Antibiotic Sensitivity Pattern of Bacterial Isolates from Different Clinical Specimens: Experience at NICVD, Dhaka

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Abstract

Background: *Infectious diseases are among the leading causes of death and sometimes curable. Bacteria are the most common etiology in hospitalized patients. The objective of this study was to evaluate the incidence of bacterial infections and their pattern of susceptibility to antibiotics in moderate and severe infections in patients admitted at NICVD hospital.*

Methodology: *The study was performed in the apical teaching hospital of Bangladesh situated at Dhaka in the first half of 2012. Patients admitted in medical wards and medical ICU, suffering from moderate and severe infections were studied. Clinical evaluation, routine and specific investigations were done in each case. Microbiological samplings were tried on day 1, after completion of antibiotic therapy or in between as required. Aerobic bacterial culture and sensitivity tests were done.*

Result: *A total of 274 cases were studied of which male (67.5%) were predominant than female (32.5%). The highest number of patients were in the age group of 30-60 years (53.6%) followed by 10-30 years (24.5%) and more than 60 years (12.8%). The mean age with standard deviation was 39.15±19.07 years (range 1-90 years). Most common isolated bacteria was the* Pseudomonas *species (14.2%) followed by* Escherichia coli *(13.5%),* Staphylococcus saprophyticus *(6.9%) and* Staphylococcus aureus *(2.2%). From these specimens* Pseudomonas *species (31.5%) was isolated mostly from pus.* E. coli *was found most commonly in pus (16.3%) and urine (14.1%).* Staph saprophyticus *(13.0%) and* Staphylococcus aureus *(4.3%) were both found most commonly in pus.* Pseudomonas *species was 100% resistant to Penicillin, Amoxycillin and Vancomycin. It was found that* Pseudomonas *species was still more than 90% sensitive only to Imipenem.* Escherichia coli *was more than 80% sensitive to only Imipenem and Amikacin.* Staphylococcus aureus *was sensitive to only Imipenem and Cephalexin.*

Conclusion: *In this study* Pseudomonas *species and* Escherichia coli *are the most common isolated bacteria in this Institution. Most of the antibiotics are resistant to these two bacteria.*

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Introduction:

Many bacterial species isolated from different clinical specimens have evolved one or more resistance mechanisms to each of the major classes of antimicrobial agents.[1] Many of these resistance mechanisms are widespread among common pathogens and cause considerable concern in several clinical situations in which treatment options have become very limited. Cardiovascular intervention is very critical to handle. A great cardiovascular surgery by an expert surgeon can go in vein due to the infection and will go more serious if that infection is caused by resistant one. It is a great concern that extended-spectrum â-lactamase-producing *Escherichia coli* and *Klebsiella pneumoniae* are increasingly reported[2,3,4] and have been associated with high mortality in adults.[5] These ESBL are frequently resistant to broad-spectrum cephalosporins.[1] Similarly, the incidence of Methicillin-resistant Staphylococcus aureus (MRSA) and Vancomycin-resistant *Enterococcus faecium* has increased noticeably.[6] Even among new antibiotic classes like oxazolidinones and the ketolides, there are reports of resistant bacteria.[1]

Emerging resistance complicates the treatment of infections in cardiovascular diseased patients, for whom the selection of antibiotics available to treat infection is already more limited. Consequently, there is an ongoing requirement for surveillance programs both to monitor current resistance trends

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and to detect resistance to agents. The purpose of the current study was to define the current levels of resistance to predominant pathogens encountered in different infections at National Institute of Cardiovascular Disease (NICVD), the tertiary care hospital.

Methodology:

This retrospective study was conducted to find out the causative agents of different infections along with their antibiotic sensitivity pattern. All patients at any age with both sex admitted at NICVD from January 2012 to June 2012 for a period of 6(six) months were enrolled for this study. Different samples were received for microbiological examination. The most common specimen were blood, urine, pus, pericardial fluid, swab from wound, conjunctiva and throat. The specimens were inoculated onto appropriate culture media. Targeted species were identified following standard procedures. Antibiotic sensitivity test was performed by disc diffusion method (Kirby-Bauer's technique) using commercially available discs (HiMedia, India) according to appropriate antibiotics panel and the results were recorded following the instruction of manufacturer. These commonly test disks used included Amoxicillin, Amikacin (30 mcg), Ciprofloxacin (5 mcg), Cotrimoxazole (1.25/23.75 mcg), Ceftriaxone (30 mcg), Cephalexin (30 mcg), Ceftazidime (10 mcg), Gentamycin (10 mcg), Tobramycin (10 mcg), Imipenem, Netilmycin, Vamcomycin (5 mcg).

