Original Article

# Prevalence & antibiogram of Pseudomonas aeruginosa at S.S.G. Hospital, Baroda, Gujarat, India

Jignasha Tadvi*, T. B. Javadekar**, Rachana Bhavsar*, Nirav Garala***

* Resident, ** Prof. & Head, Dept. of Microbiology, Government Medical College and S.S.G.Hospital, Baroda
***Asst. Professor, Dept. of Obs. & Gynec., Government medical college, Rajkot

DOI: 10.5455/jrmds.20153310

## ABSTRACT

**Background:** Pseudomonas aeruginosa is a gram negative bacterium that continues to be a major cause of opportunistic nosocomial infections, causing around 9-10% of hospital infections. It is hard to treat because of intrinsic resistance of the species and its ability to further resistance to multiple groups including β-lactams, aminoglycosides and fluoroquinolones.

**Aims:** This study was undertaken to determine the prevalence of Pseudomonas and their susceptibility pattern at S.S.G. Hospital, BARODA.

**Materials and Methods:** Between March 2015 to May 2015, 150strains of P. aeruginosa were isolated from different clinical specimens. The samples were selected on the basis of their growth on Mac Conkey and nutrient agar medium with oxidase positive. Colonies were subjected to biochemical tests to identify species. Antimicrobial susceptibility of all the isolates was performed by disc diffusion (Kirby –Bauer) method according to CLSIs guidelines.

**Results:** Majority of isolates of P. aeruginosa were obtained from specimens of blood, pus, wound, sputum, tracheal aspirates, pleural fluid, ICD fluid, bile fluid.The prevalence of pathogen was 4.15% and 98% pathogens were sensitive Piperacillin+Tazobactum followed by Meropenem (93.33%), Levofloxacin (92.66%) , Ceftazidime (82%), Cefoperazone(81.33%), Piperacillin (80.66%), Amikacin(56%), Gentamicin(54.66%).

**Conclusion:** The results confirmed the occurrence of drug resistant strains of P. aeruginosa. Meropenem, Levofloxacin and Piperacillin+Tazobactumwere found to be the most effective antimicrobial drugs. It is rational treatment regimens prescription by the physicians to limit the further spread of antimicrobial resistance among the P. aeruginosa strains.

**Key words:** Pseudomonas aeruginosa, Prevalence, Antimicrobial sensitivity

## INTRODUCTION

Antimicrobial agents have been the only easily and widely used therapeutic option available to counter the infections caused by diverse microbial agents. However, microbial populations have developed various strategies to overcome these antimicrobial agents - a major contributing factor in the development of anti-microbial resistance world-wide. Pseudomonas aeruginosa is a ubiquitous and versatile human opportunistic pathogen and has implications on morbidity, mortality and healthcare costs both in hospitals and in the community [1]. The development of resistance to all available antibiotics in some organisms may preclude the effectiveness of any antibiotic regimen [2, 3]. Infections caused by P. aeruginosa are frequently life-threatening and difficult to treat as it exhibits intrinsically high resistance to many antimicrobials [4] and the development of increased, particularly multi-drug resistance in health care settings [4, 5]. Mechanisms that cause antimicrobial drug resistance and multi-drug resistance in P. aeruginosa are due to acquisition of resistance genes (e.g. those encoding beta-lactamase [6] and amino-glycoside modifying enzymes [7] via horizontal gene transfer and mutation of chromosomal genes (target site, efflux mutations) are the target of the fluoroquinolones particularly ciprofloxacin [8]. Biofilm formation in P. aeruginosa, particularly in the case of pulmonary infections in patients with cystic fibrosis, contributes to its resistance to antimicrobial agents [9]. Hyper mutable (or mutator) strains of P. aeruginosa exhibiting increased mutation rates are common in chronic infections such as those that occur in the lungs of cystic fibrosis patients [10]. Increase in the frequency of multi-drug resistant (MDR) strains of P.

aeruginosa has severely limited the availability of therapeutic options. On-going studies on current antimicrobial resistance profiles of P. aeruginosa are essential to find out the susceptibilities of this pathogen against commonly prescribed antibiotics in any health care facility. This would help the physicians to optimize the current therapeutic treatment options. This study was designed to find out the prevalence and current antimicrobial susceptibility patterns of P. aeruginosa strains in a centrally located tertiary care hospital in S.S.G.Hospital, Baroda.

MATERIALS AND METHODS

Study duration and Sample size:

This prospective study was conducted from March 2015 to May 2015 at S.S.G. Hospital, Baroda. During these period total 3618 samples (blood, pus/wound, sputum, tracheal aspirates, pleural fluid, Inter costal drainage (ICD) fluid, and bile fluid) were tested, of which 1901 samples showed growth. Out of 1901, 150 Pseudomonas isolated from various clinical samples were tested.

