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ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF PSEUDOMONAS AERUGINOSA SPECIES ISOLATED FROM VARIOUS CLINICAL SAMPLES IN TERTIARY CARE CENTER JHALAWAR

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ABSTRACT

Introduction: Pseudomonas aeruginosa is a major nosocomial pathogen associated with increased mortality, morbidity, and healthcare costs. It is one of the most common and feared gram-negative bacilli due to its rising resistance to broad-spectrum antibiotics, posing serious clinical and economic challenges. This study aimed to determine the prevalence and antibiotic susceptibility pattern of P. aeruginosa in a tertiary care hospital. **Materials & Methods:** The study was a retrospective study conducted in the Department of Microbiology, SRG Medical College, Jhalawar, Rajasthan. Study was conducted for a period of six month from January 2023 to June 2023. The sample included all outpatient (OPD) and inpatient (IPD) specimens received at Shree Rajendra General Hospital, Jhalawar. The study population primarily comprised residents from the districts of Jhalawar, Bara, and Kota in Rajasthan. Samples were inoculated on Nutrient Agar, MacConkey Agar, and Blood Agar, and incubated aerobically at 37°C overnight. P. aeruginosa was identified by colony morphology, odour, Gram staining, pigment production, and biochemical tests. Antibiotic susceptibility testing was performed on Mueller-Hinton agar using the Kirby-Bauer disk diffusion method, as per CLSI guidelines. **Results:** Out of 2488 samples, P. aeruginosa was isolated in 126 samples showing prevalence was 5.06%. Meropenem (92.91%) and Imipenem (92.6%) show the highest sensitivity with the lowest resistance rates (7.79% and 7.4%, respectively), indicating their superior efficacy. Amikacin (83.65%) and Ciprofloxacin (81.21%) also demonstrate good sensitivity. In contrast, Cefoperazone-Sulbactam shows the lowest sensitivity (63.58%) and the highest resistance (36.42%), followed by Piperacillin-Tazobactam (68.7% sensitivity, 31.3% resistance) and Gentamicin (71.1% sensitivity, 28.9% resistance), indicating moderate effectiveness. **Conclusion:** P. aeruginosa is a major nosocomial pathogen, with rising multidrug resistance due to antibiotic misuse and limited new treatments. Its infection often lead to poor outcomes, making resistance a global concern. Judicious antibiotic use and strict infection control are key to limiting its spread.

KEYWORDS :

INTRODUCTION

Pseudomonas aeruginosa is a Gram-negative, rod-shaped and a sporogeneous bacterium. It has a pearlescent appearance and grape-like odor. P. aeruginosa grows well at 25°C to 37°C, and its ability to grow at 42°C helps distinguish it from many other Pseudomonas species.[1] Pseudomonas aeruginosa is a ubiquitous pathogen capable of surviving in a variety of environmental conditions. Its minimal nutritional requirements and tolerance to varied physical conditions allows it to persist on numerous living and non-living objects.[2]

In humans, it is capable of causing infections in people with a compromised immunity or breach of normal physiological barriers. It is strongly associated with wound infections in burns patients, respiratory infections in cystic fibrosis patients and severe life threatening infections like septicemia in neutropenic patients. It has been known to cause of variety of other infections like pneumonia, urinary-tract infection, skin and soft-tissue infections, in severe burns and in infections among immunocompromised individuals.[3]

P. aeruginosa is increasingly gaining importance as a multidrug resistant nosocomial pathogen complicating the treatment of inpatients in a hospital, especially in the ICUs. It has many mechanisms by which it expresses antimicrobial resistance and the rapid spread of these isolates can be a cause of concern to the treating physicians. The organism is intrinsically resistant to aminopenicillins, first and second generation cephalosporins, ertapenem, tigecycline, cotrimoxazole and macrolides. It can also acquire chromosomal as well as plasmid mediated resistance. Multidrug efflux pumps confer resistance to β-lactams, fluroquinolones and aminoglycosides.[4]

Continuous monitoring of the antimicrobial profile of P. aeruginosa isolates is becoming a necessity due to potentially rapid spread of resistance, its ability to persist in the environment and the implications of infections on patient morbidity, mortality and health care costs. Therefore, the main aim of this study was to know the prevalence of P. aeruginosa infection and its antibiotic susceptibility pattern in the selected tertiary care hospital.

