ORIGINAL RESEARCH

ISOLATION PREVALENCE AND ANTIMICROBIAL RESISTANCE PATTERN OF PSEUDOMONAS AERUGINOSA FROM URINE SAMPLES IN A TERTIARY CARE HOSPITAL UDAIPUR, RAJASTHAN

[1]Dr. Ajay Kumar Choudhary, [2]Dr. Ritu Bhatnagar

[1]Ph. D Scholar, Department of Microbiology, Pacific Medical College and Hospital, Udaipur, Rajasthan
[2]Professor and HOD, Department of Microbiology, Pacific Medical College and Hospital, Udaipur, Rajasthan

Corresponding author
Dr. Ajay Kumar Choudhary
Ph. D Scholar, Department of Microbiology, Pacific Medical College and Hospital, Udaipur, Rajasthan

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ABSTRACT

Introduction: Antibiotic resistance is one of the alarming issues, affecting human health Pseudomonas aeruginosa is a prototype of "multidrug-resistant pathogen" and is recognized for its ubiquitous distribution, advanced antibiotic resistance mechanisms, and nosocomial infections. The organism is classified into various phenotypes based on the drug resistance pattern, namely, drug-resistant (DR), multi-drug resistance (MDR), and extensively drug resistance (XDR). This study aims to find out the changing trends in the prevalence and antibiotic resistance patterns of urinary isolates of Pseudomonas aeruginosa

Material and Methods: This prospective study was started from January 2020 to June 2020 in department of Microbiology in Pacific Medical College and Hospital in Udaipur, Rajasthan. The culture reports which were positive for significant growth of *Pseudomonas aeruginosa* were analyzed to find out its prevalence and antibiotic resistant patterns. In our research study we have analyzed 500 samples of urine and isolated 100 samples of Pseudomonas aeruginosa. Descriptive statistics was used for data analysis. Clinical and Laboratory Standards Institute (CLSI) guidelines were followed to determine the results.

Result: *Pseudomonas aeruginosa* was isolated in 100 out of 500 urine samples. Antibiotic resistance studies revealed that 57.51% of *Pseudomonas aeruginosa* isolates showed drug resistance. The frequency of multi drug resistance *Pseudomonas aeruginosa* isolated from urine sample was found to be 42.49%. The antibiotic resistance observed were as follows Amikacin (16.4%), Colistin (17.4%), Imipenem (20.8%), Polymyxin (21.2%), Piperacillin (36.7%), Levo floxacin (43.3%) ,Piperacillin+ tazobactum (48.2%), Tobramycin (58.2%), Ciprofloxacin (65.6%), Gentamycin (69.1%), Ceftazidime (78%), Cefotaxime (82%) Amikacin was found to be the most effective antibiotic, followed by Carbapenem group of drugs.

Conclusion: Pseudomonas aeruginosa remains as a common uropathogen. Drug resistant strains are markedly high. Our data revealed a high prevalence of drug resistance of Pseudomonas aeruginosa in the total isolate of *Pseudomonas aeruginosa*. There is an urgent need to resolve the issue by taking some preventive measures. Combined efforts of health care profess ion als and researchers are required to educate people about the proper use of an tibiotics and otherin fection contro lmeas ures

Keywords: Pseudomonas aeruginosa, Antimicrobial resistance, Multi drug resistance, Drug resistance

Keywords: cholesterol,low density lipoprotein, cholelithiasis.

