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Original Article

ANTIMICROBIAL RESISTANCE OF *PSEUDOMONAS AERUGINOSA* STRAINS FROM PATIENTS WITH URINARY TRACT INFECTIONS IN SBMPMC HOSPITAL BIJAPUR, INDIA

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ABSTRACT

Objectives: Urinary tract infections (UTIs) are one of the most common bacterial infections affecting humans throughout their life span. There is paucity of literature in relation to pathogenesis of UTIs caused by *Pseudomonas aeruginosa*. Therefore the current study was conducted to know the antibiotic sensitivity pattern of *P. aeruginosa* isolated from UTIs from our hospital.

Methods: The study was carried out over a period of 3 years from January 2010 to December 2012. Urine specimens from both outpatients and inpatients of our hospital were processed. Urine samples which yielded the growth of *Pseudomonas aeruginosa* were included in the study

Results: Among females, frequency of UTI was more among 21-50 years age groups and among males elderly patients were more commonly affected. The most active antimicrobial agent against *Pseudomonas aeruginosa* isolates were piperacillin-tazobactum (54% sensitive), closely followed by Cefoparazone –salbactam (48%).

Conclusion: This study stresses the importance of prior knowledge of the sensitivity pattern of the pathogen. Treatment should be given only after culture and sensitivity has been performed which will prevent the misuse of antibiotics and reduce the development of drug resistance among bacteria

Keywords: Antimicrobial resistance, *Pseudomonas aeruginosa*, Urinary tract infections.

INTRODUCTION

Urinary tract infections (UTIs) are one of the most common bacterial infections affecting humans throughout their life span. These infections are more common in females than in men. Incidence in women in the age of 20—40 years ranges from 25 to 30% whereas in older women above 60 years of age it ranges from 4 to 43%. [1]

Pseudomonas aeruginosa is a cosmopolitan gram-negative aerobic bacillus isolated from soil, water, plants, and animals, including humans. It is associated with an ever-widening spectrum of infections.[2,3] *Pseudomonas aeruginosa* is an opportunistic pathogen, which causes complicated infections mainly of the lower respiratory tract, wounds and urinary tract in immunocompromised, immunodeficient or surgically manipulated hosts. This organism has been reported in 35 per cent cases of catheterized patients of complicated UTIs and is difficult to manage. [4] In addition to factors involved in the virulence of *P. aeruginosa*, its resistance to antimicrobials contributes to its role as an effective opportunistic pathogen. Resistance to antipseudomonal b-lactams has been well described, and resistance to recent-generation cephalosporins, monobactams, and carbapenems is becoming a disturbing clinical problem. [2] There is paucity of literature in relation to pathogenesis of UTIs caused by *P. aeruginosa.* Area-specific monitoring studies aimed to gain knowledge about resistance patterns of the isolates may help the clinician to choose the right empirical treatment. [1,5] Therefore the current study was conducted to know the antibiotic sensitivity pattern of *P. aeruginosa* be isolated from UTIs from our hospital.

MATERIALS AND METHODS

Study population, design, and setting

The study was carried out in the Department of Microbiology, India over a period of 3 years from January 2010 to December 2012. Our hospital primarily caters to the semi urban population of Southern India.

Ethical clearance and consent

As it was a retrospective study, ethical clearance and consent were not obtained.

Patient evaluation

Urine specimens from both outpatients and inpatients of our hospital having one or more urinary symptoms, like burning during micturition, fever, pyuria, frequency of urine, dysuria, hematuria, flank pain, suprapubic discomfort, etc., was processed.

Sample collection, isolation and identification of *P. aeruginosa*

Mid-stream urine sample in early morning was collected in wide mouth sterile container.[6]All urine samples were examined by routine microscopic examination by wet mount of urine. Simultaneously all urine samples were cultured over routine culture media; Cysteine lactose electrolyte deficient (CLED) agar with a sterile standard loop. These plates were incubated at 37°C for 24 hours. Culture results were interpreted according to the standard criteria and a growth of $\geq 10^5$ colony forming units/ml was considered as significant bacteriuria.[7]cultures with more than three colonies were discarded, as contaminants and their antibiotic susceptibility were not tested. *P. aeruginosa* were identified by conventional biochemical tests according to standard microbiological techniques. [6]

Antimicrobial susceptibility testing

All isolates of *P. aeruginosa* were tested for antimicrobial susceptibility on Mueller Hinton agar by the standard disc diffusion method recommended by the Clinical and Laboratory Standards Institute (CLSI). [8] Antimicrobial agents (disks) were obtained from Hi Media laboratories, Pvt Ltd, Mumbai. Appropriate quality control strains were used to validate the results of the antimicrobial disk. *E. coli,* ATCC 25922, and *Pseudomonas aeruginosa,* ATCC 27853, were used as quality control strains. [8]

Statistical analysis

Statistical analysis was performed with SPSS 14 software. Continuous data were summarized as mean and categorical data was summarized as percentage. Chi square test was applied for analysis of categorical data. P value < 0.05 was taken as significant for interpretation.

RESULTS

The most active antimicrobial agent against *Pseudomonas aeruginosa* isolates (Table 2) were piperacillin-tazobactum (54% sensitive), closely followed by Cefoparazone –salbactam (48%). Amikacin was more effective aminoglycoside than others.

Least active antibiotics were Amoxyclav (6%) and Netilmicin.(18%).

Table 1: Age wise distribution of *Pseudomonas aeruginosa* isolates from UTI patients.

