



ANTIBIOTIC SUSCEPTIBILITY PATTERN OF PSEUDOMONAS AERUGINOSA FROM CRITICAL AND NON-CRITICAL AREAS FROM A TERTIARY CARE HOSPITAL

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ABSTRACT

Understanding and comparing antibiotic susceptibility patterns of *P. aeruginosa* isolates from critical and non-critical areas is essential for guiding empirical therapy, implementing antimicrobial stewardship programs, and strengthening infection control measures in tertiary care hospitals (6). Therefore, this study was carried out to compare the antibiotic Susceptibility Pattern of *Pseudomonas aeruginosa* from Critical and Non-Critical Areas from a Tertiary Care Hospital.

METHODS: This cross-sectional study was done in the Department of Microbiology, Index Medical College, Hospital and Research Centre, M.U. Indore MP. 300 samples from patients of all age group and both sexes were enrolled in the study. The isolates were identified by standard microbiological laboratory test methods. In accordance with CLSI 2025 guidelines, each isolate was subjected to an AST using the Kirby-Bauer disc diffusion method.

RESULTS:

Out of total of 300 *Pseudomonas aeruginosa* isolates, 42 (14%) were from critical area and 258 (86%) were from non-critical area. *Pseudomonas aeruginosa* from critical area was most commonly isolated from blood (40.4%) and from non-critical area pus (46.1%) was the most common specimen. Among critical area highest isolation was from surgical ICU (47.6%). Among non-critical area highest isolation was from medicine ward (31.8%). All isolates were 100% susceptible to colistin and polymyxin B and more than 90% isolates were susceptible to imipenem and meropenem in both the areas. Ceftazidime was the least susceptible.

CONCLUSION: The prevalence and sensitivity of *P. aeruginosa* sometimes vary between communities, hospitals in the same community and among various patient group in the same hospital. The doctor in clinical practice must make clinical decisions in the face of these variances, and they should have access to up-to-date information on the prevalence and pattern of antibiotic resistance of frequently encountered infections.

INTRODUCTION

Pseudomonas aeruginosa is an opportunistic Gram-negative pathogen and a major cause of hospital-acquired infections, particularly in tertiary care settings (1). It commonly causes ventilator-associated pneumonia, bloodstream infections, urinary tract infections, and wound infections, especially among critically ill and immunocompromised patients (2). The organism possesses multiple virulence factors such as biofilm formation, efflux pumps, and enzyme production, which contribute to persistence and resistance to antimicrobial therapy (3).

The emergence of multidrug-resistant (MDR) strains of *P. aeruginosa* has become a serious global health concern. Resistance mechanisms include β -lactamase production, carbapenemase activity, reduced membrane permeability, and target site mutations, limiting therapeutic options (4). Intensive care units (ICUs) are particularly vulnerable to the emergence and spread of resistant strains due to extensive antibiotic usage, invasive procedures, and prolonged hospital stays (5). In contrast, non-critical areas may demonstrate comparatively lower resistance patterns.

Understanding and comparing antibiotic susceptibility patterns of *P. aeruginosa* isolates from critical and non-critical areas is essential for guiding empirical therapy, implementing antimicrobial stewardship programs, and strengthening infection control measures in tertiary care hospitals (6). Therefore, this study was carried out to compare the antibiotic Susceptibility Pattern of *Pseudomonas aeruginosa* from Critical and Non-Critical Areas from a Tertiary Care Hospital.

MATERIAL AND METHODS

This cross-sectional study was done in the Department of Microbiology, Index Medical College, Hospital and Research Centre, M.U. Indore MP. Study was planned for the period from July 2023 to July 2025. 300 samples from patients of all age group and both sexes were enrolled in the study. Culture-positive non-duplicate isolates identified as *Pseudomonas aeruginosa* by standard microbiological methods were included in the study.

Institutional Ethical Committee gave their clearance for the study to be conducted.

Using a practical sample collection method, all isolates of *Pseudomonas aeruginosa* from a variety of clinical specimens, including pus, urine, burn wounds, sputum, bodily fluids (ascitic fluid, pleural fluid, etc.), CSF, tracheal secretions, and patient devices (urinary catheter, endotracheal tube, i.v. catheter, tracheostomy tube, etc.) from tertiary care hospitals were included in the study.

The isolates were identified by colony morphology, Gram's staining and biochemical test according to standard laboratory test methods. In accordance with CLSI 2025 guidelines (7), each isolate was subjected to an AST using the Kirby-Bauer disc diffusion method. *Pseudomonas* ATCC 27853 was used as control strain.

STATISTIC ANALYSIS: Microsoft Excel was used to enter the collected data and statistical analysis was done by applying descriptive statistics to generate percentages.