INTRODUCTION

Pseudomonas aeruginosa is the third leading cause of hospital-acquired urinary tract infections (UTIs), accounting for about 12 % of all hospital acquired infections. It can invade the blood stream from the urinary tract, and this has been shown to be the source of nearly 40 % of Pseudomonas bacteremia. Urinary tract infection caused by *Pseudomonas aeruginosa* is usually hospital-acquired and related to urinary tract catheterization instrumentation or surgery[6]. Concurrently, the extensive use of antimicrobial agents and the evolutionary antimicrobial resistance strategies of bacteria have resulted in the emergence of drug resistant bacteria. The efficiency of many antibiotics for treatment of infections has become quite limited due to the development of resistance and threat from antimicrobial resistant organisms is accumulating and accelerating[1]. The increasing

prevalence of health-care associated infections (HAIs) produced by multidrug-resistant (MDR) *Pseudomonas aeruginosa* strains severely compromises the selection of appropriate treatments and is therefore associated with significant morbidity and mortality [2] Infections caused by *Pseudomonas aeruginosa* are difficult to cure and often require combination therapy. For *Pseudomonas aeruginosa*, antibiotic resistance is an increasing problem[3]. A varying degree of resistance to all known antipseudomonal antibiotics have been reported in different areas of the world by different authors [4-5-6]. Moreover, high rates of resistance to antibiotics are associated with nosocomial *Pseudomonas aeruginosa* strains. It has been associated with sporadic or clustered cases of infection generally confined to single hospitalization units. Treatment of UTI constitutes a great portion of prescription of antibiotics. Urinary pathogens have shown a changed pattern of susceptibility to antibiotics, showing an increased resistance to commonly used antibiotics due to extensive and inappropriate use of antimicrobial agents[7]. In *Pseudomonas aeruginosa*, increasing resistance towards the available antimicrobials preclude the effectiveness of any antimicrobial regimen. Because of increasing multidrug resistant (MDR) *Pseudomonas aeruginosa* isolates in health care settings, infections are difficult to treat, causing life threatening conditions[8]

MATERIALS AND METHODS

Study area

Department of Microbiology Pacific medical college and hospital Udaipur rajasthan .

Study design

Lab based retrospective, record based study which was conducted on all culture and sensitivity reports of urine samples obtained in the Microbiology lab at Pacific Medical College and Hospital, Udaipur.The study period of January 2020 to June 2020. Permission from institutional ethics committee was obtained.

Inclusion criteria

- All Urine culture reports with positive *P.aeruginosa*isolatesare included in the study.

Exclusion criteria

1. Contaminated sample,
2. Organism grown other then p.aeruginosa in urine culture

Method

Mid-stream urine samples and samples from catheterized patients were collected in sterile containers. The samples were cultured on Nutrient agar, Blood agar, MacConkey medium with a standard loop and were incubated at 37ºC overnight. A growth of $\geq 10^5$-10^4colony forming units/ml was considered as significant growth. *P. aeruginosa* was identified on the basis of colony morphology, Gram staining and biochemical tests including Catalase, Oxidase, Indole, Motility, Citrate, Urea, MR-VP. The antibiotic sensitivity test was performed by Kirby Bauer disc diffusion technique with commercially available discs (Hi-Media) on Muller Hinton Agar

RESULT

Out of 500 urine samples received in our lab during the study period of six months, the isolation rate of the six month was 100 (20%).

Distribution of Pseudomonas aeruginosa in different age groups and Sex:

Table 1: Pseudomonas aeruginosa in different age groups and Sex

S. no	Age	Male	Female
1	0-20	10	7
2	21-40	13	8
3	41-60	29	25
4	>61-	5	3

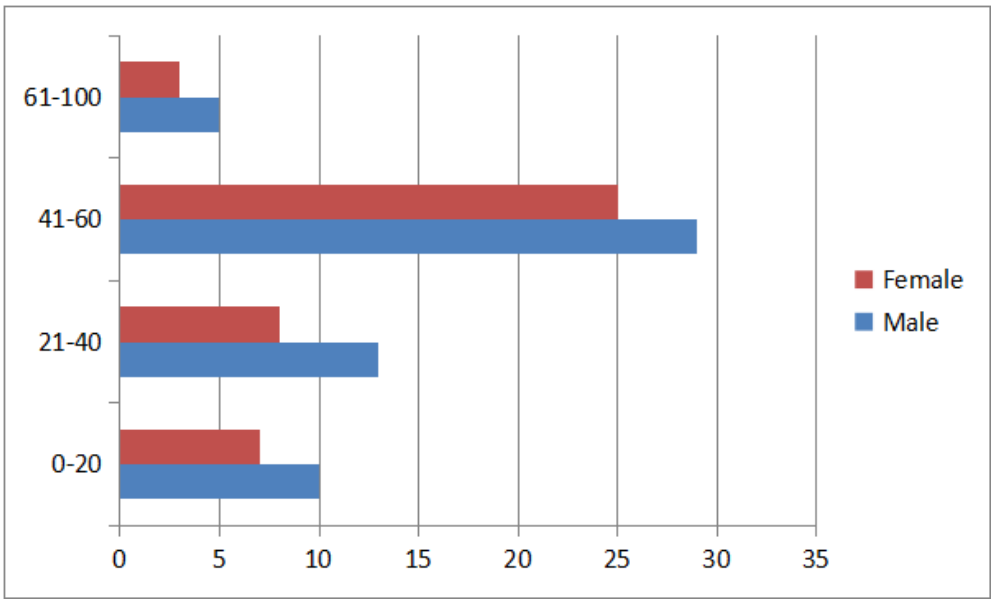

Fig 1: Age and sex wise distribution of Pseudomonas aeruginosa

The proportion of Pseudomonas aeruginosa (n=100) is very high among age group 41-60 and lowest in the age group >61. Similarly the prevalence of *Pseudomonas aeruginosa* infection was more in male patients as compared to female patients.

Prevalence of Pseudomonas aeruginosa in In door Patient Department and Out door Patient Department:

Table 2: Pseudomonas aeruginosa in IPD and OPD Patients

S. no	IPD	OPD
1	85	15

Our study shows that out of 100 Pseudomonas aeruginosa 85 were isolated from IPD patients and 15 were isolated from OPD patients.

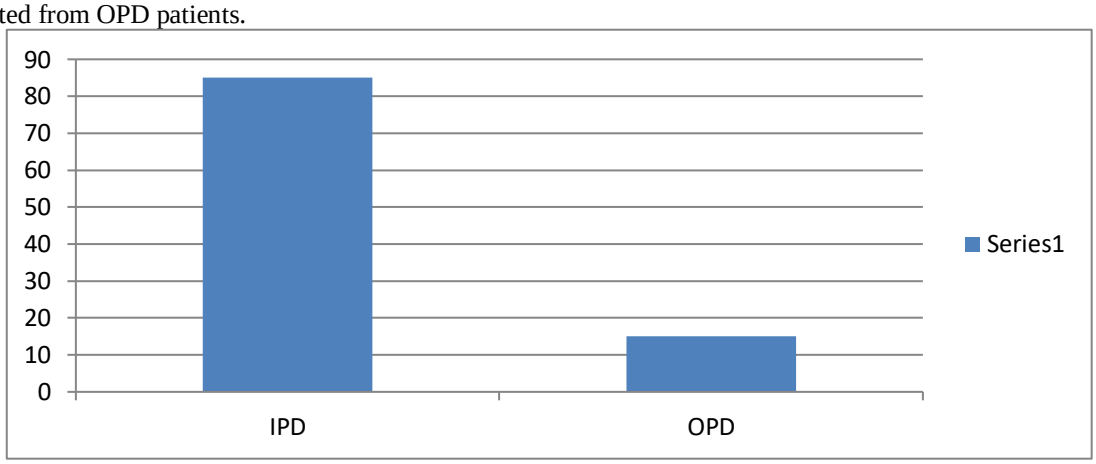

Fig 2: Isolation of *Pseudomonas aeruginosa* in IPD and OPD

Distribution of Pseudomonas aeruginosa in Catheter associated and Non Catheter associated patients

Table 3: Catheter associated and Non-Catheter associated isolate of Pseudomonas aeruginosa

Gender	Catheter associated isolate (n =55)	Non catheter associated isolates n=45
Male	35	13
Female	20	32

Of the total 55 catheterized patients 35 Pseudomonas aeruginosa were isolated from male and 20 were isolated from female patients. Similarly in non-catheterized (n= 45) patients 13 *Pseudomonas aeruginosa* infections were found in male patients and 32 were found in female patients.

