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Original Research Article

Emergence of Multidrug Resistant Pseudomonas Aeruginosa in a Tertiary Care Center

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ABSTRACT

The worldwide emergence of multi-drug resistant bacterial strains in hospitals and community continues to be a problem of due scientific concern, especially infections caused by Pseudomonas species. This study was carried out to determine the multidrug resistant pattern of P. aeruginosa, among the clinical isolates at a tertiary care hospital in Kanpur.

Methods: Total 50 P. aeruginosa were isolated from different clinical samples of a tertiary care hospital during Jun 2016 to Dec 2016. Bacterial isolates were identified by standard microbiological tests and antimicrobial resistance pattern were determined by CLSI guidelines.

Results: Among 50 P. Aeruginosa, (70%) strains were isolated from pus followed by sputum (10%), bronchial washing (20%). Most of the organism was isolated from advance age and in male patients. Out of 50 P. Aeruginosa isolates, 20 (40%) were resistant to piperacillin tazobactam, tobramycin and levofloxacin, 30 (60 %) were resistant to ceftazidime, cefepime and meropenem, 10 (20%) were resistant to imipenem and amikacin, 25 (50%) were resistant to ciprofloxacin.

Conclusion: There has been rapid emergence of MDR P. aeruginosa in recent times which is an important concern for clinicians who treat these infections. Therefore restriction of 'selected antibiotic usage' and infection control policies must be undertaken to combat the rapid emergence of MDR P. aeruginosa. P. aeruginosa showed highest resistance to piperacillin tazobactam, tobramycin and levofloxacin and minimum resistance to imipenem and amikacin.

Key words: Multidrug resistance, P. aeruginosa, Piperacillin tazobactam.

INTRODUCTION

The worldwide emergence of multi-drug resistant bacterial strains in hospitals and community continue to be a problem of due scientific concern; especially infections caused by Pseudomonas species and Pseudomonas aeruginosa in particular. P. aeruginosa is an opportunistic pathogen with inherent resistance to many antibiotics and disinfectants including anti-pseudomonal Penicillins, Ceftazidime, Carbapenems, Aminoglycosides and Ciprofloxacin [1] Extended-spectrum beta-lactamases (ESBLs) have emerged as an important cause of resistance in Gram-negative bacteria. Beta-lactam antibiotics are among the safest and most frequently prescribed antimicrobial agents all over the world intreating Gram positive and Gram negative infections. [2] Production of beta-lactamases is the most common mechanism of bacterial resistance to these antibiotics. These enzymes are numerous and are plasmid mediated, capable of hydrolysing and inactivating a wide variety of beta-lactam antibiotics. In addition, ESBL producing organisms exhibit co-resistance to many other classes of antibiotics resulting

in the limitation of therapeutic options. For this reason, ESBL–mediated infections have been increasingly reported worldwide. [3] Lately, carbapenems are being used as the last resort antimicrobial to treat serious infections due to MDR *P. aeruginosa*. In a few Indian studies, the rate of carbapenem resistance in *P. aeruginosa* has been reported to vary from 12-37 per cent. [4] The aim of the present study was to determine the incidence of multidrug resistance pattern among the clinical isolates of P. aeruginosa at a tertiary care centre.

MATERIALS & METHODS

This study was conducted in the Department of Microbiology, during Jun 2016 to Dec 2016. Total 50 P. aeruginosa were isolated from different clinical samples of a tertiary care hospital. The samples were cultured on MacConkey's Agar, and Blood Agar, cetrimide agar and the plates were incubated overnight at 37°C. *P. aeruginosa* was identified by its colony characteristics, pigment production, grape like odour, oxidase positivity, motility, gram staining (as gram negative bacilli), ability of reducing nitrates to nitrites, non-fermentative character, along with its ability to decarboxylate arginine, liquefy gelatin and to grow at 42ºC. [5] Other bacteria which were isolated were also processed and identified by standard microbiological techniques. [5]

Antibiotic susceptibility testing

Antibiotic sensitivity patterns of these isolates were studied by using Kirby Bauer Disc Diffusion method on Mueller – Hinton agar, by following CLSI 2016 Guidelines, [6] by using Hi-media antibiotic discs. 11 antibiotics were tested, which included amikacin (30mcg), netilmicin (30mcg), gentamicin (10mcg), ceftazidime (30mcg), aztreonam (30mcg), ciprofloxacin (5mcg), piperacillin (100mcg), piperacillin + tazobactam (100/10mcg), imipenem (10mcg), meropenem (10mcg) and colistin (10mcg). Strains which had the same types of resistance patterns (antibiotype) were considered to be from the same clone. *Pseudomonas aeruginosa* ATCC 27853 strains was used for quality control in the study. In our work, MDR *P. aeruginosa* was detected as a bacterium which was resistant to three or more antipseudomonal anti-microbial classes (piperacillin + tazobactam, imipenem, ceftazidime and gentamicin). [7] The study was approved by ethical committee of the teaching hospital.

