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ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF PSEUDOMONAS AERUGINOSA FROM VARIOUS CLINICAL SAMPLES IN A TERTIARY CARE HOSPITAL OF RAJASTHAN

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Abstract

Introduction

Pseudomonas aeruginosa is a gram-negative, opportunistic pathogen commonly associated with hospital-acquired infections. Due to its intrinsic and acquired resistance mechanisms, it poses significant treatment challenges. **Aim and objectives:** This study examines the prevalence and antimicrobial susceptibility pattern of P. aeruginosa isolated from various clinical samples in a tertiary care hospital in Rajasthan. **Result**: A total of 114 isolates were analyzed, revealing a higher prevalence in males (76%) and individuals aged 60-70 years (22%). Blood samples were the most common source (45%), followed by sputum (19%) and body fluids (15%). The most effective antibiotics were Colistin (97%), Tobramycin (87%), and Cefepime (84%), whereas resistance was highest against Tigecycline (71%), Minocycline (68%), and Imipenem (54%). **Conclusion**: These findings emphasize the need for routine antimicrobial susceptibility testing to guide appropriate treatment and mitigate the spread of multidrug-resistant (MDR) strains.

Keywords: *Pseudomonas aeruginosa*, antimicrobial resistance, hospital-acquired infections, multidrug resistance

INTRODUCTION

Pseudomonas aeruginosa is a rod-shaped, aerobic, gram-negative bacterium that is widely distributed in the environment. It is a leading cause of opportunistic infections, particularly in hospitalized patients with weakened immune systems (Stover et al., 2000). This pathogen is responsible for ventilator-associated pneumonia, catheter-associated urinary tract infections, and bloodstream infections in burn victims (Engel & Balachandran, 2009). Its ability to develop multidrug resistance (MDR) due to intrinsic resistance mechanisms, efflux pumps, and biofilm formation makes treatment particularly challenging (Livermore, 2002).

This study aims to evaluate the prevalence and antimicrobial susceptibility pattern of P. aeruginosa isolated from various clinical samples in a tertiary care hospital.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional study was conducted in the Department of Microbiology, National Institute of Medical Science & Research, Jaipur, Rajasthan, over one year (January 2023–January 2024).

Sample Collection and Processing

Clinical samples, including blood, urine, pus, sputum, and body fluids, were collected from hospitalized patients. The isolates were identified based on colony morphology, gram staining, and biochemical tests (Koneman et al., 2006). Antimicrobial susceptibility testing was performed using the Kirby-Bauer disk diffusion method according to Clinical and Laboratory Standards Institute (CLSI) guidelines.

RESULTS

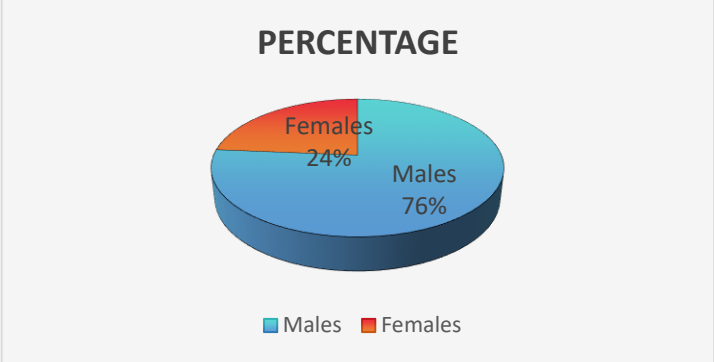
Demographic Distribution

Out of 114 isolates, 87 (76%) were from male patients and 27 (24%) were from female patients. The highest number of cases were observed in the 60-70 age group (22%), followed by 71-80 years (19%).

Table No. 1: Genderwise distribution of samples studied

Gender	Number of Isolates	Percentage
Male	**87**	**76.32 %**
Female	**27**	**23.68 %**
Total	**114**	**100 %**

In the present study out of total 114 cases, Males were significant high in number i.e 76.31 % (n = 87) than females which were 23.68 % (n = 27).