Ethical clearance: All these samples were a part of diagnosis. So ethical consideration is not necessary.

Isolation and identification of Pseudomonas

The samples were selected on the basis of their growth on routine culture media like Mac-Conkey agar, Nutrient agar. A battery of tests were performed that included gram's staining, colony morphology, motility tests, sugar fermentation tests and biochemical tests such as oxidase test, urease test and IMViC (indole, methyl red, Voges-Proskauer and citrate) tests for the confirmation of the isolates as Pseudomonas aeruginosa [11].

The Pseudomonas isolates were subjected to susceptibility testing by disc diffusion technique according to the Clinical Laboratory Standards International (CLSI) guidelines with quality controls ( P. aeruginosa ATCC 27853) [11].

**Susceptibility test for Pseudomonas**

Anti-microbial susceptibility tests were done by the Kirby-Bauer disk diffusion method as per the recommendations of National Committee for Clinical Laboratory Standards (NCCLS) [12].

The antimicrobials tested included Piperacillin (100 µg), Piperacillin+Tazobactum (100/10 µg), Amikacin (30 µg), Cefoperazone (75 µg), Levofloxacin (5 µg), Ceftazidime (30 µg), Gentamicin (10 µg), Meropenem (10 µg)

**RESULTS**

150 strains of P. aeruginosa were isolated from 3618 samples. It shows the prevalence rate is 4.15%.

Table-1shows the clinical isolates of Pseudomonas aeruginosa in different clinical samples in which pseudomonas is more commonly isolates from blood and pus/ wound samples followed by tracheal aspiration, sputum, ICD fluid, pleural fluid, and bile fluid.

**Table 1: Distribution of specimens of P. aeruginosa clinical isolates**

| Source of specimen | Number (%, n=150) |
|---|---|
| **Pus** | 34 (22.67%) |
| **Sputum** | 5 (3.33%) |
| **Wound** | 44 (29.33%) |
| **Tracheal aspirate** | 6 (4%) |
| **Blood** | 54 (36%) |
| **Pleural fluid** | 2 (1.33%) |
| **Bile** | 1 (0.67%) |
| **ICD fluid** | 4 (2.67%) |
| **Total** | 150 (100%) |

**Table 2: Antimicrobial susceptibility patterns of P. aeruginosa clinical isolates**

| Antibiotic | Sensitive no. (%, n=150) |
|---|---|
| **Piperacillin** | 121 (80.66%) |
| **Piperacillin+Tazobactum** | 147 (98%) |
| **Amikacin** | 84 (56%) |
| **Cefoperazone** | 122 (81.33%) |
| **Ceftazidime** | 123 (82%) |
| **Levofloxacin** | 139 (92.66%) |
| **Gentamicin** | 82 (54.66%) |
| **Meropenem** | 140 (93.33%) |

Table-2 shows the sensitivity pattern of P. aeruginosa. 98% P. aeruginosa were sensitive Piperacillin+Tazobactum which is the most sensitive drug followed by Meropenem (93.33%), Levofloxacin (92.66%) , Ceftazidime (82%), Cefoperazone(81.33%), Piperacillin (80.66%), Amikacin(56%), Gentamicin(54.66%).

**DISCUSSION**

Pseudomonas aeruginosa is a major cause of nosocomial infections worldwide. In this study, a total of 150 isolates of Aeruginosa were isolated and identified from various clinical sources, from the hospitalized patients and their antimicrobial susceptibility patterns were determined. The

distribution of specimens of P. aeruginosa may vary with each hospital as each hospital facility has a different environment associated with it. In this study majority of the Pseudomonas aeruginosa isolates were more from exudative specimens ofblood (36%) followed by wound (29.33%), pus (22.66%), tracheal aspiration (4%), sputum (3.33%), ICD fluid (2.66%), pleural fluid (1.33%), and bile fluid (0.66%).These results are comparable to similar results had been obtained in different studies in India reported by Mohanasoundaram [13] and Arora et al [14] respectively.

