Acta Scientific Pharmaceutical Sciences (ISSN: 2581-5423)

Volume 3 Issue 7 July 2019

Research Article

Characterization and Antibiotic profile of *Pseudomonas aeruginosa* isolated from patients visiting National Medical college and Teaching Hospital, Nepal

Amrullah Shidiki[1]*, Bijay Raj Pandit[1] and Ashish Vyas[2]

[1]*Department of Medical Microbiology, National Medical College and Teaching Hospital, Birgunj, Nepal*

[2]*Department of Microbiology and Biochemistry, School of Bioengineering and Biosciences, Lovely Professional University, Phagwara, India*

***Corresponding Author:** Amrullah Shidiki, Department of Medical Microbiology, National Medical College and Teaching Hospital, Birgunj, Nepal.

Received: February 20, 2019; **Published:** June 04, 2019

DOI: 10.31080/ASPS.2019.03.0296

Abstract

Pseudomonas aeruginosa is emerging as a major nosocomial pathogen. It has intrinsic as well as acquired resistance to many available antimicrobial drugs. It is a retrospective study carried out from February 2017 to December 2017 in department of Microbiology at National Medical College and Teaching Hospital, Birgunj, Nepal. This study aimed to evaluate the antimicrobial profile of *Pseudomonas aeruginosa* isolated from different clinical samples. A total of 2000 different clinical samples from suspected patients with 990 males and 1010 females were processed using conventional bacteriological methods. From total samples 83 (4.15%) were isolated and identified *Pseudomonas aeruginosa.* Among the specimens Pus was the most frequent for *Pseudomonas aeruginosa* infections with 38 (45.78%) followed by urine 18 (21.68%), blood 16 (19.27%) and ear swab 2 (2.40%). Regarding the antibiotic sensitivity pattern *Pseudomonas aeruginosa* shown sensitive to Piperacillin/Tazobactam (56.67%) followed gentamicin (37.93%), imipenem (31.91%), amikacin (20.40%).

Keywords: Nosocomial Infection; Antimicrobial Drugs; Antibiotic Sensitivity Profile; *Pseudomonas aeruginosa*; Clinical Samples

Introduction

Infections caused by different resistant microorganisms are the principle health problems resulting serious illness and death in developing countries [1]. *Pseudomonas aeroginosa* made 80% opportunistic infections and 50% deaths in patients of cystic fibrosis, cancer, and burns [2]. *Pseudomonas* species causes endocarditis, pneumonia and infections of the urinary tract, central nervous system, wounds, eyes, ears, skin and musculo-skeletal system [3]. *Pseudomonas aeruginosa* causes nosocomial infections due to immunocompromised patients, the high carrier of multi-drug resistant strains and prior use of broad spectrum antibiotics [4]. Once chronic infection with *Pseudomonas aeruginosa* made difficult to eradicate and increased mortality and morbidity [3]. *Pseudomonas aeroginosa* resisting mechanical forces and penetration of toxic chemicals like antibiotic chemicals, and host defense molecules through biofilm formation, quorum sensing and secretion of many proteases [5-7].

Contaminated medical devices and hospital environment are the major source of infection with *P. aeruginosa* and made high mortality due to bacterial resistance to antibiotics and a weak host defense system [8,9]. In form of multi-drug resistant *P. aeruginosa* has made serious problem of wound and burn infections [10]. *P. aeruginosa* strains found in hospital environment in areas like door handles, beds, sinks, table tops, toilets and others [11,12].

Epidemiological survey specify that antibiotic resistance shown more in clinical isolates of *Pseudomonas aeruginosa* and more than 70% were estimated to be resistant to at least one of the currently available antibiotics [13,14]. Due to which it is so-called superbugs [15].

