveillance because it preserves the information contained in routine laboratory records; however, it should lead to a prospective system that links each isolate to a defined patient episode, standardized specimen collection and clinical outcome.

There is limited contemporary report-level information describing the organism spectrum and susceptibility pattern of otitis media-related pus cultures processed at Sawai Man Singh Medical College and Hospital, Jaipur. The present study was undertaken to characterize the culture outcomes, describe the distribution of recovered organisms and summarize the reported antimicrobial susceptibility of the principal isolates. The results are intended as a local descriptive baseline for culture-directed management, antimicrobial stewardship and future prospective surveillance.

Objectives

- To describe the culture outcomes and organism distribution in pus culture reports from patients with otitis media.
- To summarize the reported antimicrobial susceptibility of the principal bacterial isolates.
- To provide a local descriptive baseline for culture-directed treatment and future surveillance.

MATERIALS AND METHODS

Study design and setting

This was a descriptive observational analysis of anonymized pus culture and antimicrobial susceptibility reports generated for patients evaluated at Sawai Man Singh Medical College and Hospital, Jaipur, Rajasthan, India. The dataset contained report dates from 21 August 2025 to 12 September 2026. The final analytical unit was a culture report. The master chart does not establish that every report represented a unique patient; therefore, the manuscript does not use the term "unique patients."

Data source and record selection

The analysis workbook was prepared from two source PDF collections of laboratory reports. Direct patient identifiers were removed and replaced by Study IDs. Exact repeated reports were excluded during data cleaning. Repeat cultures with different dates or results were retained. Culture outcome, organism name, age, sex, report dates and antimicrobial results were transcribed from the reports. Low-contrast or partly illegible fields were flagged rather than silently imputed.

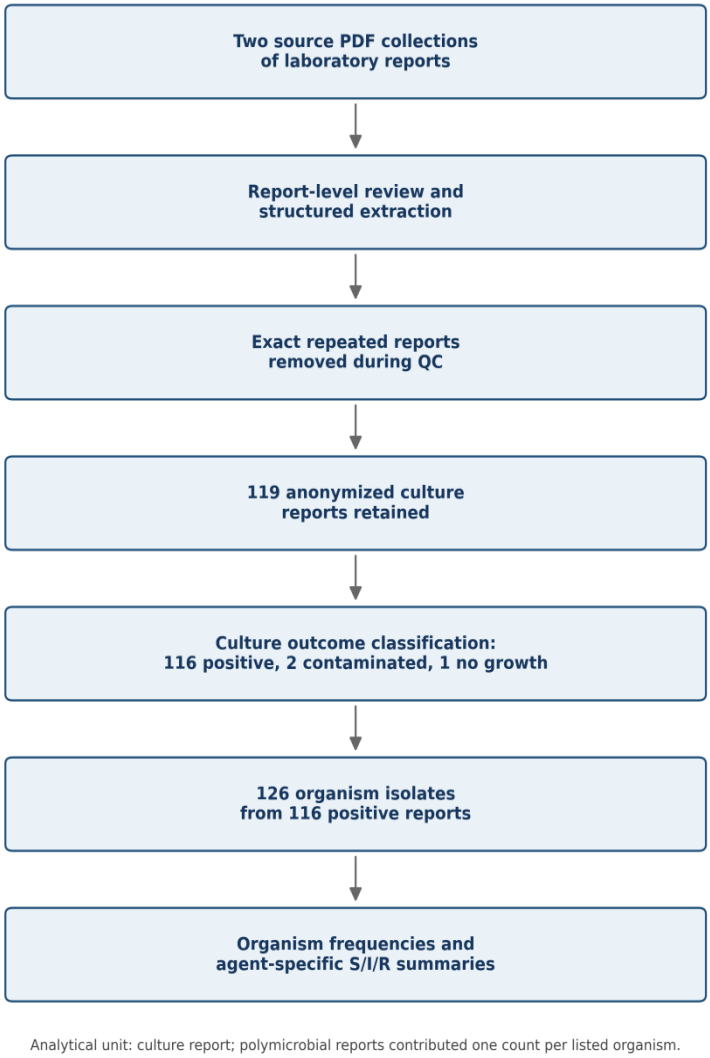

Figure 1. Flowchart of report selection, data cleaning and analysis. The analytical unit was the culture report; organisms from polymicrobial reports were counted separately.