In this study, 150 strains of P. aeruginosa were isolated from 3618 samples as shown in table-1. It shows the prevalence rate is 4.15%. This study was comparable to the similar study in Afghanistan and Greece shows the prevalence rate is 6.67% and 16.6% respectively. [15, 16]

Antibiotic susceptibility testing data for Piperacillin (100 µg), Piperacillin+Tazobactum (100/10 µg), Amikacin (30 µg), Cefoperazone (75 µg), Levofloxacin (5 µg), Ceftazidime (30 µg), Gentamicin (10 µg), Meropenem (10 µg) were compiled. Majority of Pseudomonas isolates were susceptible to Piperacillin+Tazobactum (98%), Meropenem (93.33%) and Levofloxacin (92.66%) and followed by Ceftazidime (82%), Cefoperazone (81.33%), Piperacillin (80.66%), Amikacin (56%), Gentamicin (54.66%). So, Piperacillin+Tazobactum, Meropenem, Levofloxacin continue to remain the mainstay for treatment for Pseudomonas infections.The resistance profiles of P. aeruginosa to the eight anti-microbial agents tested varied among the isolates investigated. This is consistent with a report published in 2002 in Mangalore, India [17] but other studies have showed varying degrees of resistance to imipenem in recent years [13, 14, 18, 19]. High resistance to aminoglycosides had been reported in studies done in India [13, 14], Bangladesh [20], Turkey [21] and Malaysia [22]. Similarly higher rates of resistance to fluoroquinolones such as ciprofloxacin (40.5%) had been reported in a study done in North Kerala, India [23] and ciprofloxacin resistance (92%) was shown in a study from Malaysia [19]. Amikacin alone tested showed a resistance rate of 44% in this study whereas Piperacillin+Tazobactum drug showed a lower resistance of 2% only,which makes the combination drug the preferred choice against P. aeruginosa infections. Thus, emphasis should be given towards use of combined antibiotics in the treatment of pseudomonas infections [24].

Aeruginosa strains in this study exhibited a high rate of resistance to the third generation cephalosporin drug – Ceftazidime (18%). A much higher resistance to ceftriaxone of 75%, 86% and 93.9% had been reported in studies done in India [14], Bangladesh [20] and Nepal [24]. This study revealed that chloramphenicol had the highest rate of resistance (72.41%) to P. aeruginosa strains suggesting that this drug should no longer be included in the treatment regimen for P. aeruginosa infections in this population group. A study done in Kano, Nigeria [25] demonstrated a much higher rate of resistance (97.7%) of P. aeruginosa isolates to chloramphenicol.

This study has a few limitations. First, including the community acquired isolates of Aeruginosa along with hospital isolates would have provided a much better picture of resistance patterns of strains in this geographical area. Second, it is essential to conduct a large scale study with newer anti-pseudomonas agents. Third, molecular typing and plasmid profile of the P. aeruginosa isolates would provide the much needed details about the strains and lastly extended spectrum beta-lactamse (ESBL) producing P. aeruginosa which have become a major cause of nosocomial infections.

## CONCLUSION

The prevalence of Pseudomonas aeruginosa is 4.15% among clinical isolates of various clinical samples. Active screening and compliance with recommended infection control practices play an important role in the control of hospital acquired infection. Results of the present study clearly demonstrated the occurrence of resistance to various antipseudomonal agents among the P. aeruginosa isolates. We suggest a more restricted and a more rational use of this drug in this hospital setting. Piperacillin+Tazobactum, Levofloxacin with beta-lactamase inhibitors are the preferred drugs for optimal management of infections caused by P. aeruginosa. Regular anti-microbial susceptibility monitoring is essential for local, regional and national level isolates. This would help and guide the physicians in prescribing the right combinations of anti-microbials to limit and prevent the emergence of multi-drug resistant strains of P. aeruginosa.

## REFERENCES

1. Franco BE, Martinez MA, Rodriguez MAS, Wertheimer AI. The determinants of the antibiotic resistance process. Infect Drug Resist 2009;2:1-11.
2. Carmeli Y, Troillett N, Karchmer AW, Samore MH. Health and economic outcomes of antibiotic resistance in Pseudomonas aeruginosa. Arch Intern Med 1999;159:1127-32.