Results:

A total of 274 cases were studied of which male were predominant than female which were 185(67.5%) cases and 89(32.5%) cases respectively. The highest number of patients was in the age group of 30-60 years which was 147(53.6%) cases followed by 10-30 years and more than 60 years which were 67(24.5%) cases and 35(12.8%) cases respectively. The mean age with standard deviation was 39.15±19.07 years (range 1-90 years) (Table 1).

Most common isolated bacteria was the *Pseudomonas* species which was 39(14.2%) followed by *Escherichia coli*, *Staphylococcus saprophyticus and Staphylococcus aureus* which were 37(13.5%), 19(6.9%) and 6(2.2%) respectively (Table II).

Table-I

Distribution of Study Population According to Age and Sex (n=274)

Age Group	Sex		Total
	Male	Female	
<10	17(9.2%)	8(9.0%)	25(9.1%)
10-30	38(20.5%)	29(32.6%)	67(24.5%)
30-60	103(55.7%)	44(49.4%)	147(53.6%)
>60	27(14.6%)	8(9.0%)	35(12.8%)
Total	185(100.0%)	89(100.0%)	274(100.0%)

* Pearson Chi-Square has been done to see the association.
*p value= 0.140
*Mean age ± SD= 35.15±19.07

Table-II

Distribution of Different Isolated Bacteria (n=274)

Isolated Bacteria	Frequency	Percentage
Pseudomonas	39	14.2
Escherichia coli	37	13.5
Staphylococcus saprophyticus	19	6.9
Staphylococcus aureus	06	2.2
Streptococcus pyogenes	01	0.4
No growth	172	62.8
Total	274	100

Most common specimen was urine which was 99(36.1%) cases followed by pus, blood and wound swab which were 92(33.6%) cases, 35(12.8%) cases and 32(11.7%) cases respectively. From these specimens *Pseudomonas* species was isolated mostly from pus which was 29(31.5%) cases. *E. coli* was found most commonly in pus and urine as well which were 15(16.3%) cases and 14(14.1%) cases respectively. *Staph saprophyticus* and *Staphylococcus aureus* were both found most commonly in pus which was 12(13.0%) cases and 4(4.3%) cases respectively (Table III).

Pseudomonas species was 100% resistant to penicillin, amoxycillin and Vancomycin and ~50% resistant to Cotrimoxazole, Cefuroxim, Ceftriaxone, Piperacillin, Azythromycin, Cephalexin, Netelmycin and Pfloxacillin. It was found that *Pseudomonas* species was still more than 90% sensitive only to imipenem. *Escherichia coli* was more than 80% sensitive to only imipenem and Amikacin. *Staphylococcus saprophyticus* was sensitive in Imipenem, Novobiocin and Netelmycin. *Staphylococcus aureus* was sensitive to only Imipenem and Cephalexin.

Table-III

Distribution of most frequently received specimens according to isolated bacteria

Isolated Bacteria	Pus	Urine	Blood	Wound Swab	Throat Swab	Pericardial fluid
Pseudomonas species	29(31.5%)	3(3.0%)	1(2.9%)	5(15.6%)	0(.0%)	0(.0%)
E. coli	15(16.3%)	14(14.1%)	1(2.9%)	5(15.6%)	0(.0%)	0(.0%)
Staph saprophyticus	12(13.0%)	3(3.0%)	0(.0%)	4(12.5%)	0(.0%)	0(.0%)
Staphylococcus aureus	4(4.3%)	0(.0%)	0(.0%)	2(6.2%)	0(.0%)	0(.0%)
Streptococcus pyogenes	0(.0%)	0(.0%)	0(.0%)	0(.0%)	1(25.0%)	0(.0%)
No growth	32(34.8%)	79(79.8%)	33(94.3%)	16(50.0%)	3(75.0%)	1(100.0%)
Total	92(100.0)	99(100.0)	35(100.0)	32(100.0)	4(100.0)	1(100.0)

