

Original article:

Antimicrobial susceptibility pattern of clinical isolates of *Pseudomonas aeruginosa* in a tertiary care hospital of central India

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Abstract:

Background and purpose : *Pseudomonas aeruginosa* (*P.aeruginosa*) is an important cause of morbidity and mortality in hospitalized, critically ill patients and patients with underlying medical conditions such as cystic fibrosis, neutropenia and iatrogenic immuno-suppression . The prevalence of multidrug resistant *P.aeruginosa* isolates has been increasing. The aim of this study was to determine the antimicrobial susceptibility patterns in *P. aeruginosa* strains isolated at a tertiary care hospital of central India.

Materials and Methods : During period of one year (April 2017 to March 2018) all clinical specimens received in Microbiology Department of M.G.M. Medical College, Indore (M.P.) were processed according to the standard microbiological techniques. Antimicrobial sensitivity testing of the isolates was done by Kirby-Bauer disc diffusion method according to Clinical and Laboratory Standards Institute (CLSI) guidelines.

Result: 78 clinical isolates of *P. aeruginosa* were tested. Major sources of these isolates included pus, aural swab, sputum and blood. Majority of *Pseudomonas aeruginosa* showed maximum susceptibility to meropenem (73.07%) followed by imipenem (70.51 %) and amikacin (61.53%). *P.aeruginosa* showed a sensitivity of 58.97% to Piperacillin-tazobactam, 57.69% to Levofloxacin, 56.41% to Gentamicin, 53.84 % to Polymyxin B and 41.02% to Ceftazidime. In Urine isolates *P.aeruginosa* showed 50% sensitivity to Norfloxacin and 25% to Nitrofurantoin.

Conclusion : Observations from the our study showed that the Different sensitivity pattern and multidrug resistance exhibited by *P.aeruginosa* pose a great problem in treating these infections and leads to high morbidity and mortality. These organisms have great potential to survive in hospital environment, so effective methods of sterilization and infection control measures should be implemented. Care in detection, evaluation of effective antibiotic options, judicious use of antibiotics by instituting antibiotic policy of combination therapy and rigorous infection control measures will help to fight against this microorganism for effective management of patients. The wide spread variability of sensitivity profile of common hospital isolates, indicate that every hospital should monitor their antibiogram profile of these isolates from time to time to serve as a basis for empirical therapy in emergency situation.

Keywords: *Pseudomonas aeruginosa* , Nitrofurantoin.

Introduction

Pseudomonas aeruginosa (*P.aeruginosa*) is an aerobic, non-sporing, non-fermenting Gram negative bacilli that either do not utilize glucose as a source of energy or utilize it oxidatively.¹ *P.aeruginosa* is ubiquitous in nature and emerged as an important health care associated pathogen, which can cause opportunistic infections in immunocompromised hosts². It can infect almost any external site or organ, and therefore, can be isolated from various body fluids such as sputum, urine, wounds, ear swabs and from blood.³ They have been incriminated in infections such as, septicemia, pneumonia, urinary tract infection and surgical site infections.⁴ In recent years, the problem is further compounded by the emergence of resistance to antimicrobial agents which may be due to liberal and empirical use of antibiotics.⁸ *P.aeruginosa* show resistance to a wide range of antibiotics, leading to serious infections. Multi-drug resistance (aminoglycosides, fluoroquinolones, ureidopenicillins and third generation cephalosporins) exhibited by *P. aeruginosa* poses a major clinical problem in treatment.⁵

Materials and Methods

This study was done in the Department of Microbiology MGM medical College, Indore (M.P.) from April 2017 to March 2018. During this period all clinical specimens received were processed for detection of *P. aeruginosa* without delay in the following manner.¹⁰

1. Direct smear examination by Gram staining.
2. Culture on Nutrient agar, Blood agar and MacConkey agar.
3. Motility by hanging drop method.
4. Identification with the help of biochemical tests.
5. Antimicrobial susceptibility testing on Mueller Hinton agar by Kirby Bauer's disc diffusion method.¹¹
6. Interpretation of result.

Antibiotics used in our study were piperacillin/tazobactam (100/10 µg) amikacin (30 µg), ceftazidime (30 µg), imipenem (10 µg), meropenem (10µg), gentamicin (10µg), cefepime (30µg) and levofloxacin (5µg), ceftriaxone(30µg), doxycycline(10 µg), polymyxin(300 µg), norfloxacin(10 µg) and nitrofurantoin(300 µg).