Microbiological and susceptibility data

The present analysis reports the organism names and S/I/R interpretations as printed in the source laboratory reports. The master chart does not consistently document the specimen collection technique, transport conditions, culture media, incubation atmosphere, identification platform, antimicrobial disk potency, quality-control strains or the breakpoint standard used by the laboratory. These details must be added from the laboratory SOP before submission. Because susceptibility was reported separately for each antimicrobial, denominators vary by drug. The laboratory label "Gentain" was retained as reported and requires confirmation as gentamicin before final publication.

Definitions used for analysis

A positive culture was a report with one or more identified organisms. Reports labelled contaminated and no growth were retained as separate outcomes. In a polymicrobial report, each listed organism contributed one isolate to organism-frequency analyses. Gram categories were assigned from the organism identity for analysis; Candida spp. was retained as fungal. Cefoxitin resistance in S. aureus was presented as a reported phenotype and was not independently relabelled as MRSA because confirmatory laboratory criteria and the source laboratory's reporting rule were not available.

Statistical analysis

Categorical variables are presented as counts and percentages. Age is summarized using mean, standard deviation, median, interquartile range and range when recorded. Culture positivity is reported with an approximate Wilson 95% confidence interval. Antimicrobial susceptibility percentages use the number of isolates tested for that specific agent as the denominator; intermediate results remain separate from resistant results. No inferential hypothesis testing was planned because the dataset was assembled for descriptive surveillance and patient-level independence could not be verified. Analyses were performed using a reproducible data-cleaning and tabulation script.

Ethics and reporting

Insert the approval number and date from the Sawai Man Singh Medical College Institutional Ethics Committee, and state whether informed consent was waived for this anonymized record-based analysis. The final manuscript should be checked against the STROBE recommendations for observational studies. [8]

RESULTS

Culture outcomes and demographic variables

After removal of exact repeated reports, 119 anonymized culture reports were retained. Culture was positive in 116 reports (97.5%), contaminated in two (1.7%) and negative for growth in one (0.8%). The positivity estimate was 97.5% (95% CI 92.9–99.1). Age was recorded in 98 reports. The mean age was 29.0 ± 18.9 years, median 24.5 years (IQR 16.0–36.8), with a range of 3–78 years. Sex was recorded in 99 reports: 58 male (58.6%) and 41 female (41.4%). Ten positive reports were polymicrobial.

Table 1. Demographic and culture-report characteristics. Percentages use the available records for each variable unless otherwise specified.

Variable	Available reports	Summary
Culture outcome	119	Positive 116 (97.5%); contaminated 2 (1.7%); no growth 1 (0.8%)
Age	98	Mean 29.0 ± 18.9 y; median 24.5 y; IQR 16.0–36.8; range 3–78
Sex	99	Male 58 (58.6%); female 41 (41.4%)
Polymicrobial reports	119	10 (8.4%)

