**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.aeuroginosa* 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.aeuroginosa* 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.aeuroginosa)* 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.aeuroginosa* 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.aeuroginosa* 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) ,doxicycline(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** | ***P. aeruginosa*** |
| **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 |
|  | TOTAL  | 78 | 100 |

|  |
| --- |
|  **Table 4: Antibiotic susceptibility of *Pseudomonas aeruginosa* ( 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 susceptiblein our study.According to our study sensitivity of Meropenem was 73.07% and the sensitivity ranged from 40% to 85% in other studies1,2,5,14 . *P. aeruginosa* showed resistance of 62.82% to Ceftriaxone, 42.30% to Ceftazdime 30.76% to Gentamicin and Piperacillin-tazobactum 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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