Materials and Methods

A total of 83 *Pseudomonas aeroginosa* were isolated from 2000 different clinical samples like pus, blood, urine, sputum, throat

swab, pleural fluid, synovial fluid, ascetic fluid, ear swab, cerebrospinal fluid (CSF), stool and high viginal swab in National Medical College and Teaching Hospital, Birgunj, Nepal from February 2017 to December 2017. The samples were inoculated on different media like Nutrient Agar, Blood Agar and MacConkey Agar for isolation as per the Standard Operative Procedure CLSI following GTP [16].

Pseudomonas aeruginosa were further identified by use of Indole, Citrate, Triple sugar iron (TSI), Catalase, Oxidase and physiologically by Urea hydrolysis and Mannitol motility [17].

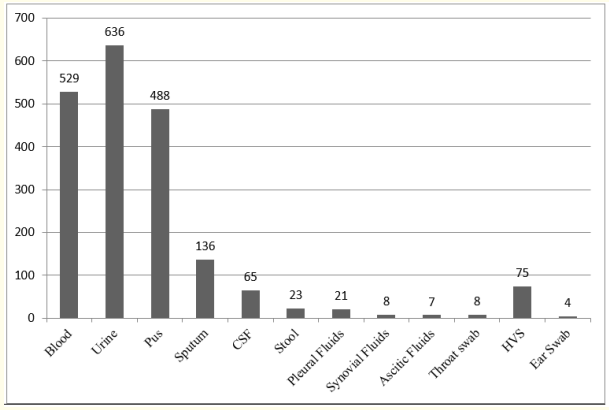
The antibiotic susceptibility pattern of 83 *Pseudomonas aeroginosa* was determined by modified Kirby Bauer disc diffusion method against the following antibiotics: Gentamicin (10µg), ciprofloxacin (5µg), Cefixime (5µg), Levofloxacin (5µg), Ceftriaxone (30µg), Amikacin (30µg), Carbenicillin (100µg), Ceftazidime (30µg), Piperacillin (30µg), Ceftazidime-sulbactam(CAS), Imipenem (10µg), Cefotaxime (30µg), Ampicillin (10µg), Piperacillin/Tazobactam (100/10µg), Ofloxacin (5µg) (Himedia, India). All tests were performed on Muller-Hinton agar, and were interpreted after incubation for 24 h at 37°C. The zone diameters measured around each disk were interpreted on the basis the Clinical and Laboratory Standards Institute (CLSI) [16].

Results

In this study 2000 different clinical samples were included and the distribution of clinical specimens was represented as in Figure 1. Among the samples regarding gender 990 (49.5%) male and 1010 (50.5%) were considered during the collection of samples that shown in Figure 2. Among total samples 83 (4.15%) were isolated and identified which was shown in Table1.The isolation of *Pseudomonas aeruginosa* was more in pus sample 38 (45.79%) followed urine sample 18 (41.87%) and blood sample 16 (19.27%). Antibiotic susceptibility test of *Pseudomonas aeroginosa* against 15 different types of antibiotics is demonstrated in Table 2. Regarding the result of this study showed, the highest resistance rate was found for Ceftazidime (89.83%) followed by Carbenicillin (79.31%), Piperacillin (60%), Ceftazidime-sulbactam (65.71%), Amikacin (38.77%). The resistance rate was not found for Piperacillin/Tazobactam (0%).

Discussion

Pseudomonas aeruginosa is mainly found in hospital environment as nosocomial pathogens. It causes major infections like wound, sepsis, UTIs and otitis externa. *P. aeruginosa* is usually found in cystic fibrosis, organ transplants and leukemia patients. Infections with *P. aeruginosa* have high mortality rates [18,19]. In



CSF-Cerebrospinal Fluid; HVS-High Vaginal Swab

Figure 1: Distribution of clinical samples.