3. Acar JF. Conequences of bacterial resistance to antibiotics in medical practice. Clin Infect Dis 1997;24(suppl1):17-8.
4. Poole K. Pseudomonas aeruginosa: resistance to the max. Front Microbiology 2011;2:1-13.
5. Kerr KG, Snelling AM. Pseudomonas aeruginosa: a formidable and ever-present adversary. J Hosp Infect 2009;73:338-44.
6. Zhao WH, Hu ZQ. β- lactamases identified in clinical isolates of Pseudomonas aeruginosa. Crit Rev Microbiol 2010;36:245-58.
7. Poole K. Aminoglycoside resistance in Pseudomonas aeruginosa. Antimicrob Agents Chemother 2005;49:479-87.
8. Strateva T, Yordanov D. Pseudomonas aeruginosa - a phenomenon of bacterial resistance. J Med Microbiol 2009;58:1133-48.
9. Davies JC, Bilton D. Bugs, biofilms and resistance in cystic fibrosis. Respir care 2009;54:628-40.
10. Oliver A, Mena A. Bacterial hypermutation in cystic fibrosis, not only for antibiotic resistance. Clin Microbiol Infect 2010;16:798-808.
11. Collee JG, Duguid JP, Fraser AG, Marmion BP, eds. Mackie and MacCartney Practical Medical Microbiology. 14th edition. New York;USA: Churchill Livingstone.1996, p. 131-49.
12. National Committee for Clinical Laboratory Standards. NCCLS document M2-A8 Vol. 23 No. 1, Performance standards for antimicrobial disk susceptibility tests, approved standard, 8th ed. 2003. National Committee for Clinical Laboratory Standards, Villanova, Pa.
13. Mohanasoundaram KM. The antibiotic resistance pattern in the clinical isolates of Pseudomonas aeruginosa in a tertairy care hospital; 2008-2010 (A 3 year study). J Clin Diagn Res 2011;5(3):491-4.
14. Arora D, Jindal N, Kumar R, Romit. Emerging antibiotic resistance in Pseudomonas aeruginosa. Int J Pharm Pharm Sci 2011;3(2):82-4.
15. Khan JA, Iqbal Z, Rahman SU, Farzana K, Khan A. Prevalence and resistant pattern of Pseudomonas aeruginosa against various antibiotics: Pak J Pharm Sci 2008;21(3):311-5
16. Tirodimos I, Arvanitidou M, Dardavessis L, Bisiklis A, Alexiou-Daniil S. Prevalence and antibiotic resistance of pseudomonas aeruginosa isolated from swimming pools in northen Greece: East Mediterr Health J. 2010;16(7):783-7.
17. Shenoy S, Baliga S, Saldanha DR, Prashanth HV. Antibiotic sensitivity patterns of Pseudomonas aeruginosa strains isolated from various clinical specimens. Indian J Med Sci 2002;56(9):427-30.
18. Javiya JA, Ghatak SB, Patel KR, Patel JA. Antibiotic susceptibility patterns of Pseudomonas aeruginosa at a tertiary care hospital in Gujarat, India. Indian J Pharmacol 2008;40(5):230-4.
19. Al-Kabsi AM, Yusof MYBM, Sekaran SD. Antimicrobial resistance pattern of clinical isolates of Pseudomonas aeruginosa in the University of Malaya Medical Center, Malaysia. Afr J Microbiol Res 2011;5(29):5266-72.
20. Rashid A, Chowdhury A, Rahman SHZ, Begum SA, Muazzam N. Infections by Pseudomonas aeruginosa and antibiotic resistance pattern of the isolates from Dhaka Medical College Hospital. Bangladesh J Med Microbiol 2007;1(2):48-51.
21. Savas L, Duran N, Savas N, Onlen Y, Ocak S. The prevalence ans resistance pattterns of Pseudomonas aeruginosa in intensive care units in a university hospital. Turk J Med Sci 2005;35:317-22.
22. Fazlul MKK, Zaini MZ, Rashid MA, Nazmul MHM. Antibiotic susceptibility profile s of clinical isolates of Pseudomonas aeruginosa from Selayang Hospital, Malaysia. Biomed Res 2011;22(3):263-6.
23. Ahmed SM, Jakribettu RP, Kottakutty S, Arya B, Shakir VPA. An emerging multi-drug resistant pathogen in a tertiary care centre in North Kerala. Annals Biol Res 2012;3(6):2794-9.
24. Bhandari S, Banjara MR, Lekhak B, Bhatta DR, Regmi SR. Multi-drug and pan-drug resistant Pseudomonas aeruginosa: a challenge in post-antibiotic era. Nepal J Sci Tech 2012;13(2):197-202.
25. Nwankwo EOK, Shuaibo SA. Antibiotic susceptibility patttern of clinical isolates of Pseudomonas aeruginosa in a tertairy health institution in Kano, Nigeria. J Med Biomed Sci 2010;37-40.

***Corresponding Author:***

Dr. Jignasha Tadvi,
A/3, 400, Vaikunth-1 Society,
Near Bapod Jakatnaka,
Waghodia road, Vadodara- 390019,
E-mail: dr.jignasha.tadvi@gmail.com

Date of Submission: 13/09/2015
Date of Acceptance: 30/09/2015

**How to cite this article:** Tadvi J, Javadekar TB, Bhavsar R, Garala N. Prevalence & antibiogram of Pseudomonas aeruginosa at S.S.G. Hospital, Baroda, Gujarat, India. J Res Med Den Sci 2015;3(3):204-7.

**Source of Support:** None
**Conflict of Interest:** None declared