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Original Article

Prevalence and Antibiotic sensitivity pattern of Pseudomonas aeruginosa; an emerging nosocomial pathogen

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ABSTRACT

To determine current trends of antibiotic resistance among clinically significant Pseudomonas aeruginosa strains causing various nosocomial and community acquired infections. A total of 158 clinical isolates of P. aeruginosa isolated in the Department of Microbiology, J.J.M.Medical College, Davangere were studied for its prevalence and susceptibility profiles. Most of the isolates were from pus (72) followed by urine (26), sputum (20), blood (16) and antral wash (10).The least number of isolates were obtained from endotracheal tube aspiration (6),aural swab(4), pleural fluid (2) and corneal scraping (2). P. aeruginosa infections were higher in males than females. The maximum numbers of isolates were from patients of age group 41-60 years. The in vitro sensitivity pattern of 158 isolates of P. aeruginosa showed highest sensitivity to imipenem (94.30%) followed by tobramycin (72.15%), amikacin (67.09%), piperacillin(64.55%) carbenicillin (62%), ceftazidime (59.5%) cephotaxime (53.16%), ciprofloxacin (50.63%), ofloxacin (39.24%), Gentamycin (31.65%) and Ceftriaxone (31.65%). The results indicate that P. aeruginosa is the most common gram-negative bacterium responsible for the nosocomial as well as community acquired infections. The excessive use of antibiotics has not only led to treat the P. aeruginosa infections but also the emergence of antibiotic resistance. The development of multidrug resistant P.aeruginosa is currently one of the greatest challenges to the effective management of infections. This suggests that in addition to curative measures promptly preventive measures such as hygienic as well as better hospital and postoperative care in administration should be adopted.

1. Introduction

Pseudomonas aeruginosa is a gram negative, asporogenous, obligate aerobic, motile and oxidase positive bacilli, usually found in the intestinal tract, water, soil and sewage. 1, 2,3,P. aeruginosa accounts for a significant proportion of nosocomial infections.4,5 A general problem with nosocomial infections is the tendency of nosocomial pathogens to acquire new antibiotic resistance.6,7 Multidrug-resistant (MDR) strains of P. aeruginosa are often isolated among patients suffering from nosocomial infections, particularly those in the intensive care unit (ICU).8 Thus, infections caused by P. aeruginosa are particularly problematic because the organism is inherently resistant to many drug classes and is able to acquire resistance to all effective antimicrobial drugs.9 As an opportunistic infectious pathogen, P. aeruginosa can often lead to life-threatening diseases. For example, P. aeruginosa is the main cause of mortality in cases of polymicrobial

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bacteraemia,10 and the second most common bacterium causing sepsis in the ICU.11 In addition, *P. aeruginosa* has been implicated in urinary tract infections, burn wounds, ventilator-associated pneumonia and multi-organ system failure.12-15

Therefore, it was important to study the susceptibility patterns of *P. aeruginosa* isolates to some commonly used antibiotics. Use of the antibiogram as an epidemiological indicator for our isolates can help us make the best use of these antimicrobial agents in the management of *P. aeruginosa* infections.

Aims and Objectives:

Despite the use of potent antibiotics still high mortality exists in case of *P. aeruginosa* infections. Nosocomial multidrug resistant P. aeruginosa is an important health care problem worldwide that prolongs the duration of hospitalization, thereby increasing the cost of patient care. Considering the problem of *P. aeruginosa* infection and multidrug antibiotic resistance in it, the present study has been carried out to determine current trends of antibiotic resistance among *P. aeruginosa* strains causing various nosocomial and community acquired infections.

2. Materials and Methods:

A total of 158 *P. aeruginosa* isolates from clinical samples such as pus, urine, sputum, blood, antral wash, aural swab, endotracheal tube aspirates and pleural fluid were identified and characterized on the basis of colony morphology and biochemical reactions according to Bergey's Manual of Determinative Bacteriology, 9th edition. All the isolates were tested for antibiotic sensitivity pattern by Kirby Bauer disc diffusion method. P. aeruginosa (ATCC27853) was used as a control strain. All the isolates were tested against Imipenem (10ug), tobramycin, piperacillin, ofloxacin (5ug), ciprofloxacin (5ug), amikacin (30ug), gentamicin (30ug), cephotaxime (30ug), ceftazidime (30ug), ceftriaxone (30ug) and carbenicillin (100ug). The plates were incubated at 37ºC for 16 -18 hours. After overnight incubation, plates were examined and zones of inhibition were measured. Results were interpreted on the basis of zone sizes, as sensitive, intermediate, resistant according to National Committee for Control Laboratory standards (NCCLS, 1993).

3. Results

A total of 158 isolates of P. aeruginosa isolated from various specimens (114 were isolated from males and 44 from females) are included in the present study. Out of these 158 samples of P. aeruginosa, 72 were isolated from pus, 26 from urine, 20 from sputum,16 from blood, 10 from antral wash,6 from endotracheal tube aspirates, 4 from aural swab and 2 each from pleural fluid and corneal scrapings (Table 3). Among 72 isolates of pus, 49 (68%) were from males and 23 (32%) were from females. Among 26 isolates of urine 18 (69.23%) were from females and 8 (30.77%) from males. Out of 20 isolates from sputum, 11 (55%) were from males and 9 (45%) were from females. In case of pus prevalence of P. aeruginosa was more in males (68%) as compared to females (32%). In case of urine the prevalence was higher in females (69.23%) as compared to males (30.77%).

