Clinical Utility of Antibiotic against Uropathogen Isolated at a Tertiary Care Hospital of Dhaka City

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Abstract Background: The antibiotic sensitivity pattern of uropathogenic bacteria is varied with different frequency. **Objective:** The purpose of the study was to determine the pattern of antibiotic sensitivity against uropathogens isolated from a tertiary care hospital of Dhaka City. **Methodology:** A cross-sectional study was conducted in the Department of Microbiology at Shaheed Suhrawardy Medical College, Dhaka, Bangladesh during period of January 2016 to December 2016. Among 307 consecutive urine samples were collected from patients of UTI in the microbiology laboratory. Samples were mid-stream urine specimens obtained by clean catch method received from various outpatient departments and inpatient wards were transported to the microbiology laboratory in sterile leak proof container were processed immediately. Bacteria were isolated and identified by standard laboratory procedure. **Results:** Of the 307 urine samples processed 170(55.4%) gave significant growth of pathogens. The prevalence of UTI is high among females (58.2%) than males (41.8%). The commonest isolates were *Escherichia coli* (71.2%), *Pseudomonas* (12.4%), *Staphylococcus aureus* (10.6%), *Acinetobacter* (4.1%) and *Klebsiella* (1.8%). Majority (92.4%) of (uropathogens) isolates were found to be MDR. **Conclusion:** The study revealed that *E. coli* is the predominant uropathogens of UTIs.

Keywords: antimicrobial agents, bacteriuria, *E.coli*, Urinary Tract Infection

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1. Introduction

Urinary tract infection (UTI) represents one of the most common diseases encountered in medical practice today, occurring from the neonate to the geriatric age group. [1] It is also the most common nosocomial infection, accounting for up to 40% of all nosocomial infections. [2] UTI is particularly responsible for discomfort in elderly patients, representing a risk of bacteremia, septic shock, respiratory distress syndrome and death. [3] Even though several different microorganisms can cause UTI, including bacteria, protozoan parasites, fungi and viruses. Bacteria are the major causative organisms and they account for more than 95% of UTI cases. [4] Bacteria causing UTI are generally of fecal origin. [5,6] Among the bacteria, *Escherichia coli* (*E. coli*) is the most common etiological agent, accounting for 75-90% of UTI in both outpatients and inpatients. [7] Complicated UTI exhibits a broader bacterial spectrum as the cause of infection. [7]

In almost all cases of UTI, empirical antimicrobial treatment is initiated before the laboratory results of urine culture and sensitivity are available. Thus, antibiotic resistance may increase in uropathogens due to frequent misuse of antibiotics. [7] In addition, the extensive use of

antibiotics, for infections outside the urinary tract, would alter the antibiotic susceptibility pattern of the intestinal bacteria that are generally implicated as uropathogens. [6] Increasing antimicrobial resistance complicates uncomplicated UTI treatment by increasing patient morbidity, costs of reassessment and retreatment and use of broader-spectrum antibiotics. [8] Patterns of antibiotic resistance in a wide variety of pathogenic organisms vary even over short periods of time. Periodic evaluation of antibacterial activity is needed to update this information. [9] For effective treatment and control of UTI in a particular area/hospital, a good knowledge of the antibiotic sensitivity pattern of the causative agents in that area/hospital is of ultimate importance [6,10].

This study was carried out to analyze various uropathogens and their antimicrobial susceptibility pattern in a tertiary care hospital, which assist in selecting the most appropriate antibiotic therapy in treatment of Urinary Tract Infection.

2. Methodology

A cross-sectional study was conducted in the Department of Microbiology at Shaheed Suhrawardy Medical College, Dhaka during period of January 2016 to

December 2016 for a period of one year. Patients diagnosed clinically as urinary tract infection (UTI) on the basis of symptoms at any age with both sexes were taken as study population. Samples were mid-stream urine specimens obtained by clean catch method received from various outpatient departments and inpatient wards were transported to the microbiology laboratory in sterile leak proof container were processed immediately. Bacteria were isolated and identified by standard laboratory procedure. Specimens were examined under microscope and those specimens showed pus cell 5 or more were inoculated on Blood agar, McConkey Agar plates, and on Chromogenic media which were incubated aerobically at 37⁰ C overnight. Antimicrobial sensitivity testing was performed using Kirby Bauer disc diffusion method as described by the Laboratory Standard Institute.¹¹ Interpretation as Sensitive or Resistant was done on the basis of the diameters of zone of inhibition of bacterial growth as recommended by disc manufacturer. The antibiotics used for susceptibility testing were Amikacin (30 µgm), Gentamycin (10µgm), Cefotaxim (30µgm), Ciprofloxacin (5µgm), Imipenem (30 µgm), Cotrimoxazol µgm, Azythromycin (15 µgm), Amoxycillin (30µgm), Cephalexin (30 µgm), Vancomycin (30µgm), Cefradin (30µgm), Ceftriaxon (30 µgm), Nitelmycin(30µgm), Ampicillin (25 µgm), Erythromycin (15µgm), Pefloxacin µgm, Cefuroxim (30 µgm), Linezolid (30 µgm), Meropenem (30µgm), Cloxacillin (20µgm), Ceftazidim (30 µgm), Amoxiclave (30 µgm), Piperacillin (100µgm) , Tetracycline (30µgm).