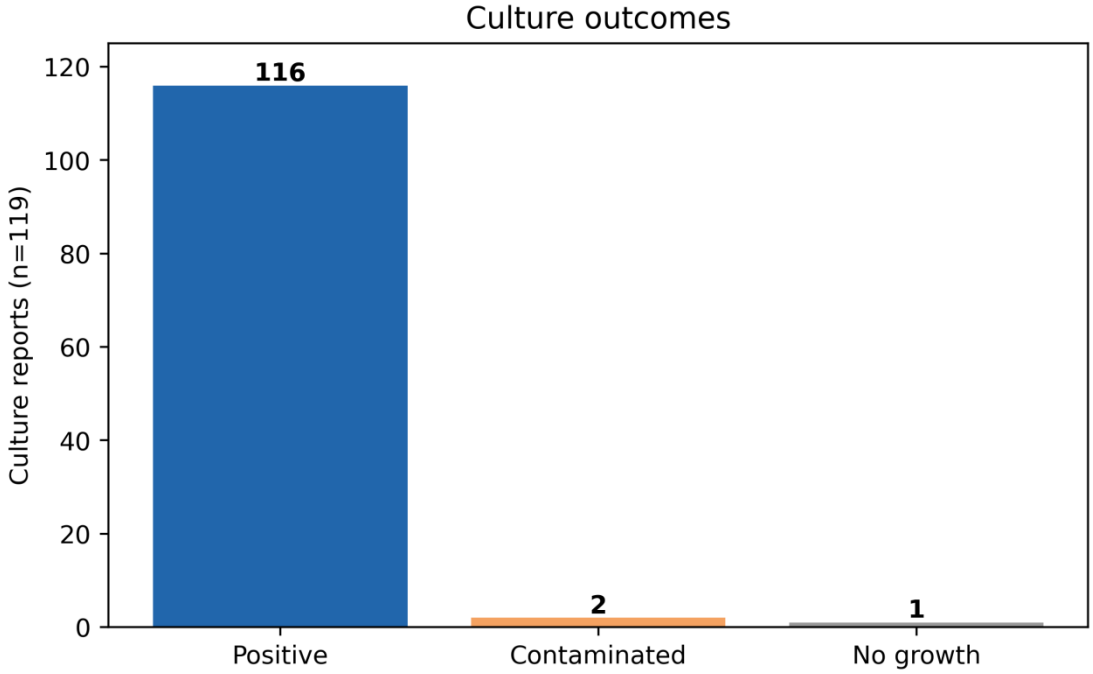

Figure 2. Culture outcomes among 119 anonymized reports.

Organism distribution

The 116 positive reports yielded 126 isolates. Gram-negative organisms comprised 91 (72.2%) isolates, Gram-positive organisms 33 (26.2%) and Candida spp. two (1.6%). Pseudomonas spp. was the most frequent organism, with 69 isolates (54.8%). S. aureus accounted for 17 (13.5%), Klebsiella spp. for seven (5.6%) and E. coli for six (4.8%).

Table 2. Distribution of isolates from positive culture reports (n = 126).

Organism	Isolates	% of isolates	Category
Pseudomonas spp.	69	54.8	Gram-negative
Staphylococcus aureus	17	13.5	Gram-positive
Klebsiella spp.	7	5.6	Gram-negative
Coagulase-positive staphylococci	6	4.8	Gram-positive
Escherichia coli	6	4.8	Gram-negative
Staphylococcus epidermidis	5	4.0	Gram-positive
Proteus mirabilis	3	2.4	Gram-negative
Enterobacter spp.	2	1.6	Gram-negative
Coagulase negative staphylococci	2	1.6	Gram-positive
Candida spp.	2	1.6	Fungal
Morganella spp.	1	0.8	Gram-negative
Providencia stuartii	1	0.8	Gram-negative
Enterococcus faecalis	1	0.8	Gram-positive
Staphylococcus haemolyticus	1	0.8	Gram-positive

Acinetobacter baumannii	1	0.8	Gram-negative
Enterococcus spp.	1	0.8	Gram-positive
Burkholderia cepacia	1	0.8	Gram-negative

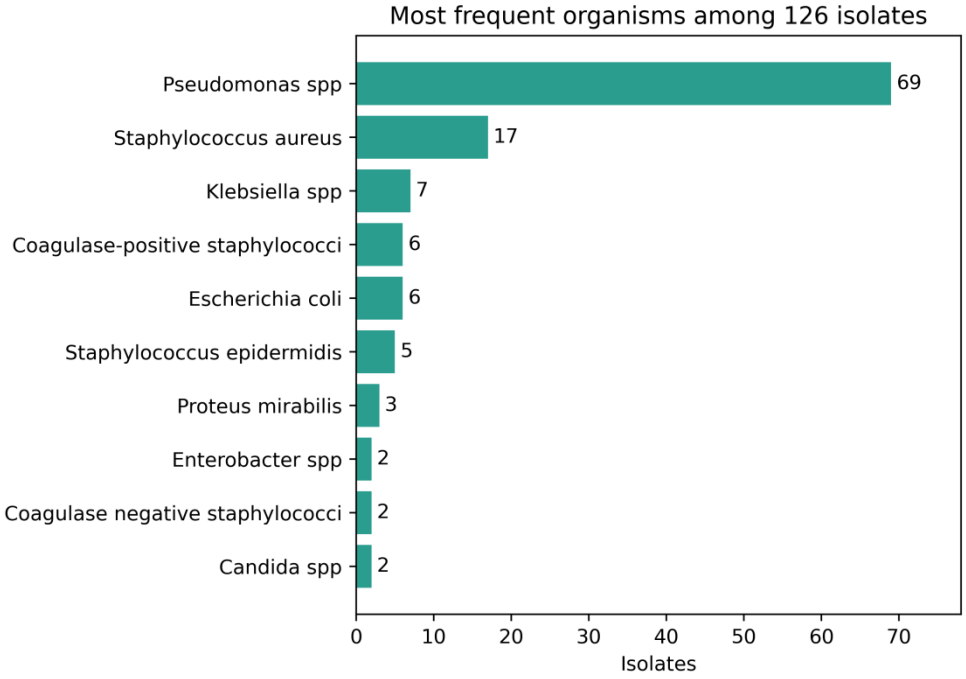

Figure 3. Ten most frequent organism categories among 126 isolates.