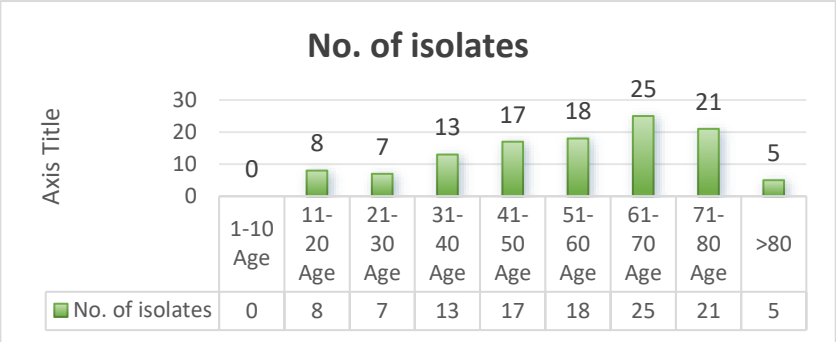


Graph.1: Genderwise distribution of samples studied

Table No.2: Age wise distribution of isolates:

S.No.	Age group	Number of Isolates	Percentage
1	1-10	0	0 %
2	11-20	8	7 %
3	21-30	7	6 %
4	31-40	13	11%
5	41-50	17	15 %
6	51-60	18	16%
7	**61-70**	**25**	**22 %**
8	71-80	21	19%
9	>80	5	4 %

Total of 114 isolates most common age were observed in age group of 60-70 years that is 22 % (n=25), followed by an age group of 71-80 years that is 19 % (n=21), 51-60 years 16 % (n=18).



Graph.2: Age wise distribution of isolates.

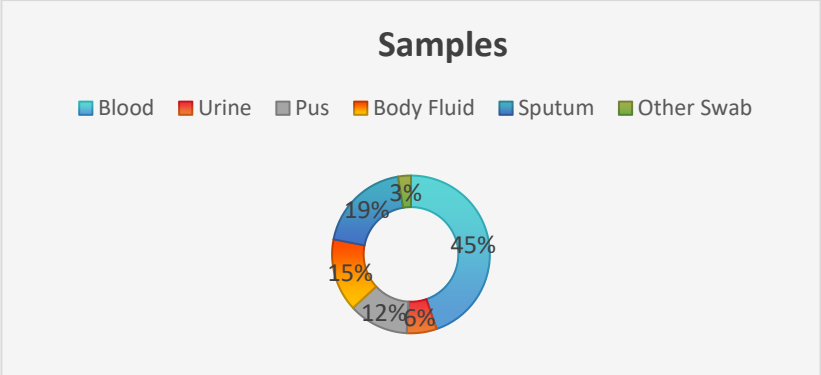
Clinical Sample Distribution

The majority of P. aeruginosa isolates were obtained from blood samples (45%), followed by sputum (19%), body fluids (15%), pus (12%), and urine (6%). The high prevalence in blood samples indicates the invasive nature of the bacterium and its association with severe infections.

Table No. 3: Distribution of *P. aeruginosa* isolated from various clinical samples

Samples	Number of samples	Percentage
Blood	**51**	**45 %**
Urine	7	6 %
Pus	14	12 %
Body Fluid	17	15 %
Sputum	22	19 %
Other swab	3	3 %

The most isolated clinical samples were Blood 45%, Sputum 19%, Body fluid 15%, Pus 12%, Urine 6% and Other swab 3% .