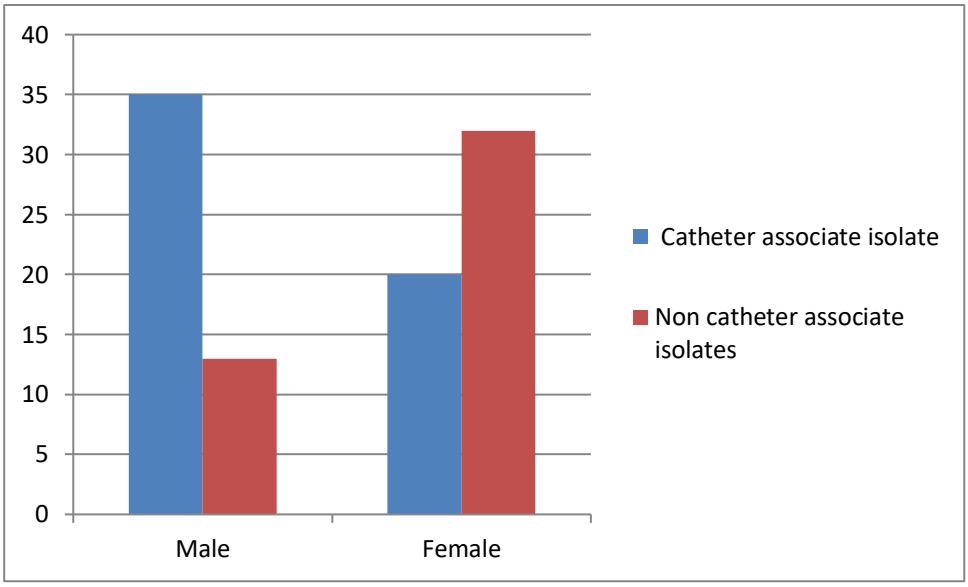

Fig 3: Catheter associated and Non-Catheter associated isolated of *Pseudomonas aeruginosa*

Antibiotic resistance pattern

Table 4: Antibiotic resistance of *Pseudomonas aeruginosa*

S.No	Name of Antibiotics	Disc Concentration	Percent of Resistance
1	Colistin	30mcg	17.4
2	Amikacin	30mcg	16.4
3	Imipenem	10mcg	20.8
4	Polymyxin	30mcg	21.2
5	Piperacillin	10mcg	36.7
6	Levofloxacin	5mcg	43.3
7	Piperacillin+tazobactum	100/10mcg	48.2
8	Tobramycin	10mcg	58.2
9	Ciprofloxacin	5mcg	65.6
10	Gentamycin	10mcg	69.1
11	Ceftazidime	30mcg	78
12	Cefotaxime	30mcg	82

The antibiotic resistance observed is as follows, Colistin (17.4%),Amikacin (16.4%), Imipenem (20.8%), Polymyxin (21.2%), Piperacillin (36.7%), Levofloxacin (43.3%), Piperacillin+tazobactum (48.2%), Tobramycin (58.2%), Ciprofloxacin (65.6%), Gentamycin (69.1%), Ceftazidime (78%), Cefotaxime (82%) Colistin Amikacin and was found to be has least antimicrobial resistance among all the most effective antibiotic, followed by Carbapenem group of drugs.Cefotaxime shoved maximum resistance among all antimicrobial drug used in present study (82%) percent of resistant antimicrobial for Pseudomonas *aeruginosa* shows Amikacin (16.4%), Colistin (17.4%),Imipenem (20.8%), Polymyxin (21.2%), Piperacillin (36.7%),Levofloxacin (43.3%), Piperacillin tazobactum (48.2%),Tobramycin (58.2%), Ciprofloxacin (65.6%), Gentamycin (69.1%), Ceftazidime (78%), Cefotaxime (82%)125 clinical isolates of Pseudomonas aeruginosa were tested. **Angadi et. al.** Shown similar antimicrobial resistance such as Amikacin (18.4%), Gentamycin (63.2%), Ceftazidime (74.4%), Ciprofloxacin (60%), Imipenem (21.6%), Piperacillin (54.4%)