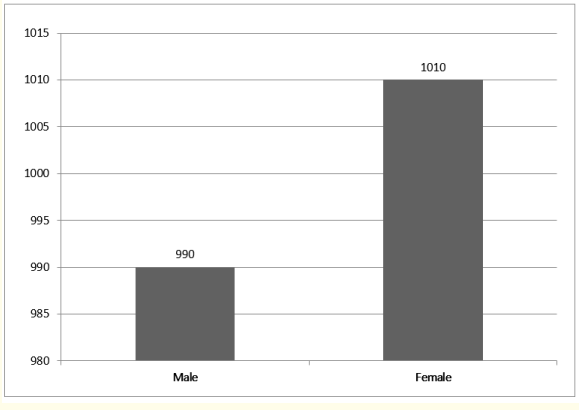


Figure 2: Gendrewise distribution of Specimens.

Specimens	No. of specimens	*P.aeroginosa* (%)
Ascitic Fluid	7	0 (0%)
Ear swab	4	2 (50%)
Blood	529	16 (3.02%)
Cerebrospinal Fluid	65	0 (0%)
Pus	488	38 (7.7%)
Pleural Fluid	21	0 (0%)
Synovial Fluid	8	0 (0%)
Sputum	136	9 (6.61%)
Stool	23	0 (0%)
Throat swab	8	0 (0%)
Urine	636	18 (2.83%)
High vaginal swab	75	0 (0%)
Total	2000	83 (4.15%)

Table 1: Isolation and Identification of *P. aeroginosa* from different clinical samples.

Antibiotics	Sensitive		Intermediate		Resistant	
	No.	%	No.	%	No.	%
Amikacin	10/49	20.40	20/49	40.81	19/49	38.77
Carbenicillin	5/58	8.7	7/58	12.06	46/58	79.31
Cefixime	1/29	3.45	5/29	17.24	23/29	79.31
Ceftazidime	0/59	0	6/59	10.16	53/59	89.83
Ciprofloxacin	9/28	32.14	2/28	7.14	17/28	60.71
Piperacillin	6/55	10.90	16/55	29.09	33/55	60
Ceftazidime-sulbactam	2/35	5.71	10/35	28.57	23/35	65.71
Imipenem	15/47	31.91	19/47	40.42	13/47	27.65
Ceftriaxone	2/18	11.11	3/18	16.67	13/18	72.23
Ampicillin	0/25	0	1/25	4	24/25	96
Piperacillin/ Tazobactam	17/30	56.67	13/30	43.34	0/30	0
Gentamicin	11/29	37.93	4/29	13.79	14/29	48.27

Table 2: Antibiotic resistance pattern in *Pseudomonas aeruginosa.*

the study, the isolation and antibiotic susceptibility pattern were comparable with other studies. *Pseudomonas* species found as part of the normal flora of human skin. It causes infection in healthy individuals but causes serious infection in immunocompromised hosts such as those with severe burns or wound surgery [20]. the most frequent of *P. aeruginosa* were isolated from pus sample (45.78%), followed by urine (21.68%), blood (19.27%), sputum (10.84%) and ear swab (2.40%). Our finding are comparable with other studies [21,22]. [23,24].

The bacteria changed resistance to different antibiotics by the process of acquiring resistance genes and mutation [23]. Increase of resistant strains especially among nosocomial infections has been reported world-wide [24-26,] and it created the major therapeutic problem in treatment due to this pathogens. Literature showed high rate of resistance against cephalosporins, quinolones and carbapenems in *P. aeruginosa* [27-29]. In the present work, the isolates are sensitive to Piperacillin/Tazobactam (56.67%) followed by Gentamicin (37.93%), Imipenem (31.91%), Amikacin (20.40%), Ceftazidime (0%), Ampicillin (0%).The results obtained are in line with studies of other researchers [27,30-32].

Our results indicate that *P.aeruginosa* strains in our hospital have higher resistance to Ampicillin and Ceftazidime while more sensitive to Piperacillin/Tazobactam and Gentamicin. This should be consider by the clinicians during antimicrobial therapy.