* Pearson Chi-Square has been done to see the association which is corrected by Fisher's Exact Test.
*p value (95% CI) = 0.026 (0.024-0.027)

Table-IVa

Distribution of isolated bacteria with sensitivity pattern

Bacteria name	Tobra	Genta	Ceftazi	Cotrimo	Cipro	imipe	cefuro	Ceftri	Amika
Pseudomonas	66.7	57.1	77.1	46.2	62.3	94.4	9.7	51.5	85.7
E coli	-	48.5	68.8	50.0	37.1	91.2	24.2	45.5	84.8
Staph saprop	-	71.4	53.3	75.0	35.3	92.3	33.3	60.0	64.3
Staph aureus	-	20.0	50.0	00	20.0	80.0	00	33.3	66.7
Strep pyogenes	-	-	100.0	-	00	-	100	100	100
P value	-	0.25	0.46	.74	.06	.79	.04	.73	.42
95% CI interval	-	.207-.311	.404-.523	.697-.800	.033-.091	.748-.843	.022-.073	.677-.782	.368-.486

*Tobra= tobramycin, genta= gentamycin, ceftazi= ceftazidime, cipro= ciprofloxacin, imipe= imipenem, cefuro= cefuroxim, ceftri= ceftriaxone, amika= Amikacin, *Staph aureus= Staphylococcus aureus, Staph saprop= Staph saprophyticus, E. coli= Escherichia coli*

Table-IVb

Distribution of isolated bacteria with sensitivity pattern

Bacteria name	Piper	Penicil	Azyth	Amoxy	Cephale	Clarith	Vancom	Novobio	Netel	Pfloxaci
Pseudomonas	9.1	00	40.0	00	14.3	-	00	-	40.0	23.5
E coli	6.7	00	50.0	00	9.5	-	00	-	83.3	11.8
Staph saprop	9.1	16.7	23.1	50.0	50.0	50.0	42.9	100	100	8.3
Staph aureus	00	-	50.0	00	100	-	00	-	-	00
Strep pyogenes	-	00	00	100	-	-	00	-	-	-
P value	1.0	.22	.65	.001	.033	-	.52	-	.20	.56
95% CI interval	.989-1.00	.173-.272	.601-.713	.0001-.011	.012-.054	-	.466-.585	-	.153-.248	.500-.617

*Piper= Piperacillin, penicil= penicillin, azyth= azithromycin, cephale= cephalexin, clarith= clarithromycin, vancom= Vancomycin, novobio= novobiocin, netel= netelmycin, pfloxaci= pfloxacin, *Staph aureus= Staphylococcus aureus, Staph saprop= Staph saprophyticus, E. coli= Escherichia coli*

Discussion

The antibiotic sensitivity pattern of organisms is changing very rapidly over a short period.[7] It is particularly true for developing countries like Bangladesh where antibiotics are prescribed irrationally not only by the medical practitioners but the antibiotics are also purchased directly from the chemists like medicine shop keepers without prescription. This type of scenario is also reported by Palikhe[8] in Nepal. It has been advised that clinicians should be aware of the rising resistance of bacteria to commonly prescribed antibiotics as well as the profile of antibiotic resistance.[9] Therefore, periodic evaluation of sensitivity pattern is essential for rational and appropriate use of antibiotics.[10]

In this study male (67.5%) was predominant than female (32.5%). The specimen was collected from the referral cardiovascular tertiary care hospital in Bangladesh and regarding this cardiovascular diseases majority of the patients was male. That's why the findings of this study are correlated with this scenario. It is seen that the highest number of patients were in the age group of 30-60 years (53.6%) followed by 10-30 years (24.5%) and more than 60 years (12.8%). The mean age with standard deviation was 39.15±19.07 years (range 1-90 years). The overall growth positive rate (37.2%) in this study was in agreement with previous studies in Nepal.[11] In this study the most common isolated bacteria were *Pseudomonas* species (14.2%) followed by *Escherichia coli* (13.5%), *Staphylococcus saprophyticus* (6.9%) and *Staphylococcus aureus* (2.2%). It is also found that *Staphylococcus saprophyticus* (13.0%) and *Staphylococcus aureus* (4.3%) were both found most commonly in pus. These findings agree with those reported by Anguzu and Olila[12] on different infections where the most common wound contaminant was *Pseudomonas* species and *Staphylococcus aureus*. The findings also agree with those of Buwembo[13] who identified *Staphylococcus aureus* as the commonest causative agent of potentially contaminated wounds. Nasal carriage of S. aureus is an important risk factor for infection of surgical site as the organism is a normal flora in the nostrils.[7] Again; it is found that with the disruption of natural skin barrier *Staphylococcus aureus*, which is a common bacterium on surfaces of the body, can easily find the way into breach of the skin surfaces. The high prevalence of *Pseudomonas* infection may be because it is an exogenous source of infection and it is assumed that infection with this organism may also be due to contamination from the hospital environment.[12]

