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Antibiotic Resistance Pattern of *Pseudomonas aeruginosa* Isolated from Urinary Tract Infections

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***Pseudomonas aeruginosa* is one of the most important pathogen with well versed multifactorial virulence factors associated with UTIs. The incidences and the rate of antibiotics resistance has been increased during these years amongst *P. aeruginosa*. In the present study antibiogram of *Pseudomonas aeruginosa* revealed that the overall percentage of resistance among all isolates was high. Isolates showed 91.30% (21/23) resistance while only 8.69% (2/23) isolates found to be susceptible. Multi drug resistance (MDR) was found to be present among isolates. Ampicillin was found to be the least active antibiotic while Imipenem, Ceftazidime and Cefepime showing good range of inhibitory activity against isolates. Prudent and more justifiable reasons for antibiotics consumption both for prophylactic and therapeutic use against UTI should be critically weighed against the side effect of resistance development.**

Key words: *Pseudomonas aeruginosa,* UTI, Multi drug resistance (MDR).

Urinary tract infections (UTIs) are one of the most common bacterial infections affecting humans throughout their life span (Chang *et al*., 2006; Kucheria *et al.,* 2005). 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% (Jarvis and Martone, 1992; Williams and Schaeffer, 2004). UTIs can be classified as uncomplicated or complicated (Mittal *et al*., 2004, Nicolle, 2000). The recognized predisposing factors in complicated UTIs are anatomic defects, vesicouretic reflux (VUR), obstruction, surgery, metabolic diseases like diabetes mellitus and generalized immunosuppression especially in patients of organ transplant (Bonadio *et al.*, 1999). Catheterization of urinary tract is one of the most common factors which predispose the host to complicated UTIs (Saint and Chenoweth, 2003).

Pseudomonas aeruginosa, a gram negative aerobic bacillus is a common environmental organism that causes a wide variety of infections in humans (Woods, *et al.,* 1986; Owlia, *et al.*, 2001) and opportunistic infections. This bacterium is often encountered in urinary tract infection (UTI) worldwide and has shown varied antibiotic susceptibility patterns. *Pseudomonas aeruginosa* is the third most common pathogen associated with hospital-acquired catheter associated UTIs. Virulence of *P. aeruginosa* is multifactorial and has been attributed to cell associated factors like alginate, lipopolysaccharide (LPS), flagellum, pilus and non-pilus adhesins as well as with exoenzymes or secretory virulence factors like protease, elastase, phopholipase,

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pyocyanin, exotoxin A, exoenzyme S, hemolysins (rhamnolipids) and siderophores (Veesenmeyer, 2009) . In addition to elaboration of virulence factors, *P. aeruginosa* has a tendency to form biofilm on the surface of urinary catheters. Growth of *P. aeruginosa* begins in the form of micro colonies, which later coalesce together to form biofilm (Hoiby *et al*., 2001; Kuchma *et al*., 2005).

P. aeruginosa has been reported to continuously sense and respond to various environmental stimuli. While establishing in the urinary tract, presence of urine, which is a complex medium, exposes invading organism to conditions like varied osmolarity, pH and Tamm-Horsfall protein (THP) as well as variability of ions such as iron. Urine is subject to change in pH and osmolarity depending on host's diet and clinical situation. Environmental conditions prevalent in the host may bring about certain changes in organism like change in outer membrane protein (Omp) profile, porin size and adhesive ability operative through lectins which may play an important role in deciding the ultimate outcome of an infection (Mittal *et al.,* 2009). Such several virulence factors of *P. aeruginosa* which aid in its pathogenicity and resistance to antimicrobial agents. Effective management of *P. aeruginosa* resistance in urinary tract infection (UTI) by health personnel would require good background knowledge of the prevailing antimicrobial susceptibility patterns of the organism. Such information would be even more valuable in the rural health centers of the country where antimicrobial susceptibility reports more often not available. This study was therefore designed to ascertain the antibiotic susceptibility patterns of the *Pseudomonas aeruginosa* isolated from urinary tract infection patients from urology centers of Akola city.