Conclusion

P. aeruginosa is a leading cause of nosocomial infection in hospital environment. Unnecessary use of antibiotics changed bacteria to multidrug resistant strains. In our study, strains are more sensitive to combination drugs like piperacillin+tazobactum and Gentamicin and carbapenems like imipenem. A more restricted and rational use of these drugs is necessary. A regular monitoring of antimicrobial susceptibility pattern is essential to guide the physicians in prescribing right combination of drugs and emergence of multidrug resistance strains of *P. aeruginosa*

Acknowledgements

The authors wish to acknowledge to the administration and laboratory workers of department of microbiology of national medical college and teaching hospital, birgunj, Nepal.

Conflict of interest

The authors declare no conflict of interest.

Bibliography

1. Black RE., *et al*. "Longitudinal studies of infectious diseases and physical growth of children in rural Bangladesh". *American Journal of Epidemiology* 115.3 (1982): 305 -314.

2. Cragg GM and Newman DJ. "Medicinals for the millennia.The historical record". *Annals of the New York Academy of Sciences* 953a (2001): 3-25.

3. Levin BR and Bonten MJM. "Cycling antibiotics may not be good for your health". *Proceedings of the National Academy of Sciences of the United States of America* 101.36 (2004): 13101-13102.

4. Otter JA., *et al*. "The role played by contaminated surfaces in the transmission of nosocomial pathogens". *Infection Control and Hospital Epidemiology* 32.7 (2011): 687-699.

5. Bjarnsholt T., *et al*. "Interference of Pseudomonas aeruginosa signaling and biofilm formation for infection control". *Expert Reviews in Molecular Medicine* 12 (2019): e 11.

6. Lieleg O., *et al*. "Mechanical robustness of Pseudomonas aeruginosa biofilms". *Soft Matter* 7.7 (2011): 3307-3314.

7. Waite RD., *et al*. "Clustering of Pseudomonas aeruginosa transcriptomes from planktonic cultures, developing and mature biofilms reveals distinct expression profiles". *BMC Genomics* 7 (2006): 162-171.

8. Meenakumari S., *et al* "Antimicrobial susceptibility pattern of clinical isolates of Pseudomonas aeruginosa in an Indian cardiac hospital". *International Journal of Engineering, Science and Technology* 3 (2011): 7117-7124.

9. Orsi GB., *et al*. "In vitro activity of commercially manufactured disinfectants against Pseudomonas aeruginosa". *European Journal of Epidemiology* 11.4 (1995): 453-457.

10. Sule A and Olusanya O. "In-vitro antimicrobial activities of fluoroquinolones compared with common antimicrobial agents against clinical bacterial isolates from parts of South Western Nigeria". *Nigerian Quarterly Journal of Hospital Medicine*10.1 (2000): 18-21.

11. Haghi M., *et al*. "Antibiotic resistance pattern of Escherichia coli Staphylococcus aureus and Pseudomonas aeruginosa isolated from burnt patients Urmia, Iran". *International Journal of Academic Research* 2 (2010): 377-380.

12. Falagas ME., *et al* "Outcome of infections due to pandrugresistant (PDR) Gram-negative bacteria". *BMC Infectious Diseases* 5 (2005): 24.

13. Koneman, E., *et al*. "Koneman's Color Atlas and Textbook of Diagnostic Microbiology". *Sixth Edn* 7 (2006): 264-269.

14. Katz ML., *et al*. "Where have all the antibiotic patents gone?". *Nature Biotechnology* 24.12 (2006): 1529-1531.

15. Balaban N and Dell' Acqua G. "Barriers on the road to new antibiotics". *Scientist* 19 (2005): 42-43.

16. CLSI. Performance standards for antimicrobial susceptibility testing. CLSI approved standard M100-S17. Clinical and Laboratory Standards Institute Wayne, PA (2007).

17. Koneman Koneman's., "Color Atlas and textbook of diagnostic Microbiology". The Non fermantative Gram-Negative Bacilli 6 (2006): 303-391.