RESULTS

Among 50 P. aeruginosa, (70%) strains were isolated from pus followed by sputum (10%), bronchial washing (20%). Most of the organism was isolated from advance age and in male patients. Out of 50 P. aeruginosa isolates, 20 (40%) were resistant to piperacillin tazobactam, tobramycin and levofloxacin, 30 (60 %) were resistant to ceftazidime, cefepime and meropenem, 10 (20%) were resistant to imipenem and amikacin, 25 (50%) were resistant to ciprofloxacin. Colistin, although it was used only as a salvage drug, showed 100% susceptibility to all the strains.

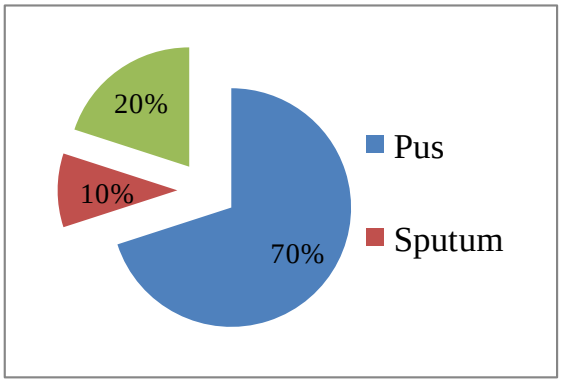

Fig 1: Distribution of sample

Table 1: Antibiotic Resistant Testing

Antibiotics	Percentage
CAZ	60
MER	20
TOB	60
P-T	60
IMP	20
AK	20
CL	0

DISCUSSION

Infections caused by P. aeruginosa are difficult to treat as the majority of isolates show varying degrees of inherent resistance. Acquired resistance is also

reported by the production of plasmid mediated AmpC beta (beta)-lactamase, ESBL and metallo beta-lactamase enzymes. [8] Among 50P. aeruginosa,(70%) strains were isolated from pus followed by sputum (10%), bronchial washing (20%).this is in contrast with a study conducted by Agarwal et al. [9] The frequency of MDR producing isolates was highest in sputum (41.67%) followed by pus (28.36%), cerebrospinal fluid and other body fluids(21.74%), urine (20.45%) and blood (13.79%). Among the beta-lactams, *P.aeruginosa* showed highest resistance to ceftazidime (60%), cefepime and merepenem. However, it was more sensitive to other beta-lactams i.e., piperacillin+ tazobactam, imipenem (60%, 80%respectively), as has been described in [Table.1], 20 (40%) were resistant to piperacillin tazobactam, tobramycin and levofloxacin, 30 (60 %), 10 (20%) were resistant to imipenem and amikacin, 25 (50%) were resistant to ciprofloxacin. Studies done by Kaushik et al., [10] Singh et al., [11] Taneja et al., [12] Agnihotri et al., [13] and Ganesamoni et al., [14] which were done in Indian context, showed resistance of *Pseudomonas spp*. in the range of 13.9 - 90% to amikacin, in the range of 4 - 90% to ceftazidime,, in the range of 50 - 77.7% to gentamicin and in the range of 41 - 95.1% to ciprofloxacin, which reflected high resistance profile of this nosocomial pathogen. Colistin, although it was used only as a salvage drug, showed 100%susceptibility to all the strains. In the present study, MDR rate (resistance to three or more of antipseudomonal antimicrobials i.e. piperacillin + tazobactam, imipenem, ceftazidime and gentamicin) was determined to be 50% (25/50). [15] In Turkey reported rates of MDR, which were as high as 60%, whereas study done by Sabir et al., in Pakistan detected lower rates of MDR (22.08%). [16] In current times, antibiotics with antipseudomonal activity which are available include the aminoglycosides, ticarcillin, ureidopenicillins, ceftazidime, cefepime, aztreonam, the carbapenems, and ciprofloxacin. Combination treatments are generally recommended for suspected Pseudomonas infections. It has been reported that the choice of a carbapenem, cefepime, or piperacillin+tazobactam, in combination with amikacin or tobramycin, in current times, appears to provide the widest potential antimicrobial activity against MDR *P. aeruginosa*, [17-20] Interestingly, our study also revealed that carbapenems, piperacillin+tazobactam, ciprofloxacin and gentamicin combinations were very effective in providing reasonable therapeutic options.

The lack of any new compounds in the near future indicates that national and local surveillance efforts are essential, to provide clinicians with correct information for choosing right antimicrobial therapy. Rigorous monitoring for MDR among Pseudomonas isolates is very important, because outbreaks caused by strains which are resistant to potentially useful agents, including carbapenems.

CONCLUSION

There has been rapid emergence of MDR P. aeruginosa in recent times which is an important concern for clinicians who treat these infections. Therefore restriction of 'selected antibiotic usage' and infection control policies must be undertaken to combat the rapid emergence of MDR P. aeruginosa. P. aeruginosa showed highest resistance to piperacillin tazobactam, tobramycin and levofloxacin and minimum resistance to imipenem and amikacin.

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