MATERIAL & METHODS

Study Design: A retrospective, record based study was conducted on culture and sensitivity reports obtained in the microbiology lab.

Study Area: Microbiology Lab, Jhalawar Medical College, Jhalawar, Rajasthan.

Study Population: Population under study is population of Jhalawar, Bara, Kota districts of Rajasthan.

Study Duration: Study was conducted from January 2023 to June 2023 (6 months)

Sample Size: All OPD and IPD samples received in Laboratory of Shree Rajendra General hospital, Jhalawar.

Sample Collection Procedure: The samples were inoculated on Nutrient Agar, Mac Conkey's Agar, and Blood Agar and incubated overnight at 37°C under aerobic conditions. P. aeruginosa was initially identified by its colony characteristics, odour, and gram staining. Subsequently, they were identified and classified based on their biochemical profile and pigment production. Antimicrobial susceptibility test was carried out on Mueller Hinton agar plates using commercially prepared antibiotic disk (HiMedia) by Kirby Bauer disk diffusion method, as per CLSI guidelines.

RESULTS

Out of a total of 2,488 clinical samples processed in the Microbiology Laboratory of Jhalawar Medical College from January to June 2023, Pseudomonas aeruginosa was isolated in 126 samples, giving a prevalence rate of 5.06%.

Table 1 presents the monthly distribution of Pseudomonas aeruginosa isolates from various clinical specimens collected between January and June 2023. Out of 2,488 total samples, P. aeruginosa was most frequently isolated from pus samples (49 isolates), followed by urine (36), sputum (32), and tracheal aspirates (9). The highest number of isolates was recorded in April, particularly from pus and urine samples, indicating a possible seasonal or clinical burden variation.

Figure 1 depicts the overall distribution of isolates by specimen type. Pus accounted for the largest proportion (38.88%), followed by urine (28.57%), sputum (25.39%), and tracheal aspirates (7.14%), emphasizing the predominance of wound and urinary tract infections caused by P. aeruginosa.

Table 1: FREQUENCY DISTRIBUTION OF PSEUDOMONAS AERUGINOSA FROM VARIOUS SAMPLES

Month	Samples	Urine	Pus	Sputum	Tracheal Aspirates
January	390	5	6	3	1
February	398	7	7	5	1
March	427	4	8	6	2
April	421	9	12	8	3
May	433	8	11	7	2
June	419	3	5	3	0
Total	2488	36	49	32	9

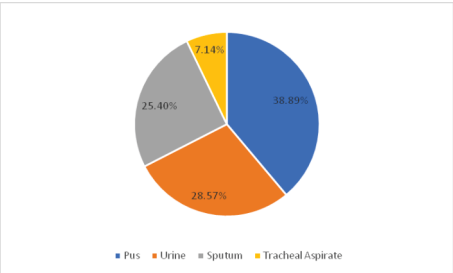
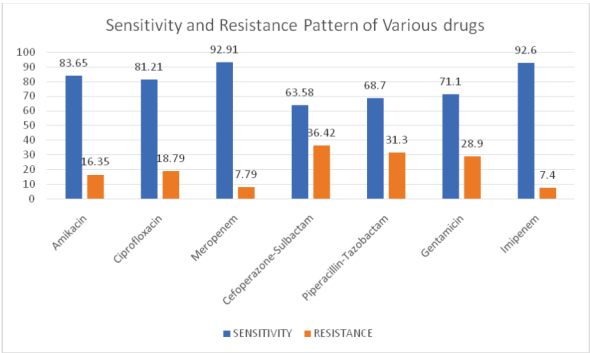


Fig 1: Distribution of Pseudomonas Aeruginosa Isolates by Sample Type

The antimicrobial susceptibility testing of Pseudomonas aeruginosa isolates revealed varied levels of sensitivity and resistance to commonly used antibiotics. Fig 2 shows the highest sensitivity was observed with meropenem (92.91%), imipenem (92.6%), and amikacin (83.65%), indicating these drugs remain highly effective treatment options against P. aeruginosa.

