Original Article

Infections by *Pseudomonas aeruginosa* and Antibiotic Resistance Pattern of the Isolates from Dhaka Medical College Hospital

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Abstract

Pseudomonas aeruginosa **is one of the most common gram-negative microorganisms identified in the clinical specimens of hospital admitted patients. This was a retrospective study done among the patients attending Dhaka Medical College Hospital during January to December, 2006. A total 294 strains of** *P. aeruginosa* **were isolated of which 206 (70%) were from admitted patients and 88 (30%) from outpatients. Some 175 (60%) of the isolates were from males while 119 (40%) from females. Majority of the patients (141, 41.2%) were aged between 21-40 years and 102 (34.7%) were below 20 years. A significant proportion (about 45%) of the patients were from casualty wards, surgical outdoor, ear-nose-throat outdoor and burn unit. Four of the clinical specimens including wound swab, pus, aural swab and urine comprised of 279 (95%) of the total samples. The bacteria isolated were identified by colony morphology, microscopy and relevant biochemical tests. Antimicrobial sensitivity pattern was tested using standard guidelines. Almost all of the** *P. aeruginosa* **isolates were resistant to cefixime (93.3%) and co-trimoxazole (93.5%), majority were resistant to ceftazidime (86.8%), gentamycin (77.3%) and ciprofloxacin (75.5%). The result of the study shows that imipenem is the most effective drug against** *P. aeruginosa,* **followed by amikacin and ciprofloxacin.**

Key words: *Pseudomonas aeruginosa*, **Antimicrobial Resistance**

Introduction

In the second half of the last century, *Pseudomonas aeruginosa* has become an important hospital pathogen.[1] It needs minimal nutritional requirements for growth. It is a commensal of human microflora in healthy people. This rate of commensalism increases gradually with the increased duration of hospital stay.[2] This bacteria is frequently isolated as an opportunistic pathogen in recurrent infections of hospitalized patients and has been isolated from a number of sites in the hospital environment.[3,4] *P. aeruginosa* is the most important, resistant and dangerous organism infecting the burn patients.[5] It is the fifth common pathogen among hospital microorganisms and causes 10% of all hospital-acquired infections.[6] In Bangladesh, it ranks third and causes a wide range of infections.[7] Recently this bacteria has become increasingly resistant to various antimicrobial agents.[8,9] With the widespread use of quinolones, both in the hospital and in the community setting, drug-resistant *P. aeruginosa* isolates has emerged and continues to escalate rapidly.[10] Over a period of time, we observed an increase in number of *P. aeruginosa* among our laboratory isolates. So, we decided to carry out a retrospective study to see infections caused by *P. aeuriginosa* and susceptibility pattern of the organism isolated from different clinical specimens at Department of Microbiology, Dhaka Medical College.

Methods

The study was conducted in the department of Microbiology, Dhaka Medical College (DMC) during the period of January to December, 2006. The cases were from the inpatients' and outpatients' departments of DMC Hospital. The various clinical specimens included woun swab, urine, pus, aural

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swab, etc. were cultured and the isolated organisms were identified by colony morphology, microscopic examination and relevant biochemical tests according to standard laboratory methods.[8] Antimicrobial sensitivity test was done by disk diffusion method following the recommendations of National Committee for Clinical Laboratory standards (NCCLS), US, against a panel of anti-psudomomal antimicrobials including imipenem, co-trimoxazole, ciprofloxacin, nalidixic acid, ceftazidime, doxycycline, gentamycin, ceftriaxone, cefixime, ofloxacin, amikacin and azithromycin of standard strengths.

Result

A total of 294 *P. aeruginosa* were isolated of which 206 (70.0%) were from indoor and 88 (30.0%) were from outdoor patients. Some 175 (60.0%) of the patients were males and the rest 119 (40.0%) were females. Most of the patients (121, 41.2%) were aged between 21-40 years, while 102 (34.7%) were below 20 years. (Table I)

Table I: Age distribution of cases

Age (in years)	Number	Percentage
<20	102	34.7%
21-40	121	41.2%
41-60	54	18.3%
>60	17	5.8%
Total	294	100%

About 95% of the total samples were wound swab, pus, urine, and aural swab. Nearly half (129, 44.0%) of the *P. aeruginosa* was isolated from wound swab only, among which 13% were from the casualty wards, 11% from surgical outdoor, 10% from burn unit and the rest from other locations. Majority of the samples included were wound swab (129, 43.88%), urine (86, 29.25%), pus (33, 11.23%) and aural swab (31, 10.54%). Almost all of the aural swabs (29, 93.55%) were collected from Out Patients Department. (Table II)

The resistance rate (%R) of *P. aeruginosa* isolated from different specimens to different antimicrobials varied greatly. Organisms isolated from wound swab and pus samples were more resistant to azithromycin (100%), cefixime (93.3%), ceftazidime (86.8%), ceftriaxone (86.1%) and ciprofloxacin (75.5%). The only drug found least resistant (3.1%) was imipenem. Among the organisms isolated from aural swabs, the rate of resistance was 9.7% for amikacin and 13.3% for

ciprofloxacin. All (100%) of the *P. aeruginosa* isolated from tracheal aspirates were resistant to ciprofloxacin, ceftazidime, ceftriaxone, cefixime and amikacin. The resistance pattern of cotrimoxazole varied from 33% to 94% in different clinical specimens. (Table III)