Figure 1

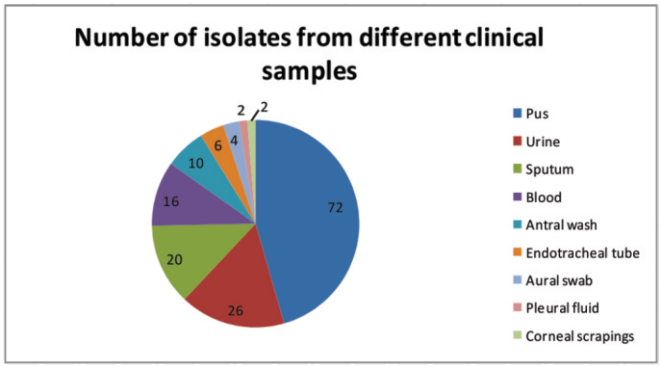
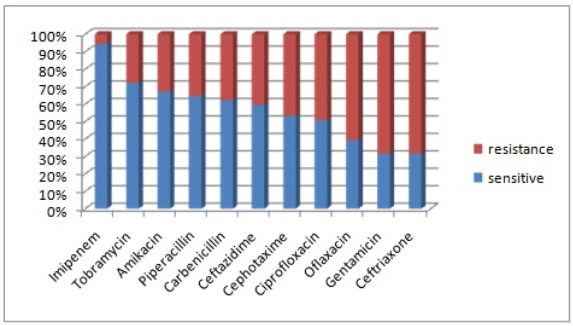


Table 1 shows the susceptibilities of the 158 isolates. Three aminoglycosides, that is, tobramycin, Amikacin, and gentamycin were tested against P. aeruginosa. Out of these three aminoglycosides, amikacin showed 67.09% susceptibility, tobramycin showed 72.15% sensitivity and gentamycin showed 35.44% sensitivity. Among the fluoroquinolones, ciprofloxacin was found effective against 50.63% isolates and ofloxacin showed 39.24% sensitivity. Among 3rd generation cephalosporins, ceftazidime showed 59.5% sensitivity, Cefotaxime showed 53.16% sensitivity and ceftriaxone showed 31.65% sensitivity. Piperacillin showed 64.55% sensitivity while carbenicillin showed sensitivity to 62% of the isolates. Imipenem was found to be the most effective antibiotic among all the antibiotics used in this study. The percentage of sensitive organisms was 94.3%, whereas, only 5.7% were resistant to imipenem.

Table 1 - Sensitivity pattern of Pseudomonas aeruginosa isolated from clinical samples



4.Discussion

In our study a significant increase was found in the number of P. aeruginosa strains isolated from pus followed by urine and sputum. Similar pattern of isolation of *P.aeruginosa* from pus, urine, sputum, blood, ear, nose, wound and other infection sites was reported by some other studies.16, 17 In the present study, uropathogenic *P.aeruginosa* was found higher in females than males. The one reason may be that *P.aeruginosa* may be a common inhabitant of lower intestinal tract and in female the distance between anal and vaginal opening is small, thus *P.aeruginosa* through fecal contamination invade and colonized urinary tracts causing

infection. Longer stay in the hospital increases the colonization of skin and environment of the patient and may be responsible for higher incidence of Urinary catheter related infections. 18 In the present study, endotracheal tube aspirates, aural swabs, pleural fluid and corneal scrapings samples were so less to comment on, this may be due to the low number of endotracheal tube aspirates, aural swabs, pleural fluid and corneal scraping samples sent from wards and OPD's during the study period. *P. aeruginosa* is currently one of the most frequent nosocomial pathogen and the infections due to this organism are often difficult to treat due to antibiotic resistance.19

The mechanisms of resistance to antibiotics include reduced cell wall permeability, production of chromosomal and plasmid mediated ß-lactamases20, aminoglycoside-modifying enzymes21 and an active multidrug efflux mechanism22. In the present study, the sensitivity pattern of 158 clinical isolates of P. aeruginosa, showed highest resistance to ceftriaxone (68.35%) and gentamicin (64.66%). The next most resistant antibiotics were ofloxacin (60.76%), ciprofloxacin (49.37%), cephotaxime (46.84%), ceftazidime (40.5%), carbenicillin (38%), piperacillin (35.45%), amikacin (32.91%), tobramycin (27.85%) and imipenem (6.7%). Among most commonly used cephalosporins, ceftazidime and cephotaxime proved to be most effective against P.aerugionsa, with resistant rate of (40.5%) and (46.84%), respectively. This finding is consistence with other findings.23 An important striking feature found in this study was increased resistance to gentamycin (66%) whereas the strains were sensitive to amikacin and tobramycin. Various workers have also reported the increased sensitivity of P. aeruginosa strains to amikacin and resistance to gentamicin.16, 24 Majority of the *P. aeruginosa* strains from the present study were multiple antibiotic resistant, especially the isolates recovered from pus. Such multiple resistance patterns have also been documented earlier 9. Resistance means that people cannot be effectively treated and they remain ill for longer period of time. It also means that epidemics are prolonged and thus that there is a greater risk of infection to others. The development of resistance is accelerated when antimicrobials are misused. Despite the use of potent antibiotics still high mortality exists in case of *P. aeruginosa* infections. Nosocomial multidrug resistant *P.aeruginosa* is an important health care problem worldwide. Antimicrobial resistance prolongs the duration of hospitalization, thereby, increasing the cost of patient care. There are multiple factors, which contribute to the global spread of resistance. Decreasing unnecessary antibiotic use, treating with narrow spectrum agents, improving compliance with therapy, decreasing use of antibiotic in animal and agriculture, and improving infection control all have a role in confronting this problem.

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