RESULTS:

Out of total of 300 *Pseudomonas aeruginosa* isolates, 42 (14%) were from critical area and 258 (86%) were from non-critical area. *Pseudomonas aeruginosa* from critical area was most commonly isolated from blood (40.4%) and from non-critical area pus (46.1%) was the most common specimen.

Among critical area highest isolation was from surgical ICU (47.6%) followed by medicine ICU (38.1%). Among non-critical area highest isolation was from medicine ward (31.8%) followed by surgery ward (22.5%).

ANTIBIOTIC SUSCEPTIBILITY PATTERN: Antibiotic susceptibility pattern of isolates from critical area are shown in table 4 and non-critical area are shown in table 5. All isolates were 100% susceptible to colistin and polymyxin B and more than 90% isolates were susceptible to imipenem and meropenem in both the areas. Ceftazidime was the least susceptible.

TABLE 1: SAMPLE WISE DISTRIBUTION OF PSEUDOMONAS AERUGINOSA

SAMPLE	CRITICLE AREA	NON- CRITICLE AREA
ABSCCESS FLUID	2 (4.7%)	0
BLOOD	17 (40.4%)	0
BRONCHIAL WASHING	8 (19.04%)	0
ENDOTRACHEAL SWAB	3 (7.1%)	0
PLEURALFLUID	8 (19.04%)	0
TRACHEAL SWAB	3 (7.1%)	6 (2.3%)
URINE	1 (2.4%)	30 (11.6%)
PUS	0	119 (46.1%)
SPUTUM	0	97 (37.6%)
THROAT SWAB	0	6 (2.3%)
TOTAL (n=300)	42 (14%)	258 (86%)