It is found that 62.8% specimen had no bacterial growth. This could be due to prior use of antibiotic, or may be the normal healing process where the bacteria have been overpowered by body's defense mechanism, antimicrobial activity in patients circulation since all of them had been on antibiotic therapy post operatively at time of collecting the samples or adequate nursing care like use of antiseptics for cleaning the wounds.[12] It is also possible that some organisms could have been anaerobic bacteria that were missed as cultures were incubated aerobically. This condition could not therefore support growth of such organisms.[12]

In this study the most common specimen was urine (36.1%) followed by pus (33.6%), blood (12.8%)

and wound swab (11.7%). It is interesting that *E. coli* was found most commonly in pus (16.3%) and next to this is the urine (14.1%). Rahman et al[14] has reported similar finding. Almost similar findings was reported by Shrestha et al[15] in Nepal and observed that bacterial growth in 35.7% of the urine samples collected from all age groups. On the contrary, this was much higher than this present findings among adults as have been reported by Rajbhandari et al,[16] Rai et al,[7] Shrestha et al[15] and Chhetri et al[17] (77.5%). This discrepancy could be because of the age of the subjects included in those studies. Another reason may be due to the sample size of the present study. In this present study isolated from different specimens *Pseudomonas* species was isolated mostly from pus (31.5%). *Pseudomonas* species was 100% resistant to Penicillin, Amoxycillin and Vancomycin and ~50% resistant to Cotrimoxazole, Cefuroxim, Ceftriaxone, Piperacillin, Azythromycin, Cephalexin, Netelmycin and Pfloxacillin. However *Pseudomonas* species are still more than 90% sensitive only to Imipenem. The resistance observed in *Pseudomonas* species could also be attributed to irrational use of antibiotics for conditions that may not clinically indicate their use, over-the-counter sell of antibiotics in pharmacies without prescription by authorized practitioners, some new drug formulations which may be of poor quality and dumping of banned products into the market where the public may get access to them[12]. In view of the resistance observed, infections caused by MRSA can be expensive in terms of costs of treatment, morbidity and prolonged hospitalisation.[18]

Escherichia coli was more than 80% sensitive to only Imipenem and Amikacin. Similar result was reported by Rahman et al[14] that most of the antibiotics were resistant to *E coli* and mentioned that only Ceftriaxone and Ceftazidime were more than 80% sensitive. *Staphylococcus saprophyticus* was sensitive in Imipenem, Novobiocin and Netelmycin. *Staphylococcus aureus* was sensitive to only Imipenem and Cephalexin. The resistance shown to Amoxycillin, Ampicillin and Chloramphenicol may be due to the antibiotics having been in use for much longer time and their oral route of administration that affects their rate of absorption into blood stream.[12] Some of them were used as prophylaxis therefore increasing their use in patients. Over-use of antibiotics contributes to organisms developing resistance.[19] In another study in Bangladesh Shamsuzzaman et al[20] has reported that there is a trend of antibiotic resistant among the *Pseudomonas* species, *E coli* and *Staphylococcus aureus* isolated from different samples and has shown that the resistant pattern gradually increases among the isolated bacteria from different clinical specimens. This clearly indicates that antibiotic resistant is alarming to the community of this country. It is now an urgent need to develop antibiotic policy as soon as possible to save the future generation from these bugs.

Conclusion:

Since a high proportion of samples have positive cultures, infection control is recommended as a strategy to minimize spread of resistant organisms. Future studies should be extended to include cultures under anaerobic conditions to establish presence of other organisms that require such environment for growth. It is recommended that judicial antibiotic use should be carried out. Finally, there is need to develop national surveillance of antibiotic-resistant organisms.

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