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Original Research Article

Incidence of carbapenem-resistant *pseudomonas aeruginosa* in clinical samples

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Abstract

Background: Pseudomonas aeruginosa have been reported to show resistance to carbapenem drugs. Detection of carbapenem resistance pseudomonas is now important to prevent their spread as discriminates of these bacteria could be fetal to the hospitalized patients. The main objective of this study was to detection of carbapenem resistant pseudomonas aeruginosa. We also aimed to search for the treatment option for this multidrug resistant *P.aeruginosa*.

Method: A present study was conducted over a period of 6 months. 239 isolates of Pseudomonas aeruginosa were obtained from the samples from hospitals of Pt. J. N. M. Medical College, Raipur (C.G.) from January 2015 to June 2015. These isolates were tested for susceptibility to antipseudomonal drugs and considered to be resistant to carbapenem. Antibiogram generated by disc diffusion susceptibility testing was used for clinically relevant antibiotics.

Results: Out of total 239 Pseudomonas aeruginosa isolates, 25(10.46%) were found to be carbapenem resistant. All imipenem resistant isolates were sensitive to polymyxin B (300µg) and colistin (10µg).

Conclusion: The rapid dissemination of carbapenem resistance is worrisome and calls for the implementation of surveillance studies as well as judicious use of antibiotics. This is a therapeutic challenge to the clinicians and also need proper selection of antibiotics especially carbapenems.

Keywords: Carbapenem resistance, *Metallo β- lactamase*, *Pseudomonas aeruginosa*, MDRPs

1. Introduction

Pseudomonas aeruginosa has been described as the most common and serious cause of infections and one of the most infectivity among all pathogenic microorganism. Problems of MDRPs are due to intrinsic as well as acquired resistance to many effective groups of antibiotics. In the past few decades, MDRPs increasing worldwide recognized as a pathogens in a variety of serious infections in hospitalized patients.[1-3]

The carbapenemes have been drug of choice for the treatment of serious infection caused by gram negative bacterial infections.[4] Pseudomonas shows resistance to carbapenem due to decrease outer membrane permeability, increased efflux system, alteration penicillin binding protiens and carbapenem hydrolyzing enzymes carbapenemase.[5]

The introduction of carbapenem, of great help to the clinician for the treatment of serious bacterial infections caused by beta lactam resistant bacteria, Carbapenem, due to their stability to hydrolysis by the most beta lactamase, have been the drug of choice for treatment of infection caused by penicillin resistant or carbapenem resistant gram negative infections.[6]

Carbapenem resistance is due to the Metallo β-lactamase producing *P.aeruginosa*. Acquired MBLs have started spreading worldwide as a broad spectrum activity to resistance of β- lactam antibiotics.

In view of the paucity of information on carbapenem resistance *Pseudomonas aeruginosa* infection in hospitalized patient, we undertook the present study to determine its incidence.

2. Material and Method

The study was conducted in the department of microbiology, Pt. J.N.M. Medical College, Raipur (C.G.) from January 2015 to June 2015. Total no. of 239 isolates of Pseudomonas aeruginosa obtain from various samples collected with universal safety precautions. The entire clinical sample received in the microbiology department where processed without delay. Sample were processed and identified by standard laboratory technique.[7]

Sample processed were blood, urine, pus, wound swab, CSF, body fluids, respiratory secretion, sputum and throat swab. Blood cultures were processed using a conventional method. Antimicrobial sensitivity testing was performed on Mueller Hinton Agar plates with commercially available discs (Hi Media Pvt. Ltd, India) by the Kirby bauer disc diffusion method.[8]

The routine antibiotic sensitivity test put up for amikacin (30 µg), gentamicin (10 µg), netilmycin (30 µg), tobramycin (10 µg), cefoperazone (75 µg), cefepime (30 µg), ceftazedime (30 µg), getifloxacin (5 µg), ciprofloxacin (5 µg), imipenem (10 µg), polymyxin – B (300µg), colistin (10µg), piperacillin (10µg) and piperacillin tazobactum (100/10µg).

3. Results

239 isolates of Pseudomonas aeruginosa from various samples were collected over 6 month of period. Out of 239 Pseudomonas aeruginosa isolates of 25 were found to be resistant to carbapenem.

Table No. 1: Distribution of *P. aeruginosa* from various clinical samples.