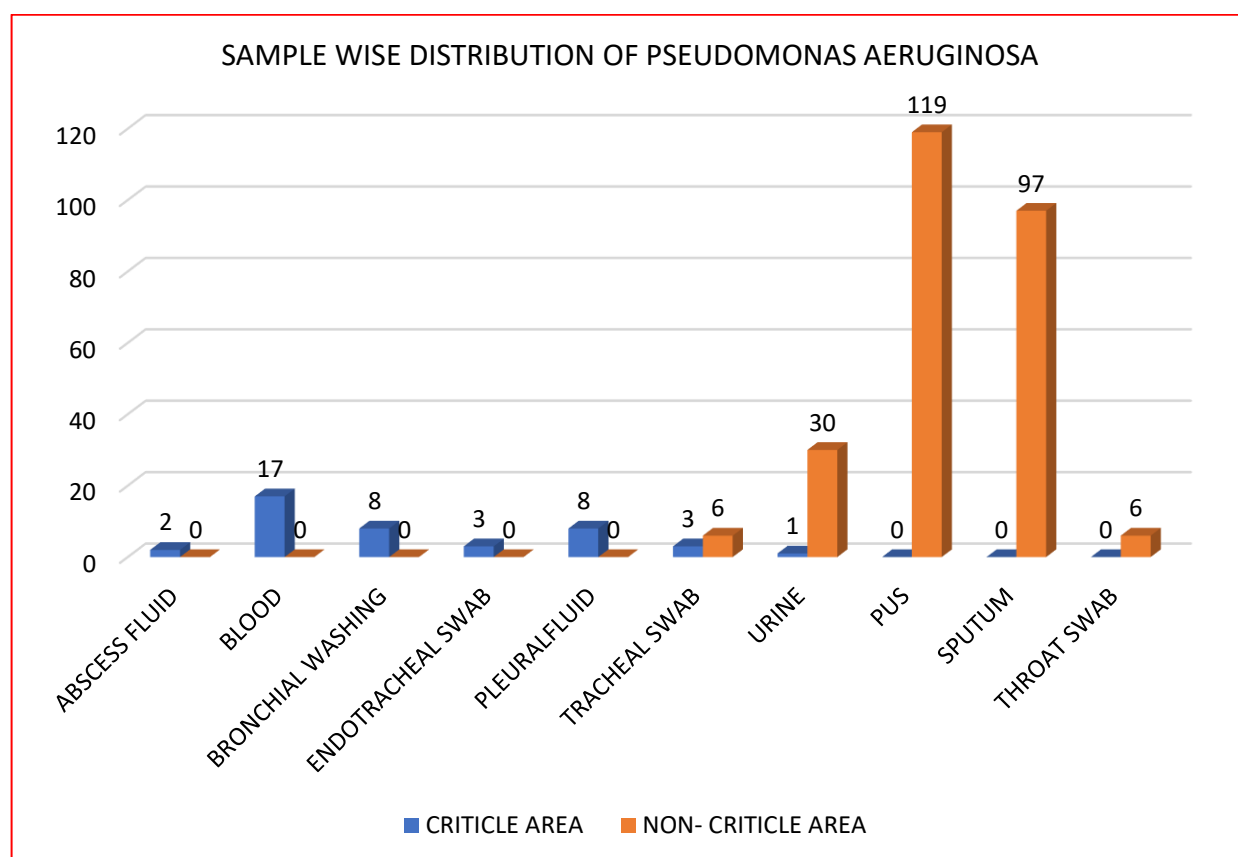


Table 2: DISTRIBUTION OF PSEUDOMONAS AERUGINOSA IN CRITICAL AREA

SAMPLE	MICU	PICU	SICU	NICU	TOTAL
ABSCCESS FLUID	0	0	2	0	2
BLOOD	5	1	9	2	17
BRONCHIAL WASHING	1		7		8
ENDOTRACHEAL SWAB	3	0	0	0	3
PLEURALFLUID	7	1	0	0	8
TRACHEAL SWAB	0	1	2		3
URINE	0	0	0	1	1
TOTAL	16 (38.1%)	3 (7.1%)	20 (47.6%)	3 (7.1%)	42

TABLE 3: DISTRIBUTION OF PSEUDOMONAS AERUGINOSA IN NON-CRITICAL AREA

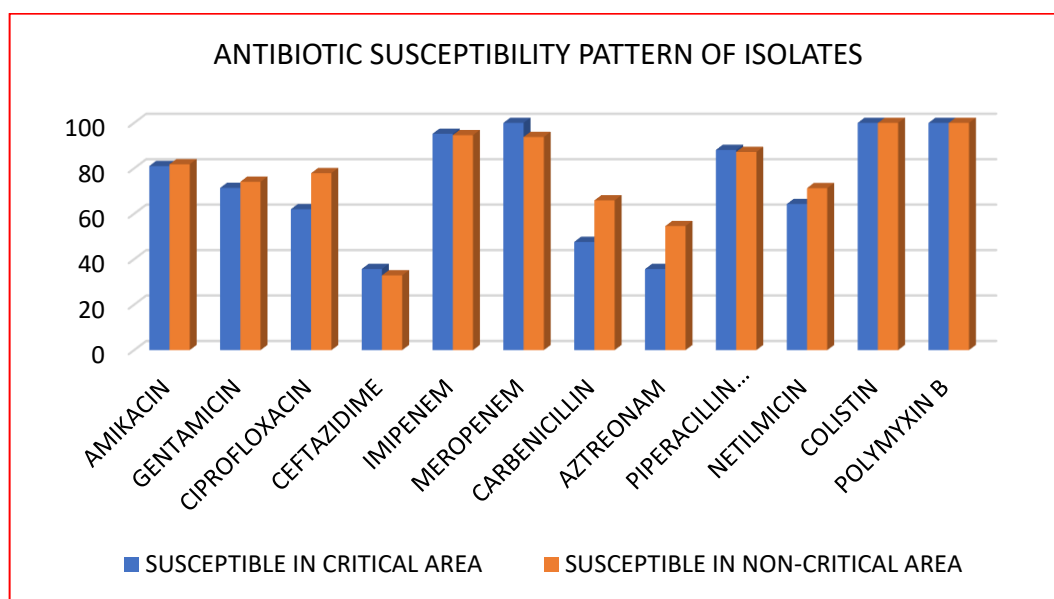
SAMPLE	SURGERY WARD	PEDIATRIC WARD	ORTHOPEDIC WARD	OBS WARD	GYN	MEDICINE WARD	BURN WARD	CHEST WARD	TOTAL
TRACHEAL SWAB	3	0	0	0		3	0	0	6
URINE	13	1	0	6		3	7	0	30
PUS	30	4	41	24		17	3	0	119
SPUTUM	12	3	0	2		53	0	27	97
THROAT SWAB	0	0	0	0		6	0	0	6
TOTAL	58 (22.5%)	8 (3.1%)	41 (15.9%)	32 (12.4%)		82 (31.8%)	10 (3.8%)	27 (10.5%)	258