Antimicrobial susceptibility

Across the antibiogram table, 1,391 entries had an interpretable S, I or R result: 934 (67.2%) were susceptible, 90 (6.5%) intermediate and 367 (26.4%) resistant. One entry had no interpretation and was excluded from agent-specific calculations. The denominators below therefore represent isolates tested for each antimicrobial, not the full number of isolates.

Table 3. Selected antimicrobial susceptibility results for Pseudomonas spp. (n = 69 isolates; agent-specific denominators).

Antimicrobial	Tested	S	I	R	S (%)
Amikacin	69	44	0	25	63.8
Cefepime	69	55	5	9	79.7
Cefoperazone-sulbactam	68	53	1	14	77.9
Ceftazidime	67	56	2	9	83.6
Ciprofloxacin	69	32	3	34	46.4
Imipenem	67	59	4	4	88.1
Piperacillin-tazobactam	65	63	2	0	96.9
Tobramycin	66	46	5	15	69.7

Table 4. Selected antimicrobial susceptibility results for Staphylococcus aureus (n = 17 isolates; agent-specific denominators).

Antimicrobial	Tested	S	I	R	S (%)
Cefoxitin	17	6	1	10	35.3
Ciprofloxacin	17	0	0	17	0.0
Clindamycin	16	14	0	2	87.5
Co-trimoxazole	17	16	0	1	94.1
Doxycycline	17	16	0	1	94.1
Erythromycin	16	4	3	9	25.0
Linezolid	17	16	0	1	94.1
Teicoplanin	17	17	0	0	100.0
Vancomycin	16	16	0	0	100.0

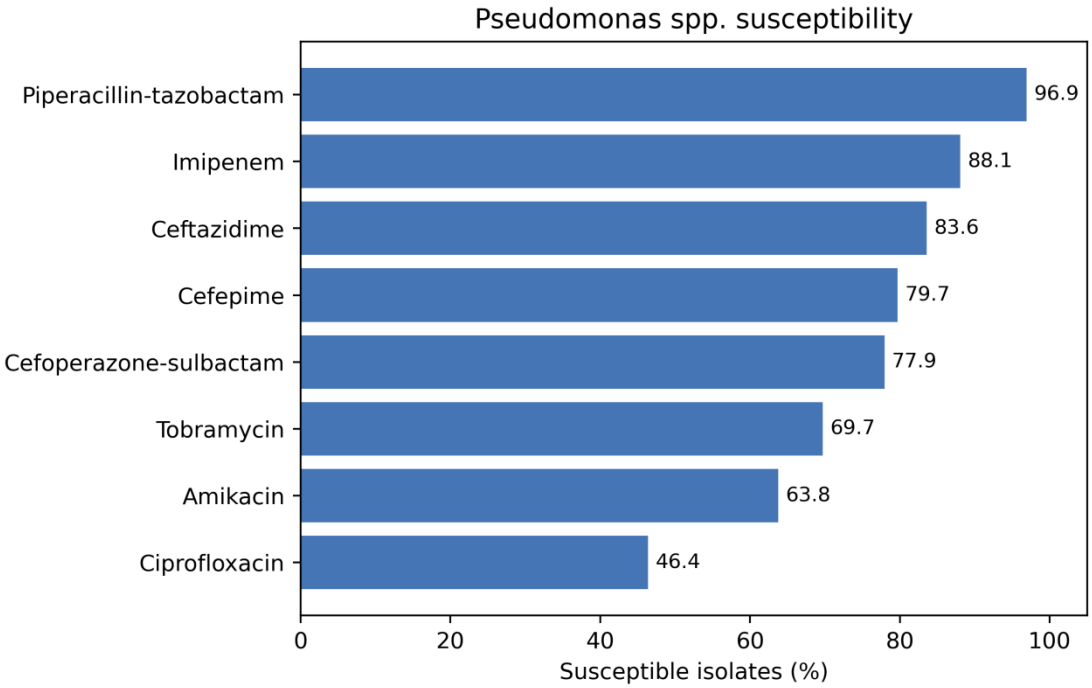

Figure 4. Susceptibility of Pseudomonas spp. to selected antimicrobial agents.