3. Results

Out of 307 urine samples majority were given the significant growth of bacteria which was 170 (55.4%)

cases (Table 1). In the demographic profile of UTI the patients were between 1 and 78 years of age. The prevalence of UTI was high among females (58.2%) than males (41.8%). The commonest isolates were *Escherichia coli* (71.2%), *Pseudomonas* (12.4%), *Staphylococcus aureus* (10.6%), *Acinotobactor* (4.1%) and *Klebsiella* (1.8%).

Table 1. Culture Positivity of Study Population (n=300)

Isolated Organism	Frequency	Percent
No growth	137	44.6
Growth	170	55.4
Total	307	100.0

Table 2. Demographic characteristics of the study subjects

Age in years	Male		Female		Total	
	No	%	No	%	No	%
1-20	18	25.4	26	26.3	44	25.9
21-40	21	29.6	35	34.4	56	32.9
41-60	20	28.2	26	26.3	46	27.1
>60	12	16.9	12	12.1	24	14.1
Total	71	41.7	99	58.3	170	100.0

Table 3. Rate of Isolated Uropathogenic Bacteria

Types of organism	Number	Percentage (%)
<i>E.Coli</i>	121	71.2
<i>Pseudomonas</i>	21	12.4
<i>Staphylococcus</i>	18	10.6
<i>Klebsila</i>	3	1.8
<i>Acinotobactor</i>	7	4.1

Table 4. Antibiotic sensitivity and Resistance pattern of isolated organisms in UTI

	E.Coli		Pseudomonas		Staphylococcus		Klebsiella		Acinotobactor	
	S	R	S	R	S	R	S	R	S	R
Amikacin	96.4%	3.6%	100%	00	75%	25%	100%	00	100%	00
Gentamycin	81.9%	18.1%	68.4%	31.6%	100%	00	50%	50%	60%	40%
Cefotaxim	67.9%	32.1%	60%	40%	80%	20%	33.3%	66.7%	50%	50%
Ciprofloxacin	67.2%	32.8%	41.7%	58.3%	71.4%	28.6%	00	00	60%	40%
Imipenem	78.3%	21.7%	50%	50%	70%	30%	50%	50%	50%	50%
Cotrimoxazol	61.8%	38.2%	40%	60%	50%	50%	100%	00	33.3%	66.7%
Azythromycin	36.5%	63.5%	60%	40%	54.5%	45.5%	50%	50%	50%	50%
Amoxycillin	47.7%	52.3%	33.3%	66.7%	33.3%	66.7%	100%	00	25%	75%
Cephalexin	44.4%	55.6%	55.6%	44.4%	60%	40%	00	100%	66.7%	33.3%
Vancomycin	40%	60%	46.2%	53.8%	70%	30%	100%	00	50%	50%
Cefradin	42%	58%	28.6%	71.4%	30%	70%	50%	50%	33.3%	66.7%
Ceftriaxon	40.7%	59.3%	42.9%	57.1%	40%	60%	100%	00	25%	75%
Nitelmycin	57.9%	42.1%	84.6%	15.4%	75%	25%	50%	50%	100%	00
Ampicillin	56.9%	43.1%	62.5%	37.5%	12.5%	87.5%	00	00	40%	60%
Erythromycin	34.8%	65.2%	33.3%	66.7%	33.3%	66.7%	66.7%	33.3%	100%	00
Pefloxacin	43.4%	56.6%	42.9%	57.1%	25%	75%	00	00	20%	80%
Cefuroxim	35.7%	64.3%	15.4%	84.6%	75%	25%	00	00	33.3%	66.7%
Linezolid	53.1%	46.9%	70%	30%	77.8%	22.2%	00	00	50%	50%
Meropenem	59.1%	40.9%	40%	60%	50%	50%	66.7%	33.3%	75%	25%
Cloxacillin	51%	49%	75%	25%	45.5%	54.5%	0	100%	50%	50%
Ceftazidim	50%	50%	30%	70%	50%	50%	50%	50%	25%	75%
Amoxiclave	61.9%	38.1%	33.3%	66.7%	42.9%	57.1%	0	100%	100%	00
Piperacillin	51.4%	48.6%	44.4%	55.6%	37.5%	62.5%	0	100%	100%	00
Tetracycline	59.3%	40.7%	20%	80%	100%	00	100%	00	100%	00