MATERIALS AND METHODS

The present study includes examination of 114 samples of urine from urinary tract infected patients of various hospitals from Akola city. Fresh midstream urine samples were collected in sterile containers. Each sample was inoculated on Cystein Lactose Electrolyte Deficient agar plates using a calibrated loop delivering 0.01ml of the sample. The plates were incubated at 37°C for 24hrs. The plates showing $>10^5$ CFU/ml were considered as significant bacteriuria as per the Kass count (Kass, 1956). Further the isolates of *Pseudomonas* were identified by their morphological and biochemical characteristics.

The antibiotic sensitivity of *P. aeruginosa* isolates was tested using Muller Hinton agar by Kirby-Bauer method. The antibiotics used for the study were Ampicillin(10mcg), Amoxyclav(30mcg), Tetracycline(30mcg), Cephalexin (30mcg), Norfloxacin (10mcg), Ciprofloxacin (5mcg), Gentamycin (10mcg), Erythromycin(15mcg), Chloramphenicol (30mcg), Nalidixic acid (30mcg), Vancomycin (30mcg), Nitrofurantoin (50mcg) Ceftazidime (30mcg), Cefepime (50mcg) and Imipenem (10mcg).

RESULTS

Total of 23 (15.23%) *Pseudomonas aeruginosa* were identified with conventional methods from 151 isolates from urine samples. The antibiotic susceptibility patterns of all isolates were checked by Kirby Bauer method. It was found from results that most of the isolates showing multiple drug resistance (Table 1).

Table 1. Antibiotic resistance pattern among isolates of *Pseudomonas aeruginosa*

Antibiotics	% of isolates showing resistance (n= 23)
Ampicillin	91.30 (21)
Amoxyclave	82.60 (19)
Tetracycline	82.60 (19)
Ciprofloxacin	73.91 (17)
Nalidixic acid	73.91 (17)
Norfloxacin	69.56 (16)
Nitrofurantoin	69.56 (16)
Vancomycin	65.27 (15)
Cephalexin	56.52 (13)
Gentamycin	52.17 (12)
Chloramphenicol	47.82 (11)
Erythromycin	43.47 (10)
Ceftazidime	26.08 (6)
Cefepime	15.15 (5)
Imipenem	04.34 (1)

Figures in parenthesis indicates no. of isolates

The antibiogram of *Pseudomonas aeruginosa* revealed that the overall percentage of resistance among all isolates was high. Isolates showed 91.30% (21/23) resistance while only 8.69% (2/23) isolates found to be susceptible. Our study showed that *P. aeruginosa* was highly resistant to Ampicillin accounting 91.30% resistance rates. This trend was also occurred for Amoxyclave and Tetracycline (82.60%) which can be placed at second position in terms of resistance among isolates. Ciprofloxacin and Nalidixic acid were at third position showed 73.91% (17/23) while Norfloxacin and Nitrofurantoin were ranked at fourth accounting 69.56% (16/23) resistance among isolates of *Pseudomonas*. The resistance toward other antibiotics has also recorded to be more as Vancomycin, 65.27% (15/23), Cephalexin, 56.52% (13/23), Gentamycin, 52.17% (12/23), Chloramphenicol, 47.82% (11/23) and Erythromycin, 43.47% (10/23) as compared to Ceftazidime, 26.08% (6/23) and Cefepime, 15.15% (5/23). Though Imipenem was found to be most effective antibiotic but still *Pseudomonas* showed a fewer amount of resistance, 4.34% (1/23).

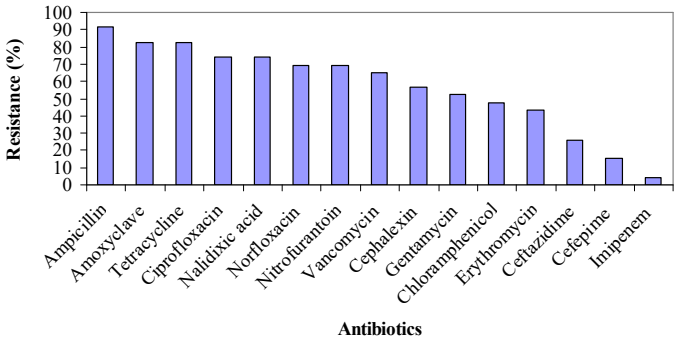

Fig. 1. Resistance pattern of *P. aeruginosa* in UTI

DISCUSSION

Administration of antibiotics as a prophylactic measure against UTI should always be analyzed critically and the benefits seen to be well above the side effects of which resistance is one of them, before choosing such a management option (Struelens, 1998). Prolonged or permanent urethral catheterizations are notable scenarios often encountered and their benefits need be periodically reviewed. Also, health personnel should be aware of the prevailing antimicrobial activity pattern of, at least, the locally available antibiotics against *P. aeruginosa* so as to make correct or near correct prescriptions in the absence of a comprehensive antimicrobial susceptibility report (Swedish- Norwegian Consensus Group, 1998). This would help reduce the external stimuli from inappropriate drug prescriptions towards the development and acquisition of resistance genes by bacteria.