Results:

Table 1: Sex wise distribution of *P. aeruginosa*

Sex	Number of cases	Percentage
Males	42	53.85
Females	36	46.15
Total	78	100

Table 2: Age wise distribution of *P. aeruginosa*

Age in years	Number of cases	Percentage
<1	03	3.85
1 -10	04	5.13
11-20	01	1.28
21-30	12	15.38
31-40	09	11.54
41-50	17	21.79
51-60	14	17.95
61-70	18	23.08
Total	78	100

Table 3: Sample wise distribution of *P. aeruginosa*

S.No	Specimen	<i>P. aeruginosa</i>	
		N	%
1	Pus	25	32.89
2	Blood	07	9.21
3	Aural swab	18	23.68
4	Sputum	10	13.15
5	Urine	04	5.26
6	Pleural fluid	05	6.57
7	Tracheal swab	03	3.94
8	CSF	03	3.94
9	Throat swab	03	3.94

Table 4: Antibiotic susceptibility of <i>Pseudomonas aeruginosa</i> (n=78)			
	Sensitive (%)	Inermediate sensitive (%)	Resistant (%)
Meropenem	73.07	11.53	15.38
Imipenem	70.51	6.41	23.07
Amikacin	61.53	7.69	30.76
Piperacillin +Tazobactam	58.97	10.25	30.76
Levofloxacin	57.69	12.82	29.48
Gentamycin	56.41	12.82	30.76
Polymyxin B	53.84	12.82	33.33
Norfloxacin*	50	0	50
Ceftazidime	41.02	16.66	42.3
Nitrofurantoin*	25	0	75
Cefepime	24.35	10.25	65.38
Doxicyclin	19.23	8.97	71.79
Ceftriaxone	15.38	21.79	62.82
Cotrimoxazole	12.82	10.25	76.92

***For urinary isolates only**

Discussion

A total of 1095 specimens were processed during study period , out of which 78 *P. aeruginosa* were isolated. The incidence of *P. aeruginosa* was 7.12%. *P. aeruginosa* isolation was higher in male patients (53.85%) and most common in the age group of 60-70 years(23.08%) (Table1&2). Majority of *P. aeruginosa* were isolated from pus samples,(32.89%) followed by aural swab (23.68%) (Table 3). *P. aeruginosa* had showed maximum susceptibility to meropenem (73.07%) followed by imipenem (70.51 %) and amikacin (61.53%) (Table 4). In our study the incidence of *P. aeruginosa* was 7.12%, which resembles with the studies of Prakash *et al*² (9.62%) and Grewal *et al*.⁸(11.6%).*P. aeruginosa* are known to cause infection in extremes of age which was seen in our study (23.08%) in the age group of 61 to 70 years ,similar to study by Rashid *et al*³ (20% in 71 to 80 years of age group), which could be due to physiologically deficient immune system. Out of total 78 patients, 53.85% were males and 46.15% were females which was about similar to study of Chander *et al*.¹⁴ (58.58% were males while 41.42% were

females) . In our study majority of *P. aeruginosa* were isolated from pus samples,(32.89%) which was similar to study done by Malini *et al*⁹(42.2%) . *P. aeruginosa* displays a wide and variable spectrum of antibiotic sensitivity pattern. There is no antibiotic for which all isolated *P. aeruginosa* were susceptible in our study. According to our study sensitivity of Meropenem was 73.07% and the sensitivity ranged from 40% to 85% in other studies^{1,2,5,14} . *P. aeruginosa* showed resistance of 62.82% to Ceftriaxone, 42.30% to Ceftazidime 30.76% to Gentamicin and Piperacillin-tazobactam which are commonly used by the clinicians in our hospital. For urinary isolates, *P. aeruginosa* showed 50% resistance to Norfloxacin while 75% to Nitrofurantoin in our study. *P. aeruginosa* showed a good sensitivity to Amikacin 61.53% in our study. *P. aeruginosa* showed an overall 23.07% resistance to Imipenem in our study, compared to study by Taneja *et al*¹³, which showed 36%. The differences in the percentage may be due to the variation in the sample size.

Conclusion

Observations from the our study showed that the Different sensitivity pattern and multidrug resistance exhibited by *P. aeruginosa* pose a great problem in treating these infections and leads to high morbidity and mortality. These organism have great potential to survive in hospital environment, so effective methods of sterilization and infection control measures should be implemented. Care in detection, evaluation of effective antibiotic options, judicious use of antibiotics by instituting antibiotic policy of combination therapy and rigorous infection control measures will help to fight against *P. aeruginosa* for effective management of patients. The wide spread variability of sensitivity profile of common hospital isolates, indicate that every hospital should monitor their antibiogram profile of these isolates from time to time to serve as a basis for empirical therapy in emergency situation.

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Date of Submission: 27 September 2020

Date of Publishing: 25 November 2020

Author Declaration: Source of support: Nil, Conflict of interest: Nil

Ethics Committee Approval obtained for this study? YES

Was informed consent obtained from the subjects involved in the study? YES

For any images presented appropriate consent has been obtained from the subjects: NA

Plagiarism Checked: Urkund Software

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DOI: 10.36848/IJBAMR/2020/26215.55551