TABLE 4: ANTIBIOTIC SUSCEPTIBILITY PATTERN OF ISOLATES FROM CRITICAL AREA

ANTIBIOTIC	RESISTANT	INTERMEDIATE	SUSCEPTIBLE
AMIKACIN	8 (19.04%)	0	34 (81%)
GENTAMICIN	12 (28.6%)	0	30 (71.4%)
CIPROFLOXACIN	11 (26.2%)	5 (11.9%)	26 (62%)
CEFTAZIDIME	27 (64.3%)	0	15 (35.7%)
IMIPENEM	2 (4.8%)	0	40 (95.2%)
MEROPENEM	0 (0%)	0	42 (100%)
CARBENICILLIN	22 (52.4%)	0	20 (47.6%)
AZTREONAM	27 (64.3%)	0	15 (35.7%)
PIPERACILLIN TAZOBACTAM	5 (11.9%)	0	37 (88.1%)
NETILMICIN	15 (35.7%)	0	27 (64.3%)
COLISTIN	0 (0%)	0	42 (100%)
POLYMYXIN B	0 (0%)	0	42 (100%)

TABLE 5: ANTIBIOTIC SUSCEPTIBILITY PATTERN OF ISOLATES FROM NON-CRITICAL AREA

ANTIBIOTIC	RESISTANT	INTERMEDIATE	SUSCEPTIBLE
AMIKACIN	47 (18.2%)	0	211 (81.8%)
GENTAMICIN	67 (25.9%)	0	191 (74.1%)
CIPROFLOXACIN	47 (18.2%)	10 (3.9%)	201 (77.9%)
CEFTAZIDIME	154 (59.7%)	19 (7.4%)	85 (32.9%)
IMIPENEM	14 (5.4%)	0	244 (94.6%)
MEROPENEM	16 (6.2%)	0	242 (93.8%)
CARBENICILLIN	88 (34.1%)	0	170 (65.9%)
AZTREONAM	97 (37.6%)	20 (7.6%)	141 (54.6%)
PIPERACILLIN TAZOBACTAM	33 (12.8%)	0	225 (87.2%)
NETILMICIN	74 (28.7%)	0	184 (71.3%)
COLISTIN	0 (0%)	0	258 (100%)
POLYMYXIN B	0 (0%)	0	258 (100%)



DISCUSSION:

Pseudomonas aeruginosa infections were commonly seen in immunocompromised hospitalized patients. The innate defense mechanisms might be impaired in hospitalized individuals due to diseases or because of medical intervention. The disruption of skin or mucosal barrier leads to the colonization and establishment of *P. aeruginosa* infection.

In present study, Out of total of 300 *Pseudomonas aeruginosa* isolates, 42 (14%) were from critical area and 258 (86%) were from non-critical area. In study Apoorva B et al (8) *Pseudomonas aeruginosa* was found in 224 (11.067 %) samples, out of which 143 (63.8 %) were from non-critical areas and 81 (36.1 %) from critical areas.

The present study showed higher isolation of *Pseudomonas aeruginosa* from pus sample (46.1%) in non-critical area which is in accordance with the findings (47.11 %) reported by Apoorva B et al (34.26 %) (8). On the contrary, Shreshta S et al. (2016) reported higher isolation from sputum and urine samples (36.3 %) followed by pus and devices (9.8 %).⁹ Whereas, in critical area, higher isolation was observed from blood (40.4%). In study Apoorva B et al 8, in critical area, higher isolation was observed from endotracheal aspirate (19.8 %) and Kumari M et al. (2019) reported 23.3 % isolates from endotracheal aspirate.¹⁰

Among critical area highest isolation was from surgical ICU (47.6%) followed by medicine ICU (38.1%). Among non-critical area highest isolation was from medicine ward (31.8%) followed by surgery ward (22.5%) in the present study. In study Apoorva B et al 8, The distribution of *Pseudomonas aeruginosa* among non-critical area was highest among the surgery ward (30.76 %) and Ranjan K et al. (2010) reported 29.6 % pseudomonas isolates from post-operative patients.¹¹ Among the critical area, In study Apoorva B et al 8, showed maximum isolations from MICU (56.79 %).

In present study, All isolates were 100% susceptible to colistin and polymyxin B and more than 90% isolates were susceptible to imipenem and meropenem in both the areas. Ceftazidime was the least susceptible. In study Apoorva B et al 8, Antibiotic susceptibility pattern of *Pseudomonas aeruginosa* isolated from non-critical areas showed resistance to meropenem (41.95 %), levofloxacin (37.76 %) and ciprofloxacin (33.56 %). Resistance rate against imipenem was found to be 20.27 %. 100 % sensitivity against polymyxin B and colistin was observed in both the critical and non-critical areas.

CONCLUSION: The prevalence and sensitivity of *P. aeruginosa* sometimes vary between communities, hospitals in the same community and among various patient group in the same hospital. The doctor in clinical practice must make clinical decisions in the face of these variances,

and they should have access to up-to-date information on the prevalence and pattern of antibiotic resistance of frequently encountered infections. Therefore, it is crucial to set up a system for monitoring antibiotic resistance that would include gathering and compiling clinical and microbiological data.

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