The alarming resistance (91.30%) was recorded against Ampicillin among the isolates. Our findings showed similarity with other studies (Khan and Zaman, 2006; Enayattollah *et al.,* 2008; Manjunath *et al.,* 2011) who also reported resistance values from 90-99%.

Our data showed moderate activity has been exerted by Gentamycin among *P. aeruginosa* isolates. The resistance rate was 52.17% which is in concordance with the reports of Enayattollah *et al.,* (2008) reporting 52% resistance rate to Gentamycin. On the other hand Hasan *et al.,* (2007) documented much higher value (89.7%) than the present one.

In case of ciprofloxacin the resistance was recorded, 73.91% among *P. aeruginosa* isolates. This shows similarity with the results of other studies. For instance, in 2009 Khadri and Alzohary, reported 71% and in 2010 Mahesh *et al.,* reported 74.51%. the another member of fluroquinolone group, Norfloxacin found more effective as less resistance was recorded than Ciprofloxacin (69.56%). Our findings about Norfloxacin resistance among *P. aeruginosa* are much less than Manjunath *et al.,* (2011) who reported alarming resistance among *P. aeruginosa* (90%).

The Nalidixic acid also found to be ineffective among *P. aeruginosa* as it also showed 73.91% resistance among isolates. This value is in agreement with that of Tankhiwale *et al.,* (2004) who reported 73.8% resistance of this organism to Nalidixic acid. The high degree of resistance among *P. aeruginosa* to Amoxyclave has also recorded in our work (82.60%).

In present study *P. aeruginosa* showed 69.56% resistance to Nitrofurantoin. This is in agreement with the reports of Mahesh *et al.,* (2010) who found 66.67% of isolates resistance to Nitrofurantoin. On the other hand the results of present study disagree with the findings of Behroozi *et al.,* (2010) who reported only 26% of the resistance to Nitrofurantoin among these isolates.

In our study the resistance to tetracycline shown by isolates of *P. aeruginosa* found higher (82.60%) than the previous report (Khadri and Alzohary, 2009, 49%). While according to Akram *et al.,* (2007) tetracycline was totally ineffective against *Pseudomonas aeruginosa*.

The Cephalexin tested in the present study showed 56.62% resistance. This value is higher than the recent findings of Manjunath *et al.,* (2011) who came across only 28% of resistant strains of *P. aeruginosa.* While resistances to other antibiotics like chloramphenicol (47.82%), Vancomycin (60.60%), Ceftazidime (26.08%) and Cefepime (15.15%) were found to be less as compared to other studies (Khadri and Alzohary., 2009; Enayattollah *et al.,* 2008; Ullah *et al.,* 2009; Akram *et al.,* 2009).

Imipenem was found to be the most effective drug against *P. aeruginosa*. But even though a small degree (4.34%) of resistance has occurred among some strain which also can be an indication about future that this drug may also become ineffective in the trend of increasing resistance patterns. Literature by Khadri and Alzohary, (2009) and Mahesh *et al.,* (2010) also supports the present results. This also further supports the fact that, prolonged contact of antibiotics with bacteria stimulates them to develop resistance and occurrence which can be controlled if the duration of contact is adequately and considerably shortened through prudent and more justifiable reasons for antibiotics prescriptions and intake.

In conclusion, this study has shown that, the rate of antibiotics resistance against *P. aeruginosa* is high. Prudent and more justifiable reasons for antibiotics consumption both for prophylactic and therapeutic use against UTI should be critically weighed against the side effect of resistance development. Furthermore, antimicrobial susceptibility testing should be performed as a basic laboratory procedure among hospitals and clinics so as to aid in the choice of antibiotics prescriptions.

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