Ciprofloxacin also showed good efficacy with a sensitivity rate of 81.21%, while gentamicin and piperacillin-tazobactam demonstrated moderate sensitivity at 71.1% and 68.7%, respectively.

On the other hand, the highest resistance was noted against cefoperazone-sulbactam (36.42%), followed by piperacillin-tazobactam (31.3%), and gentamicin (28.9%), suggesting a gradual decline in the effectiveness of these antibiotics. Resistance to ciprofloxacin was 18.79%, and amikacin resistance was comparatively low at 16.35%. The lowest resistance was found with imipenem (7.4%) and meropenem (7.79%), reaffirming the role of carbapenems as potent agents against P. aeruginosa infections. 20.69% of the P. aeruginosa isolates were found to be multidrug-resistant (MDR), indicating resistance to three or more antibiotic classes.These findings emphasize the importance of continuous antimicrobial surveillance and rational use of antibiotics to manage emerging resistance patterns.



DISCUSSION

Pseudomonas aeruginosa is the most common gram-negative, non fermenting bacteria isolated from clinical specimens that pose serious challenge for the treatment of nosocomial infections.In the present study, Pseudomonas aeruginosa was isolated in 5.06% of the total clinical samples processed. This prevalence is comparable to the findings of Thomas et al [2], who reported a prevalence of 5.71% in a tertiary care center in South India , and Wajid et al.[1], who reported 5.8% . However, it is notably lower than the 12.9% prevalence reported by M. Abdur Rahman et al. in a similar hospital-based study [5]. The variation may be attributed to differences in patient populations, local infection control practices, antibiotic usage policies, and geographic factors.

The majority of isolates in the current study were obtained from pus (38.88%), followed by urine (28.57%), sputum (25.39%), and tracheal aspirates (7.14%). This distribution aligns with the known opportunistic nature of P. aeruginosa, particularly its role in wound, urinary tract, and lower respiratory tract infections in hospitalized patients.

Regarding antimicrobial susceptibility, the isolates showed high sensitivity to imipenem (92.6%), meropenem (92.21%), and amikacin (83.65%), consistent with the findings of Thomas et al.,[2] who also reported greater susceptibility to carbapenems and aminoglycosides. However, increased resistance was observed to cefoperazone-sulbactam (36.42%), piperacillin-tazobactam (31.3%), and gentamicin (28.9%), highlighting the growing concern over declining effectiveness of β-lactam–β-lactamase inhibitor combinations and aminoglycosides.

Ciprofloxacin resistance in our study was noted in 18.79% of isolates, which is considerably lower than the 45.7% resistance rate reported by Rahman et al.[5]. Such variability underscores the importance of localized antibiograms to guide empirical therapy.

Furthermore, 20.69% of P. aeruginosa isolates in the present study were multidrug-resistant (MDR). This is in line with global trends showing rising MDR rates, which pose significant challenges to treatment and emphasize the need for judicious antibiotic use, effective infection control measures, and routine antimicrobial surveillance[1].

CONCLUSIONS

P. aeruginosa is one of the most challenging nosocomial pathogens, especially due to the significant changes in microbial ecology resulting from the misuse of antibiotics and the lack of new antibacterial agents. Additionally, infection with such strain can lead to poor clinical outcomes, making the spread of multidrug resistance a worldwide issue.In our study, it accounted for 5.06% of all clinical isolates, with the majority obtained from pus and urine samples. While the organism demonstrated high susceptibility to carbapenems and amikacin, there was moderate to high resistance observed against piperacillin-tazobactam, cefoperazone-sulbactam, and gentamicin.The emergence of multidrug

resistance in 20.69% of isolates is a cause for concern, reflecting a global trend that compromises treatment outcomes. These findings reinforce the importance of judicious antibiotic prescribing, regular antibiogram updates, and robust infection control policies to curb resistance and ensure optimal patient care.

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