Antimicrobial Sensitivity Pattern of *Pseudomonas Aeruginosa* Isolated from a Tertiary Care Hospital

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ABSTRACT

Introduction: *Pseudomonas aeruginosa (P. aeruginosa)* is one of the major cause of nosocomial infection. Multi-drug-resistant *P. aeruginosa* (MDR PA) are increasingly encountered in clinical samples .Therefore, this study was undertaken to know the sensitivity pattern of *P. aeruginosa* and to detect MDR PA from clinical samples.

Methods: This was a laboratory based retrospective-cross sectional study conducted at Department of Microbiology at a tertiary care referral centre in Kathmandu, Nepal from December 2018 to December 2019. Total of 200 isolates of *P. aeruginosa* were isolated from clinical samples. Non repetitive sample per patient was included in the study. Samples were processed according to standard methodology and antimicrobial sensitivity testing (AMST) was carried out by Modified Kirby Bauer disk diffusion test as per Clinical Laboratory Standard Institute guideline. MDR was defined as strains resistant to one or more agent of ≥ 3 groups of antimicrobial categories.

Results: Highest number of *P. aeruginosa* were isolated from sputum (93), followed by wound swab (35), and pus (29). AMST revealed the most sensitive drug to be Amikacin (91.51%) followed by Meropenem (78.5%) and Piperacillin/Tazobactam (77.50%). Out of 200 isolates, 69 (34.5%) were MDRPA.

Conclusions: The information regarding sensitivity pattern of *P. aeruginosa* will help clinicians to choose most effective antimicrobials for the treatment of patients thus saving the time duration and total cost of patient management and also it will play a key role in setting antimicrobial stewardship policy.

Key words: antimicrobial sensitivity; multidrug resistant; *Pseudomonas aeruginosa*

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INTRODUCTION

Pseudomonas aeruginosa is the major pathogenic species in the family Pseudomonadaceae. The ability of *P. aeruginosa* to grow with minimal nutrient requirement and its tolerance to diverse conditions has allowed this organism to persist in hospital as well as in community. Outside the hospital, *P. aeruginosa* is commonly found in soil, water and plants. Within the hospital, *P. aeruginosa* can colonize moist surfaces of patient, moist inanimate objects in the environment including water in sinks, drains, toilet, showers, mops, respiratory ventilators and cleaning solutions.[1,2]

P. aeruginosa emerged as a major human pathogen in the 1960s, since than it has become one of the most serious cause of nosocomial bacterial infections.[3,4] Furthermore, the increasing frequency of MDRPA are increasingly encountered in clinical samples, leaving clinicians with very few effective drugs for treatment of patient leading to high morbidity and mortality.

Many studies have shown that treatment of MDR PA infections are really challenging with huge financial burden. Therefore, this study was carried out with the objective to isolate *P. aeruginosa* from various clinical samples, to know their antimicrobial sensitivity pattern and to identify multi drug resistant *pseudomonas aeruginosa* (MDRPA) among the isolates which will ultimately help clinicians to choose better treatment option.

METHODS

This was a laboratory based retrospective-cross sectional study carried out at department of Microbiology in a teaching institute located in Kathmandu, Nepal from 2018 December to 2019 December. Total of 200 *P. aeruginosa* were isolated from various clinical samples. Non repetitive sample per patient was included in the study. Antimicrobial sensitivity testing was carried by Modified Kirby Bauer disk diffusion method. Interpretation was done as per Clinical and Laboratory Standards Institute (CLSI) guideline.[5] The definition of MDR was established as isolates resistant to at least one or more agent of ≥ 3 groups of antimicrobial categories.[6] *P. aeruginosa* ATCC 27853 was used as quality control.

RESULT

Total of 200 *P. aeruginosa* were isolated from various clinical samples. The details of sample wise distribution is shown in Table 1. Antimicrobial sensitivity testing revealed Amikacin (91.5%) to be the most sensitive drug against *P. aeruginosa* followed by Meropenem which is depicted in Table 2. Out of 200 isolates, 69 (34.5%) were MDR PA.