Samples	Total sample no. (%)	Total No. of *P. aeruginosa* & (%)	Carbapenem Resistant *P aerugionsa* no. (%)
Urine	1666 (41.78)	48 (20.08)	05 (19.23)
Pus	1103 (27.66)	99 (41.42)	06 (23.07)
Blood	995 (24.95)	38 (15.89)	04 (15.38)
Sputum	120 (3.00)	07 (2.92)	01 (3.84)
CSF	41 (1.02)	19 (7.94)	03 (11.53)
Vaginal Swab	12 (0.30)	04 (1.67)	01 (3.84)
Pleural Fluid	10 (0.25)	02 (0.83)	00 (00)
Endotrachial tube	12 (0.30)	07 (2.92)	02 (7.69)
Throat swab	12 (0.30)	03 (1.25)	00 (00)
Cather Tip	16 (0.40)	12 (5.02)	03 (11.53)
Total No.	3987	239	25 (10.46)

Table No 2: Antibiotic pattern of *P. aeruginosa* strain in clinical isolates

Antibiotics	*P. aeruginosa* (n = 239) (%)	*P. aeruginosa* (n = 239) (% resistant)
Amikacin	145 (60.66)	94 (39.33)
Ceftazidime	169 (70.71)	70 (29.28)
Netilmicin	130 (54.39)	109 (46.60)
Ceprofloxacin	171 (71.54)	68 (28.40)
Piperacillin	198 (82.84)	41 (17.45)
Tobramycin	178 (74.47)	61 (25.20)
Gentamicin	132 (55.23)	112 (46.86)
Gatifloxacin	199 (83.26)	40 (16.73)
Cefepime	179 (74.85)	60 (25.10)
Aztreonem	101 (42.25)	178 (57.74)
Piperacilin/tazobactum	220 (92.05)	19 (7.94)
Imipenem	214 (89)	25 (10.46)
Polymyxin – B	239 (100)	0 (00)
Colistin	239 (100)	0 (00)

Table no. 3: Resistant pattern of *P. aeruginosa* to imipenem

Total no. *p. aeruginosa* isolates	Total no. of *p. aeruginosa* sensitive to imipenem	Total no. of *p. aeruginosa* resistant to imipenem
239	214 (89%)	25 (10.46%)

4. Discussion

Pseudomonas aeruginosa is one of the most frequent nosocomial pathogens and the infections due to these are often difficult to treat due to antibiotic resistance. [(6)] carbapenem are beta lactam antibiotics, presently considered as the most potent agents of treatment of multidrug resistant gram negative bacterial infection due to the stability of these agents against the majority of β-lactamases and their high rate of permeation through bacterial outer membranes.[9]

In various studies across the world, varying rates of resistance (4-60%) have been reported for imipenem and meropenem.[10] Of the Indian workers, Gladestone *et al* reported 42.8% carbapenem resistance among *P.aeruginosa* isolates.[5] Taneja *et al* reported that 36.4% of nosocomial urinary tract infections were caused by nonfermenters resistance to imipenem[11] In the present study, of the 239 *P.aeruginosa* isolates, we found that 10.46% were resistant to imipenem.

Because of its unique antipseudomonal activity ceftazidime is a reserved drug for *P.aeruginosa* infections. In CLSI guidelines [5] also this is included in group A drugs. In our study, 10.46% resistance was observed against ceftazidime (Table 3) which is correlate with 11% resistance observed in the study of Sarkar *et al*.[12] In the study of Shahid *et al*[13] and Pitt *et al*[14] ceftazidime resistance was 20% and 39.6% respectively. Piperacillin is another β-lactam

antibiotic included in group A. We observed 17.40% resistance against these antibiotics. Sarkar *et al*[12] and Pitt *et al*[14] observed 12% and 31.9% resistance respectively against piperacillin. Among aminoglycosides, amikacin showed resistance in our study 39.37%, Sarkar *et al*[12] found resistance in amikacin 40.90% as compared to gentamicin 46.60%, Tobramycin 25.20% and Netilmycin 46.67%.

In the study of Nagoba *et al*[15] and Veenu *et al*[16] amikacin was found to be most effective antipseudomonal agents. Quinolones in particular ciprofloxacin is still active against about 60% of *P. aeruginosa*.

We conclude the polymyxin B or colistin represent the best treatment option. However, colistin is very expensive and this limits its use. After that the best treatment options a combination of gatifloxacin, amikacin and piperacillin /tazobactam. And the last this rapid dissemination of carbapenem resistance is worrisome and calls for the implementation of surveillance studies and the judicious selection of antibiotics in clinical practice.

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