ANTIMICROBIAL SUSCEPTIBILITY OF *PSEUDOMONAS AERUGINOSA* ISOLATED FROM VARIOUS CLINICAL SAMPLES IN PONDICHERRY.

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ABSTRACT

The present study was undertaken with an aim to assess the existing antimicrobial susceptibility pattern of *Pseudomonas aeruginosa* from diverse clinical samples of our hospital. A total of 5381 biological specimens were processed for culture and sensitivity between January to August 201. *Pseudomonas aeruginosa* accounted for 15% of the gram negative organisms, predominantly isolated from pus (64%) and urine (16.6%) samples. Maximum susceptibility was observed to meropenam (100%), imipenam (82.6%), aztreonam (80%), followed by ciprofloxacin, tobramycin (77.7%), ceftazidime (57.5%) and ceftriaxone (57.1%). A high level of resistance was observed to ticarcillin (69.2%) and amikacin (50%). Based on the above study, the use of meropenam, imipenam, aztreonam, ciprofloxacin and tobramycin appears to be rationale and warrant careful consideration by clinicians to monitor and optimize the use of antimicrobials to reduce occurrence and spread of resistant pathogen.

KEY-WORDS: *Pseudomonas aeruginosa*, Antimicrobials, Susceptibility, Resistance.
INTRODUCTION

Among Gram-negative pathogens *Pseudomonas aeruginosa* (*P.aeruginosa*) is considered as most challenging pathogen. It has been implicated in nosocomial infections like pneumonia, urinary tract infection, surgical site infection, burns infection and infections of patient undergoing either chemotherapy for neoplastic disease or those on antibiotics therapy. In addition, these nosocomial infections were often associated with high morbidity, mortality rate and cost of therapy. This may be due to its notable resistance to many currently available antibiotics. Especially *P. aeruginosa* demonstrates resistance to multiple antibiotics, thereby jeopardizing the selection of appropriate treatment. Preventing the emergence, dissemination and effective management of resistant *P. aeruginosa* is critical for control of hospital infections. Regular periodic monitoring of *P.aeruginosa* susceptibility patterns can guide the clinician for choosing appropriate empirical or specific therapy. The aim of our study was to assess the current status of antimicrobial susceptibility pattern of *P. aeruginosa* from clinical specimens collected from the patients of our hospital.

MATERIALS AND METHODS

This retrospective analysis was carried out in the Departments of Pharmacology and Microbiology at Sri Manakula Vinayagar Medical College Hospital, Pondicherry during the period from January to August, 2012. The samples included urine, blood, pus, swabs, cerebrospinal fluid (CSF), ascitic fluid (AF), synovial fluid (SF), pleural fluid (PF), stool, sputum etc., from outpatients and inpatients. Samples were processed for culture and sensitivity by standard methods. All significant isolates were identified by standard procedures and their antimicrobial susceptibility was tested by Kirby Bauer disc diffusion method and interpreted as per Clinical and Laboratory Standards Institute (CLSI) recommendations. Control strains (ATCC 27853) were used for checking the quality of discs. The antibiotics which were included for the isolates were ticarcillin, piperacillin, piperacillin +tazobactum, imipenam, meropenam, aztreonam, nalidixic acid, norfloxacin, ciprofloxacin, levofloxacin, amikacin, tobramycin, cefazolin, cefotaxime, ceftazidime, ceftriaxone, cotrimoxazole and amoxycillin+clavulanic acid. The results were expressed in percentages.

RESULTS

Among 5381 specimens received, 1485 bacterial isolates were recovered from diverse biological specimens of both inpatients and out patients (Table -1).

<table>
<thead>
<tr>
<th>Specimen</th>
<th>urine</th>
<th>blood</th>
<th>pus</th>
<th>sputum</th>
<th>A.F</th>
<th>CSF</th>
<th>Stool</th>
<th>P.F</th>
<th>S.F</th>
<th>Swab</th>
<th>others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>2486</td>
<td>1002</td>
<td>794</td>
<td>661</td>
<td>43</td>
<td>19</td>
<td>160</td>
<td>45</td>
<td>12</td>
<td>87</td>
<td>72</td>
</tr>
<tr>
<td>Percent</td>
<td>46.2</td>
<td>18.6</td>
<td>14.7</td>
<td>12.3</td>
<td>0.79</td>
<td>0.35</td>
<td>2.9</td>
<td>0.8</td>
<td>0.2</td>
<td>1.6</td>
<td>1.3</td>
</tr>
</tbody>
</table>

(P.F – Pleural fluid, A.F – Ascitic fluid, S.F – Synovial fluid, CSF – Cerebrospinal fluid)

72% of the samples show bacterial growth on culture and 15% out of them are *P. aeruginosa* isolates (Fig -1 and Fig -2). The other common gram negative organisms isolated were *E.coli* (57%), *Klebsiella* sp. (22%), *Proteus* sp. (3%) and others (3%). *Pseudomonas aeruginosa* was mostly isolated from pus (64%) followed by urine (16.6%). Significant isolates were also isolated from other
specimens like drain tip, swabs. Distribution of *P. aeruginosa* among the various biological specimens is shown in Graph -1.