18. Bodey GP., *et al*. (1983). "Infections Caused by Pseudomonas aeruginosa". *Reviews of Infectious Diseases* 5.2 (1983): 279-313.

19. Diekema DJ., *et al*. "Antibacterial-Resistant Pseudomonas aeruginosa: Clinical impact and complex regulation of chromosomally encoded resistance mechanisms". *Clinical Microbiology Reviews* 22.4 (1999): 582-610.

20. Dale RMK., *et al*. "Therapeutic efficacy of nubiotics against burn wound infection by Pseudomonas aeruginosa". *Antimicrob. Agents Chemother* 48.8 (2004): 2918-2923.

21. Haleem H., *et al*. "Isolation of Pseudomonas aeruginosa from Clinical Cases and Environmental Samples, and Analysis of its Antibiotic Resistant Spectrum at Hilla Teaching Hospital". *Medical Journal Of Babylon* 8.4 (2011): 34-41.

22. Zhanel GG., *et al*. "Canadian Antimicrobial Resistance Alliance. Antimicrobial susceptibility of 2746 pathogens from Canadian hospitals: results of the CANWARD 2007-11 study". *Journal of Antimicrobial Chemotherapy* 68.1 (2013): 17-22.

23. Lister PD., *et al*. "Antibacterial-Resistant Pseudomonas aeruginosa: Clinical impact and complex regulation of chromosomally encoded resistance mechanisms". *Clinical Microbiology Reviews* 22.4 (2009): 582-610.

24. Orrett FA. "Antimicrobial susceptibility survey of Pseudomonas aeruginosa strains isolated from clinical sources". *Journal of the National Medical Association* 96.8 (2004): 1065-1069.

25. Chen HY., *et al*. "Mechanisms of resistance to beta-lactam antibiotics amongst Pseudomonas aeruginosa isolates collected in the United Kingdom in 1993". *Journal of Medical Microbiology* 43.4 (1995): 300-309.

26. Jones RN., *et al*. "Geographic Variations in Activity of Broad-Spectrum -Lactams Against Pseudomonas aeruginosa: Summary of the Worldwide SENTRY Antimicrobial Surveillance Program (1997-2000)". *Diagnostic Microbiology and Infectious Disease* 43 (2002): 239-243.

27. Shahcheraghi F., *et al*. "Prevalence of ESBLs genes among multidrug-resistant isolates of Pseudomonas aeruginosa isolated from patients in Tehran". *Microbial Drug Resistance* 15.1 (2009): 37-39.

28. Güney M., *et al*. "The antibiotic resistance patterns of Pseudomonas aeruginosa strains isolated from blood cultures specimens in the Medical Microbiology Laboratory of Gulhane Military Medical Academy". *Gulhane Medical Journal* 53.23 (2011): 119-122.

29. Fatima A., *et al*. "Antimicrobial susceptibility pattern of clinical isolates of Pseudomonas aeruginosa isolated from patients of lower respiratory tract infections". *Springerplus* 1.1 (2012): 70.

30. Vaziri F., *et al*. "The prevalence of aminoglycoside-modifying enzyme genes (aac (6')-I, aac (6')-II, ant (2")-I, aph (3') (VI) in Pseudomonas aeruginosa". *Clinics (Sao Paulo)* 66.9 (2011): 1519-1522.

31. McCracken M., *et al*. "Canadian Antimicrobial Resistance Alliance (CARA). Characterization of Acinetobacter baumannii and meropenem resistant Pseudomonas aeruginosa in Canada: results of the CANWARD 2007-2009 study". *Diagnostic Microbiology and Infectious Disease* 69.3 (2011): 335-341.

32. Mohan BS., *et al*. "Prevalence and Antibiotic sensitivity pattern of Pseudomonas aeruginosa, an emerging nosocomial pathogen". *International Journal Of Biological and Medical Research* 4.1 (2013): 2792-2731.

Volume 3 Issue 7 July 2019