Age in years	Total(n=81)	
	Number	Percentage
1-20	2	2.4
21-50	43	53.1
> 51	36	44.4

Among females, frequency of UTI was more among 21-50 years age group and among males elderly patients were more commonly affected. (Table 1)

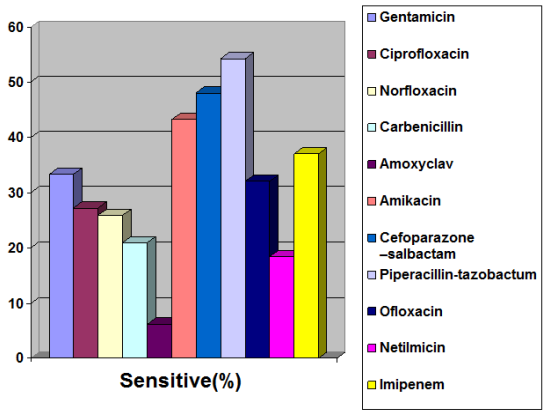
Table 2: Antimicrobial susceptibility of uropathogenic *Pseudomonas aeruginosa* isolates.

Antibiotics	Sensitive	Sensitive(%)
Gentamicin	27	33.3
Ciprofloxacin	22	27.2
Norfloxacin	21	25.9
Carbenicillin	17	20.9
Amoxyclav	05	6.17
Amikacin	35	43.2
Cefoparazone –salbactam	39	48.1
Piperacillin-tazobactum	44	54.3
Ofloxacin	26	32.1
Netilmicin	15	18.5
Imipenem	30	37

Table 3: The prevalence of multi-resistance of *Pseudomonas aeruginosa* isolates from UTI patients

No. of classes of antibiotics resisted	No. of resistant *Pseudomonas aeruginosa* isolates
1	0
2	3
3	19
4	22
5	37
>3	78

Seventy eight (97%) of all the isolates (Table 3) were multi-drug resistant. Multi-drug resistance in this study was defined as resistance of an isolate to at least one antimicrobial agent in at least three classes of antimicrobial agents tested.



Graph 1: Antimicrobial susceptibility of uropathogenic *Pseudomonas aeruginosa* isolates.

DISCUSSION

UTI represents one of the most common diseases encountered in medical practice, causing significant associated morbidity and occurring from neonate to the elderly. Studies have demonstrated geographic variation in etiologic characteristics of UTI and their resistance patterns to antibiotics. Therefore to successfully eradicate UTI by empiric treatment, knowledge of local etiologic agents and their antibiotic susceptibility is of great value. [9-11]

Among females, frequency of UTI was more among 21-50 years age group. Among sexually active young women the incidence of symptomatic UTI is high, and the risk is strongly associated with recent sexual intercourse, recent use of diaphragm with spermicide, and a history of recurrent UTI. [12] Among males frequency of UTI was more in people of more than 50 years, elderly patients were more commonly affected This is probably because with advancing age, the incidence of UTI increases among males due to prostate enlargement and neurogenic bladder. [13]

Pseudomonas aeruginosa is intrinsically resistant to several classes of antibiotics, thus limiting therapeutic options. Unfortunately, antimicrobial therapy is becoming even more problematic due to acquired or mutational resistance. A wide range of resistance mechanisms have been identified including multi-drug efflux pumps (which can confer resistance to, among others, cephalosporins ureidopenicillins, fluoroquinolones and aminoglycosides), aminoglycoside-modifying enzymes, b-lactamases, and target site modifications. Resistance to a particular class may be mediated by several mechanisms. For example, isolates may lose susceptibility to a carbapenem due to production of a carbapenemase, loss of the OprD porin, or via a multidrug efflux pump. Souli et al. Recently published data from 23 countries on the European Antimicrobial Resistance Surveillance System website. Resistance rates for aminoglycosides, carbapenems, quinolones and ceftazidime were 0-51.9%; 9-50.5%; 7.2-51.9% and 4-48.5%, respectively. [13, 14]

In our study resistance rates were slightly higher when compared with above study. It is remarkable that there are considerable differences among isolates in different geographic regions. The reasons for these differences in antimicrobial susceptibility are generally unclear but may be due to differences in antimicrobial utilization practices and the quality of infection control practices or public health infrastructures. [2]

Perhaps the most concerning development in recent years has been the emergence of carbapenemases in MDR strains of *P. aeruginosa.* Loss of the carbapenems, which have been the mainstay of therapy for infections caused by MDR strains, severely limits therapeutic options. [3] In our study also the rare of resistance to imipenem was high (67%)

Majority of the isolates were from hospitalized patients this can be explained by the following reasons. Several properties of *P. aeruginosa* favor persistence in the hospital environment. The bacterium is inherently resistant to several disinfectants such as biguanides and quaternary ammonium compounds through the action of multidrug efflux pumps. Furthermore, the ability to form biofilm on a range of inanimate surfaces also contributes to disinfectant resistance as well as impeding physical removal.[3,15]Similar results have been reported by other investigators. [16,17]

CONCLUSION

Given the potential severity of specific *P. aeruginosa* infections and problems in selecting optimal therapy for multidrug resistant (MDR) isolates, identification and implementation of effective strategies to prevent these infections are urgent priorities. [3] It is a matter of great concern that, majority of the isolates included in this study were found resistant to three or more antibiotics. Therefore treatment should be given only after culture and sensitivity have been performed which will prevent the misuse of antibiotics and reduce the development of drug resistance among bacteria.

CONFLICT OF INTERESTS

Declared None

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