DISCUSSION

P. aeruginosa, particularly MDRPA has become challenge for the treatment leading to high morbidity and mortality. *P. aeruginosa* was most commonly isolated from upper and lower respiratory tract followed by pus and wound swabs as reported by Agrawal S et al. and Ansari S et al.[7,8] In this study also, highest number of *P. aeruginosa* was isolated from upper and lower respiratory tract

Table 1. Distribution of *P. aeruginosa* in clinical samples

Sample type	Number of isolates	% of isolates
Sputum	93	46.5
Wound swab	35	17.5
Pus	29	14.5
Tracheal aspirate	20	10
Urine	10	5
Throat swab	5	2.5
Bronchoalveolar lavage	5	2.5
Eye swab	2	1
Pleural fluid	1	0.5

Table 2. Sensitivity Pattern of *P. aeruginosa* (n=200)

Antibiotics	Sensitivity number	Sensitive (%)
Amikacin	183	91.50
Meropenem	157	78.50
Piperacillin/Tazobactam	155	77.50
Tobramycin	149	74.50
Piperacillin	139	69.50
Ciprofloxacin	139	69.50
Levofloxacin	135	67.50
Ceftazidime	103	51.50

samples (61.5%) followed by pus and wound swabs (35%). However, study by Jayarajan et al. reported 71.37% from pus and wound swabs which was much higher and 14.2% from sputum which was much lower in comparision to our study.[9]

Most sensitive drug was found to be Amikacin (91.50%) which was slightly higher than the observations made by Agrawal S et al. (85.23%), and Jatan S et al. (84.21%).[7,10] Second most sensitive drug was found to be carbapenem (78.50%) which was in concordance with Agrawal S et al. (78.33%) while Agrawal G et al. reported 91.95% which was much higher as compared to our study.[11] Our study as well as study by Agrawal S et al. and S. Jatan et al. have shown decreasing sensitivity towards β lactams, cephalosporins, and fluoroquinolones. Dahal R et al. also reported very low sensitivity towards β lactams, cephalosporines and fluoroquinolones.[12] Increasing resistant to β lactams, cephalosporins and fluoroquinolones may be explained by its easy availability, easy route of administration and widely use of these drugs for treatment of various infections and it could also be due to the ability of bacteria conferring resistance to different groups of antibiotics associated with different resistance mechanism. Meta analysis done by Gauri et al. found an association between the use of quinolones and acquisition of MDRPA.[13] From our study and other studies it has been observed that Amikacin with different percentage of sensitivity, is found to be the most sensitive drug for the treatment of MDRPA infection followed by carbapenems.

The percentage of MDRPA ranged from 18.6% by Shrestha S et al. to 100% by Moazami-Gaudarzi et al. and Ranjbar et al.[14-16] Our study observed 34.5% MDRPA which was comparable to above findings.

However Saderi H et al. (54.5%), Yong-hua gao et al. (59.9%), Bayani et al. (60%) and Senthamarai et al. reported (41.35%) which was much higher as compared to our study.[17-20] From these studies it has been observed that MDRPA represents as high as 100% in some countries which is a very worrisome finding in terms of treatment, huge financial burden associated with high morbidity and mortality as well as wide spread of MDRPA in different countries. Though very limited drugs are available for the treatment of MDRPA infection at present, there seems a hope as there are some drugs in the pipeline: imipenem-relebactam, cefepime-zidebactam, and murepavadin which could be the next option for the treatment of MDRPA infection.[21] Although our study is a single centric study with limited number of sample size, it is expected that it shall help shed some light in the academic world of infectious diseases.

CONCLUSIONS

Multi drug resistant *P. aeruginosa* infection is constantly increasing worldwide as a major cause of nosocomial infection. Indiscriminate use of antimicrobials has led to develop resistance to many groups of antimicrobials, thus leaving clinicians with less therapeutic options for the treatment of MDRPA infection. Therefore, it is important to carry out such studies in large scale to formulate antimicrobial policy in the hospital as well as at the national level**.** Implementation of antimicrobial stewardship and infection control policies in hospitals can minimise the spread of MDRPA. In addition, national strategic approach is required for the use of antimicrobials which can preserve the effective drugs for the future use.

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