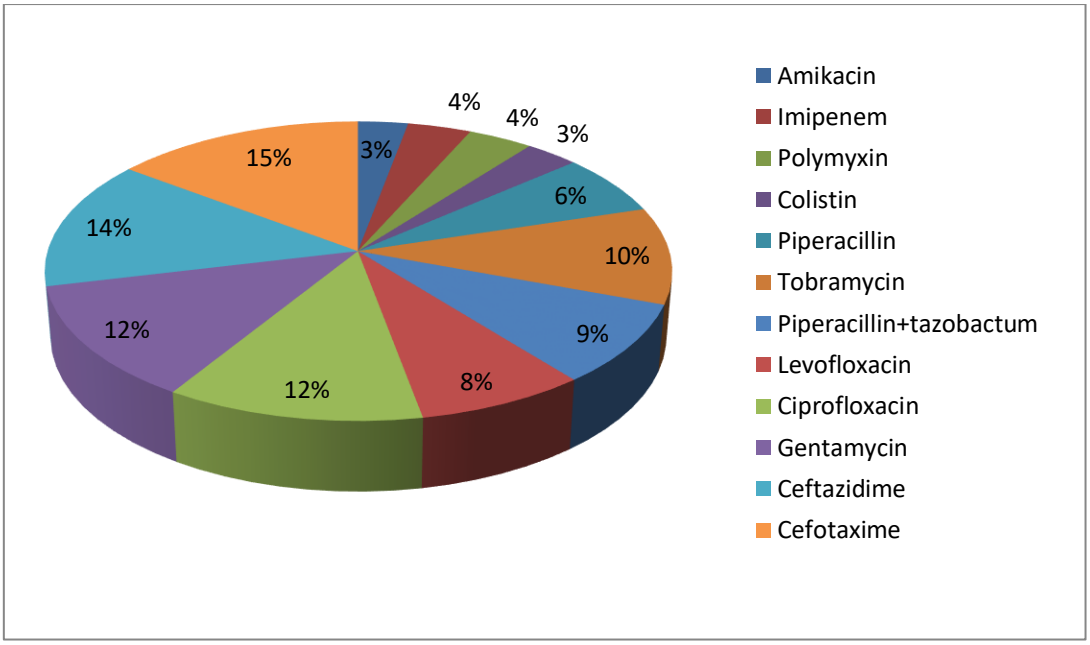

Fig 4: Resistance pattern of Pseudomonas aeruginosa

DISCUSSION

P. aeruginosa has emerged as a significant pathogen and is the most common dreadful gram negative bacilli found in various health care associated infections all over the world due to its virulence, well known ability to resist killing by various antibiotics and disinfectants. The bacterial resistance has been increasing and this has both clinical and financial implication in therapy of infected patients[16]. aeruginosa has established itself as a significant pathogen which may cause complications if not treated properly. Antibiotic resistance is a major clinical problem in treating infections caused by this microorganism. The resistance patterns and isolation rates of P.aeruginosa varies regionally. Hence, increasing importance has been placed on the careful monitoring of antimicrobial resistance patterns of P.aeruginosa isolates for appropriate empirical as well as targeted treatment of the same. Our study shows that the number of *Pseudomonas aeruginosa* 85 was isolated from IPD patients and 15 were isolated from OPD patients. Our study showed 17.4% resistance to colistin, while the study by **Angadi** showed lower resistance i.e.12.9% in tertiary care hospital of Pune[21] and 21.6% by Paul, et al. in their studies [28]. In our study were showed 55% prevalence of catheter associated P. aeruginosa isolates in male 63.63% and 36.37% in female which contrary to Bekelel et al. study which showed out of the total 73 catheterized patients included in this study 51 (69.68%) were male and 22 (30.42%) were females. In our study highest percent of resistant antimicrobial for Pseudomonas *aeruginosa* shows Amikacin (16.4%), Colistin (17.4%),Imipenem (20.8%), Polymyxin (21.2%), Piperacillin (36.7%),Levofloxacin (43.3%), Piperacillin tazobactum (48.2%),Tobramycin (58.2%), Ciprofloxacin (65.6%), Gentamycin (69.1%), Ceftazidime (78%), Cefotaxime (82%)125 clinical isolates of Pseudomonas aeruginosa were tested. Angadi et. al. Shown similar antimicrobial resistance such as Amikacin (18.4%), Gentamycin (63.2%), Ceftazidime (74.4%), Ciprofloxacin (60%), Imipenem (21.6%), Piperacillin (54.4%), Piperacillin tazobactum (45.6%), Polymyxin-B (20%), Colistin (15.2%), Tobramycin (55.2%), Levofloxacin (41.6%), 21.6% of the isolates were resistant to Imipenem. Our studied showed lower resistance to Colistin (17.4%),Amikacin (16.4%),Imipenem (20.8%), Polymyxin (21.2%) and increasing resistance to Cefotaxime (82%) ,Ceftazidime (78%),Ceftazidime (78%),Piperacillin+tazobactum (48.2%) and third generation Cephalosporins (>60%). Among the aminoglycosides, resistance to Amikacin was seen in 16.4% of the isolates in our