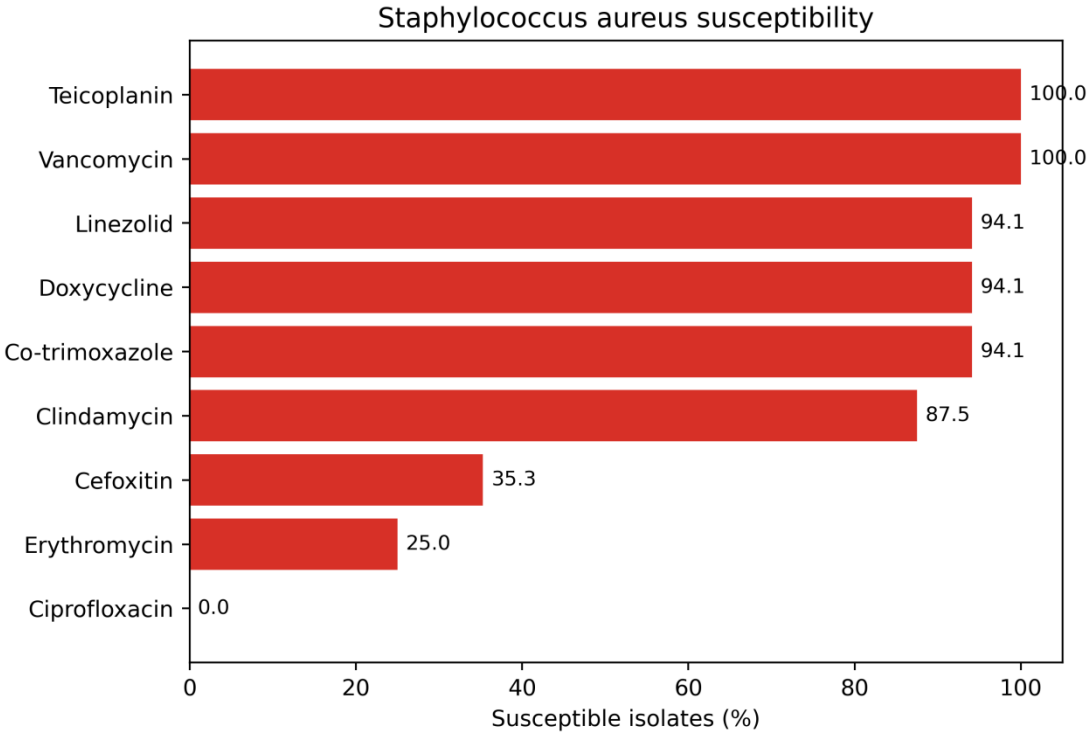

Figure 5. Susceptibility of Staphylococcus aureus to selected antimicrobial agents.

DISCUSSION

The principal finding of this study is the dominance of Gram-negative organisms, particularly Pseudomonas spp., in the Jaipur pus culture reports. Pseudomonas accounted for 69 of 126 isolates (54.8%), while Gram-negative organisms as a group represented 72.2% of all isolates. This pattern is biologically plausible in chronic draining ears because Pseudomonas can persist in moist environments, form biofilms and express multiple mechanisms of antimicrobial tolerance. It is also consistent with the broad Indian literature, although the reported proportion differs according to whether studies include only bacterial isolates, include fungi, accept polymicrobial cultures and define CSOM using the same duration of discharge.

The findings are comparable with regional studies. Lathi and colleagues, working in southern Rajasthan, reported Pseudomonas as the most frequent isolate and found high meropenem activity, whereas Gupta and Kumbhat reported Pseudomonas followed by S. aureus in western Rajasthan. [4,5] In a larger adult series from northern India, P. aeruginosa was again the leading organism, followed by MSSA and MRSA. [6] These comparisons support the reproducibility of

Pseudomonas as an important pathogen but also show why a single regional percentage should not be generalized to all Indian patients.

Ten reports in the present dataset were polymicrobial, producing 126 isolates from 116 positive reports. Mixed growth may represent true coexistence of organisms in a chronically inflamed middle ear, biofilm-associated infection, contamination during collection or selective recovery after previous antimicrobial exposure. The dataset cannot distinguish these possibilities because clinical examination findings, sampling depth and treatment history were not consistently available. Nevertheless, retaining the organisms rather than collapsing a mixed report into a single category preserves information for future quality improvement. The isolate percentages should be read as proportions of recovered isolates and must not be interpreted as patient-level prevalence.