Table II: Isolation of *Pseudomonas aeruginosa* from different clinical specimens

Name of specimen	Number of *P. aeruginosa* isolated	Percentage
Wound swab	129	43.88%
Urine	86	29.25%
Pus	33	11.23%
Aural swab	31	10.54%
Tracheal aspirate	05	1.70%
Sputum	03	1.02%
Others	07	2.38%
Total	294	100.0%

Table III: Resistance pattern (% R) of *Pseudomonas aeruginosa* isolates

Antimicrobials	Wound swab & Pus (n=162)	Urine (n=86)	Ear swab (n=31)	Tracheal aspirate (n=5)	Sputum (n=3)	Others (n=7)
Imipenem	3.1	9.5	NT	0	0	0
Ciprofloxacin	75.5	72.2	13.3	100	0	33.3
Nalidixic Acid	66.7	82.6	100	NT*	NT*	100
Ceftazidime	86.8	71.2	48.3	100	50	66.7
Doxycycline	76.7	64.9	83.3	60	33.3	66.7
Gentamycin	77.3	77.3	63.5	48.0	80	33.3
Ceftriaxone	86.1	68.8	51.7	100	66.6	66.7
Cefixime	93.3	62.7	86.2	100	66.6	50
Ofloxacin	79.2	76.9	NT*	75	0	0
Amikacin	22.7	22.6	9.7	100	0	0
Azithromycin	100	100	NT*	NT*	NT*	100
Co-trimoxazole	93.5	86.5	85.2	80.0	33.3	66.6

* NT- Not tested

Discussion

There is mounting evidence that proportion of resistance (%R) among *P. aeruginosa* isolates are increasing steadily. The rise in the rate of antimicrobial resistance to a specific antibiotic was greatest for ciprofloxacin, showing an absolute increase of 16%.[9] In addition to being intrinsically resistant, it can acquire resistance trait during therapy through an array of mechanisms.

In the present study, isolates of *P. aeruginosa* from wound swab and pus were found relatively more resistant than those from other specimens. The rate of resistance (%R) for azithromycin was 100%, cefixime 93.3%, cefrtiaxone and ceftazidime was 86%, ciprofloxacin 75.5% and amikacin 22.7%. Previous study in 2000-2001, in Bangladesh, showed that %R of *P. aeruginosa* to co-trimoxazole was 92%, ciprofloxacin 62.5%, cephalexin 100%, ceftriaxone 75% and ceftazidime 37%.[7] However, in another study, the resistance to amikacin was 2%, ceftriaxone 43%, ceftazidime 25% and ciprofloxacin 50%.[9] The number of multi-drug resistant strains has increased in recent years. An Iranian study in 2003 had their resistance pattern worse than this study, where the %R to gentamycin was 93.7%, ceftazidime 96%, amikacin 93% and ciprofloxacin 86%.[11] A five-year retrospective Indian study, from 1997-2002, found resistance pattern of *P. aeruginosa* as amikacin 52%, gentamycin 69%, ciprofloxacin 89%, and ceftazidime 62%, which shows that the trend of resistance was also increasing. Taneja in 2004 found the pattern of resistance about 90% each for ceftazidime and amikacin while 45 % for ciprifloxacin.[12]

Regarding the urine samples, rate of resistance of the organism to azithromycin was 100%, nalidixic acid 82.6%, ciprofloxacin 72.2%, ceftazidime 71.2%, ceftriaxone 68.8% and gentamycin 63.5%. Another study in Bangladesh showed the %R to ciprofloxacin 29%, ceftazidime 12%, ceftriaxone 20% and gentamycin 37%.[9] The study of Shahnaz in 2002 found %R of *P. aeruginosa* isolated from urine as ceftazidime 94%, gentamycin and ciprofloxacin 90% and ceftriaxone 85%.[13] The increased %R to ciprofloxacin is frustrating. Some 11% specimens of the current study were aural swab, >90% of which was from the ENT OPD. The %R to co-trimoxazole was reported 85% in treating ear infection as found by Wadud *et al*.[9] The rate of resistance as observed in the present study to amikacin was 9.7%, to ceftriaxone and ciprofloxacin were 52% and 13%, respectively, which was 21% and 7% respectively in the previous study by Wadut *et al*.[9]

The resistance pattern of *P. aeruginosa* found in tracheal aspirate was very alarming, which ranged from 60-100%. It might be due to the fact that the patients were aged and were suffering from chronic illness. A high %R to antibiotics indicates the improper use of antibiotics in the hospital.[3] The result of this study indicates that commonly used drugs can no more be used as empirical therapy for suspected pseudomonad infections.

The number of patients admitted far exceeds the treatment facilities available in Dhaka Medical College Hospital. So, it can be concluded that every effort should be made for routine microbiological surveillance to reduce infections. It is also necessary to carry out a large-scale study with newer antimicrobials. This will hopefully reduce the resistance pattern and thus the treatment cost, and initiate quality patientcare.

Acknowledgement

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