**Figure 1**
*Frequency distribution of culture positive and negative specimens*

![Frequency distribution of culture positive and negative specimens](image)

**Figure 2**
*Frequency distribution of Gram Negative organisms*

![Frequency distribution of Gram Negative organisms](image)

**Graph 1**
*Frequency distribution of *Pseudomonas aeruginosa* isolated from different clinical specimens*
Among the semisynthetic penicillins tested, only Pipracillin showed high sensitivity rates (71%). The other penicillins like ampicillin and amoxycillin with beta lactamase inhibitors showed very high resistance (90 - 100%). Sensitivity range for ceftazidime and ceftriaxone were 57.5% & 57.1% respectively whereas the other cephalosporins showed high resistance rates (70 - 90%). We also observed that *P. aeruginosa* had susceptibility rates of 100% to meropenam, 82.6% to imipenem and 80% to aztreonam. Selected aminoglycosides like tobramycin and gentamicin showed significant antibacterial sensitivity (77.7% & 57.1% respectively) whereas amikacin showed less sensitivity (50%). Fluroquinolones and cotrimoxazole also had high resistant rates (30 - 90%) but with ciprofloxacin and levofloxacin showed high sensitivity rates (67 - 87%) (Graph -2&3).

**Graph 2**

*Sensitivity and Resistance pattern of *P. aeruginosa* against beta lactam antibiotics*

The sensitivity and resistance shown in the figure is the percentage (AZT-Aztreonam, CT-Cefotaxime, CTZ-Ceftazidime, CFT-Ceftriaxone, IM-Imipenam, MP - Meropenam, PN-Piperacillin, TN-Ticarcillin).
Sensitivity and Resistance pattern of *P. aeruginosa* against Aminoglycosides, Fluroquinolones and Cotrimoxazole

![Graph 3](image)

*The sensitivity and resistance shown in the figure is the percentage (AM-Amikacin, TM-Tobramycin, GM-Gentamicin, CP-Ciprofloxacin, LF-Levofloxacin, CoT - Cotrimaxazole).*

**DISCUSSION**

*P. aeruginosa* is the leading gram negative organism which causes nosocomial infections, accounting for 20% of pneumonia and 16% of urinary tract infections based on national Nosocomial Infections Surveillance System. Our study gives an account of the currently used antimicrobials and the sensitivity pattern against *P. aeruginosa* isolated from various clinical samples in our hospital. In the present study, it was found that, out of 120 (15%) *P. aeruginosa* isolates, 77(64%) were isolated from pus followed by urine 20(16.6%) as reported previously in a Gujarat study. Meropenam (100%) and Imipenam (82.6%) were found to be most effective followed by Aztreonam (80%) as observed in our study. This sensitivity rates were almost similar to a study conducted by Fazlul et al. Another study conducted in Karachi showed sensitivity rates to Imipenam was 76% 

Studies supporting low incidence of Imipenem resistance (7.2%) was also reported previously in India. The resistance to Carbapenems, with *P. aeruginosa* is usually due to reduced levels of drug accumulation/increased expression of pump efflux, production of metallo-β-lactamases (MBL), which can be chromosomally encoded or plasmid mediated. The carbapenem hydrolyzing enzyme carbapenamase may be class B-metallo β-lactamases or class D-oxacillanases. The major limiting factor for using Penicillins is rapid hydrolysis by beta lactamases elaborated especially by the gram negative organisms including *Pseudomonas*. However, antipseudomonal penicillins are still effective against *Pseudomonas* which is proved in our study. Sensitivity rates for piperacillin was 71%, where as for ticarcillin the sensitivity rate was low (30%). High sensitivity rates towards piperacillin were also documented with beta lactamase inhibitor tazobactam. Compared with penicillin group of antimicrobials cephalosporins also acquire resistance due to production of ESBLs by gram negative organisms. In our study sensitivity rates for ceftazidime and ceftriaxone were only 57%. High levels of resistance with
cephalosporins were previously reported. Among the aminoglycosides tested, tobramycin and gentamicin showed high sensitivity rates when compared with a study conducted in India. But amikacin sensitivity rates were similar. Amikacin is more resistant to aminoglycoside inactivating enzymes and therefore preferred for resistant cases. In our study, amikacin resistance rate was high (50%) compared to Karachi study (35%). However based on our study, tobramycin and gentamicin can be considered as promising option for P. aeruginosa infection. With fluoroquinolones family, high level sensitivity were noted with ciprofloxacin and levofloxacin (77.7% and 67% respectively). The development of resistance to quinolones is due to the decrease in binding of the target quinolones to the enzymes because of changes in DNA gyrase enzyme/ topoisomerase enzyme. The antimicrobial resistance seen with above agents against P. aeruginosa could be due to increased and inappropriate use of higher antibiotics.

**CONCLUSION**

It has been concluded from the present study that antimicrobials like semisynthetic penicillins (piperacillin), aminoglycosides (tobramycin, gentamicin, amikacin), fluoroquinolones (ciprofloxacin) and third generation cephalosporins (ceftriaxone, ceftazidime) are recommended for Pseudomonas aeruginosa infection. Further meropenam, imipenam, aztreonam, ciprofloxacin and tobramycin should be reserved for the treatment of severe nosocomial infections to avoid rapid emergence of resistant strains in future. Moreover periodic monitoring of antimicrobial susceptibility patterns of Pseudomonas aeruginosa and appropriate revision of existing antibiotic policy is suggested.

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**CONFLICT OF INTEREST DECLARED:** NONE

**REFERENCES**