Pseudomonas spp. showed the highest reported susceptibility to piperacillin–tazobactam (96.9%) and imipenem (88.1%), followed by ceftazidime (83.6%) and cefepime (79.7%). Ciprofloxacin susceptibility was lower at 46.4%, with 34 of 69 tested isolates reported resistant. This difference matters because quinolones are commonly considered convenient agents for otorrhoea, but convenience does not guarantee local activity. The data support obtaining a culture before prolonged or repeated antimicrobial therapy when clinically feasible, particularly in persistent or recurrent discharge. They do not, by themselves, establish that piperacillin–tazobactam or imipenem should be used empirically, because route, toxicity, disease severity, topical options and the laboratory breakpoint system must also be considered.

The S. aureus results show a different pattern. Susceptibility was high for linezolid, doxycycline and co-trimoxazole, and all tested isolates were reported susceptible to vancomycin and teicoplanin. However, the cefoxitin results require careful interpretation: 10 of 17 isolates were recorded as resistant, one was recorded as intermediate and six as susceptible. Current disk-diffusion interpretation for S. aureus does not use an intermediate category. Therefore, the cefoxitin findings should be reconciled with the original report and the laboratory's breakpoint version before any estimate of MRSA is published. A cefoxitin-resistant report can support a methicillin-resistant phenotype only when the appropriate organism-specific method and interpretive criteria have been applied. [9]

The apparent susceptibility to vancomycin should also be interpreted in the context of the test method. If the results were generated by disk diffusion without MIC confirmation, they should be described as reported laboratory interpretations rather than proof that reduced vancomycin susceptibility was excluded. Similar caution applies to colistin and polymyxin results. EUCAST states that colistin disks and gradient tests do not reliably predict resistance, and broth microdilution is the reference approach for clinically meaningful testing. [10] These observations are not reasons to discard the historical records; they identify the laboratory-method information that should be made explicit in a publishable surveillance study.

Age and sex were incomplete, but the available records suggest that the dataset included a broad age range, with a median age of 24.5 years and a male predominance among records with known sex. Because the study was based on laboratory reports rather than a prospectively recruited clinical cohort, these demographic summaries should not be interpreted as estimates of the age or sex distribution of all otitis media patients attending the hospital. Future surveillance should use a standardized clinical proforma that records age, sex, laterality, duration and character of discharge, tympanic membrane phenotype, cholesteatoma status, previous antibiotics and whether the specimen was collected before or after aural toilet.

From a service perspective, the study provides a useful baseline for an annual or six-monthly local antibiogram. Such surveillance should use one clearly defined isolate per patient episode when the objective is resistance estimation, retain polymicrobial episodes in a separate category, report the number tested for every drug and exclude duplicate isolates according to a prespecified rule. Linking laboratory results to clinical outcome would allow a subsequent study to determine whether culture-directed therapy improves drying of the ear, hearing outcomes or the need for surgery. The present report is therefore best viewed as a foundation for a more clinically integrated prospective study.

The study also illustrates why local antibiograms need transparent denominators and quality checks. Cumulative susceptibility guidance recommends standardized collection, analysis and presentation of susceptibility data. [7] Our approach preserves the S, I and R categories and keeps agent-specific denominators visible, but the missing laboratory SOP details limit the strength of clinical recommendations. The results should guide questions for the microbiology and ENT teams rather than replace bedside assessment.

Strengths and limitations

Strengths include the use of a sizeable real-world laboratory dataset, anonymization, removal of exact repeated reports, retention of polymicrobial information and preservation of agent-specific denominators. Limitations include the retrospective report-level design, incomplete age and sex fields, uncertain patient-level uniqueness, absence of clinical phenotype data such as perforation type, duration of otorrhoea, prior treatment and hearing status, and incomplete documentation of microbiology methods and breakpoint standards. The organism labels "Pseudomonas spp." and "Gentain" should be verified against the laboratory register. The results describe reported laboratory findings and cannot establish treatment effectiveness or causal relationships.

CONCLUSION

Pseudomonas spp. was the predominant organism in pus culture reports from patients with otitis media at this tertiary care centre in Jaipur, followed by S. aureus and enteric Gram-negative organisms. Susceptibility varied substantially across agents, with high reported activity of piperacillin–tazobactam and imipenem against Pseudomonas spp. and high reported activity of linezolid, doxycycline and co-trimoxazole against S. aureus. A centre-specific, periodically updated culture-guided treatment policy is appropriate, provided that specimen collection, identification, susceptibility testing and breakpoint interpretation are standardized.

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