Graph.3: Clinical sample distribution

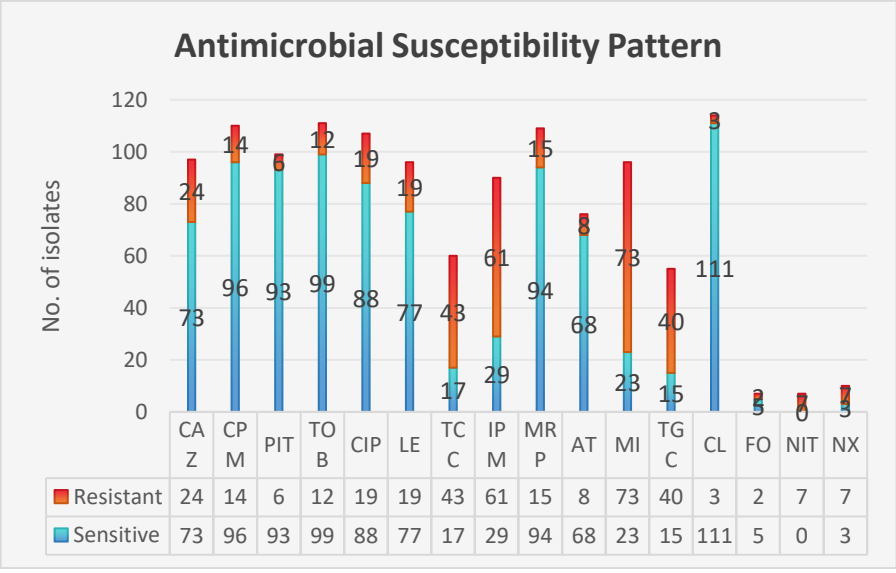
Antimicrobial Susceptibility Pattern

Among the tested antibiotics, the highest sensitivity was observed for Colistin (97%), Tobramycin (87%), and Cefepime (84%). Resistance was most significant against Tigecycline (71%), Minocycline (68%), and Imipenem (54%). The results indicate the emerging resistance to carbapenems, highlighting the necessity for alternative therapeutic approaches.

Table No. 7: Antimicrobial susceptibility of *Pseudomonas aeruginosa* against various antimicrobial

Antimicrobial	No of isolates Sensitive	Resistant	Intermediate	Total	Remarks
Ceftazidime (CAZ)	73 (64%)	17 (15%)	24 (21%)	114	
Cefepime (CPM)	96 (84%)	4 (4%)	14 (12%)	114	
Piperacillin tazobactem (PIT)	93 (82%)	15 (13%)	6 (5%)	114	
Tobramicine(TOB)	99 (87%)	3 (3%)	12 (10%)	114	
Ciprofloxacin(CIP)	88 (77%)	7 (6%)	19 (17%)	114	
Levofloxacin (LE)	77 (67%)	18 (16%)	19 (17%)	114	
Ticarcillin clavulanate (TCC)	17(15%)	54 (47%)	43 (38%)	114	
Imipenem (IPM)	29 (25%)	24 (21%)	61 (54%)	114	
Meropenem (MRP)	94 (83%)	5 (4%)	15 (13%)	114	
Aztreonam (AT)	68 (60%)	38 (33%)	8 (7%)	114	
Minocycline (MI)	23 (22%)	11 (10%)	73 (68%)	107/107	**Used for other than urine i.e 107**
Tigecycline (TGC)	15 (27%)	1(2%)	40(71%)	56/56	**Used for other than blood and urine i.e.58**
Colistin (CL)	111 (97%)	0	3 (3%)	114	
Fosfomycin (FO)	5 (71%)	0	2 (29%)	7/7	**Drugs tested for urine samples i.e 7**
Nitrofurantoin (NIT)	0	0	7 (100%)	7/7	**Drugs tested for urine samples i.e 7**

The **Colistin** was most Sensitive (**97**%) antibiotics followed by **Tobramicine (87**%) and **Cefepime** (**84**%). And the Drug most resistance was **Tigecycline (71%) followed by Minocycline (68%)** and **Imipenem (54%)**



Graph.4: Antimicrobial susceptibility pattern of all *Pseudomonas aeruginosa* isolates.

DISCUSSION

The study revealed that *P. aeruginosa* is a significant nosocomial pathogen, predominantly affecting older males. The high prevalence of isolates in blood samples suggests its ability to cause severe bloodstream infections, consistent with findings from previous studies (Dash et al., 2014). The increasing resistance to carbapenems, such as Imipenem (54%), raises concerns about the effectiveness of commonly used antibiotics (Negi et al., 2021). Similar studies have reported a rise in MDR strains, often linked to biofilm production, which enhances bacterial survival and antibiotic resistance (Høiby et al., 2010). The findings underscore the importance of routine antimicrobial susceptibility testing to guide appropriate treatment decisions and prevent therapeutic failure.

CONCLUSION

This study highlights the alarming antibiotic resistance trends in *P. aeruginosa* isolates from hospitalized patients. The high prevalence in older adults and the significant resistance to commonly used antibiotics necessitate continuous surveillance and antibiotic stewardship programs. The use of alternative treatments, such as combination therapies and non-antibiotic approaches, should be explored to manage MDR P. aeruginosa infections effectively.

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