study. While polymyxin colistin showed fair susceptibility rates in our study. Resistance to Tobramycin was seen in 58.2% of isolates in our study. Resistance to the third generation Cephalosporins (Cefotaxime and Ceftazidime) was seen more than 70% in our study. In India, prevalence rate of *P.aeruginosa* infection varies from 10.5% to 30%. It ranged from 3 to 16%, in a multicellular study conducted[14]. The prevalence in our study was found to be 20% which is comparable to study of Ling J M, Cheng AF. Antimicrobial resistance of clinical isolates from in Hong Kong. In the present study *P.aeruginosa* was the third most common urinary isolate after *E,coli* and *Klebsiella* species Other authors also observed *P.aeruginosa* as the third most frequent urinary isolate [10-13]. Another important factor in this study is age. The isolation rate was higher among middle age greater than 40 years and in older age group. In light of this study advancing age might be one of the predisposing factors. Thus it is wise to give due

attention to UTI when catheterizing older patients. This study provides information regarding the prevalence and anti-microbial susceptibility pattern of urinary isolates of *P.aeruginosa*. The study stresses on the importance of culture reports provided by the microbiology laboratory, so that clinician can select the appropriate antibiotic therapy. It emphasizes the importance of close monitoring of antibiotic susceptibility patterns by preparation of antibiogram and its regular updating. The study also intends to motivate the strict implementation of restrictive and rotational antibiotic policies and adherence to the concept of reserve drugs.

CONCLUSION

P.aeruginosa remains as a common uropathogen. Drug resistant strains are markedly high in our area. The susceptibility pattern of one region differs widely from the other. The resistance of P.aeruginosa does not have a consistent trend over years. Irregular resistance pattern is observed except in some antibiotics such as Amikacin, Imipenem and Colistin which showed a decreasing trend. Reserved drugs like Piperacillin-tazobactam and Cefotaxime showed an alarming drug resistance. It is emphasized that each institution should have an antibiotic policy based on the antibiogram which should be renewed yearly. Instead of going for higher options of antibiotics each time, strict implementation of restrictive and rotational antibiotic policies and adherence to the concept of 'Reserve drugs" should be followed by each institution. This is the only modality to inhibit the emergence of resistance strains of all uropathogens especially opportunistic pathogens like *P.aeruginosa*.

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