Table 5. Pattern of Multi drug resistant Uropathogenic Bacteria

Isolated organisms	MDR (n=157)		Non MDR (n=13)	
<i>E. Coli</i>	113(93.4%)		8	6.6
<i>Pseudomonas</i>	18	85.7	3	14.3
<i>Staphylococcus</i>	18	100	0	00
<i>Klebsila</i>	3	66.7	1	33.3
<i>Acinobacter</i>	6	85.7	1	14.3
Total	157	92.4	13	7.6

The antimicrobial potency and spectrum for 24 selected antimicrobial agents of different classes. *E. coli* showed high sensitivity to amikacin (96.4%), gentamycin (81.9%) and imipenem (78.3%) followed by cefotaxim (67.9%), ciprofloxacin (67.2%) and amoxaclave (61.9%). *Pseudomonas* showed highest sensitivity to amikacin (100%) followed by cloxacilin (75%), linezolid (70%) and gentamycin (68.4%). *Staphylococcus aureus* showed highest sensitivity to gentamycin and tetracycline (100%) followed by cefotaxim (80%). amikacin, contrimoxazol, amoxycillin, vancomycin, ceftriaxon and tetracycline are 100% sensitive against *Klebsiella* followed by erythromycin (66.7%) and meropenem (66.7%). *acinobacter* showed highest sensitivity to amikacin, nitelmycin and erythromycin, amoxiclave, piperillin and tetracyclin (100%) followed by Cephalixin (66.7%), Gentamycin and Ciprofloxacin (60%). Majority (92.4%) of Enterobacteriaceae isolates were found to be MDR.

Multi Drug Resistant (MDR) is defined as isolates resistant to at least 3 classes of drugs.

4. Discussion

The study observes that the prevalence of UTI is high among females (58.3%) than males (41.7%). Females of the reproductive age group (21-40 years) constituted 29.6% of the total patients with UTI. It has been reported that adult women have a higher prevalence of UTI than men, principally due to anatomical and physical factors. [12] Among males an increased prevalence of UTI was recorded in elderly age group 41-78 (45.1%) than young (25.4%). This is probably because with advancing age, the incidence of UTI increases in men due to prostate enlargement and neurogenic bladder. [13]

In this study out of all samples majority (55.4%) are growth positive. The reason is that the suppurative infection of the skin, ear, and eye are common occurrences in hospitalized patients as well as in the outpatients department. Furthermore wound infection is regarded as the most common nosocomial infection among surgical patients. [14] It has been associated with increased trauma care, prolonged hospitals stay, and treatment. [15]

The study demonstrates that *E.coli* remain the leading uropathogen being responsible for 71.2% of UTI. This is in consistence with findings of other studies in which *E. coli* was the most frequently reported isolate from patients with UTIs. [16] Following *E.coli* our study shows *Pseudomonas* (12.4%), *Staphylococcus* (10.6%), *Acinobacter* (4.1%) and *Klebsiella* (1.8%) as the other

common uropathogens. Our findings are in accordance with a study by Dias *et al.* [17]

In this study the antimicrobial potency and spectrum for 24 selected antimicrobial agents of different classes. *E. coli* showed high sensitivity to amikacin (96.4%), gentamycin (81.9%) and imipenem (78.3%) followed by cefotaxim (67.9%), ciprofloxacin (67.2%) and amoxiclave, (61.9%). *Pseudomonas* showed highest sensitivity to amikacin (100%) followed by cloxacilin (75%), linezolid (70%) and gentamycin (68.4%). *Staphylococcus aureus* showed highest sensitivity to Gentamycin and Tetracycline (100%) followed by Cefotaxim (80%). Amikacin, contrimoxazol, amoxycillin, vancomycin, ceftriaxon and tetracycline are 100% sensitive against *Klebsiella* followed by Erythromycin (66.7%) and Meropenem (66.7%). *Acinobacter* showed highest sensitivity to Amikacin, Nitelmycin and Erythromycin, Amoxiclave, Piperillin and Tetracyclin (100%) followed by Cephalixin (66.7%), Gentamycin and Ciprofloxacin (60%). Majority (92.4%) of Enterobacteriaceae isolates were found to be MDR. This finding is comparable to Shilpi *et al.* [18] in Bangladesh who has found that members of Enterobacteriaceae variably sensitive to different antibiotics. Similar susceptibility pattern was also reported by Sultana *et al.* [19]

The overall prevalence of MDR among enterobacteriaceae isolates identified from patients with symptomatic UTI was 92.4% which is similar with the results from previous study in Gondar (85.5%), Eshetie (87.4%) and Mozambique (88.2%) [20,21,22] while it was higher than reports from other study in Ethiopia: Gondar (68%), and Dessie (74.6%) [23,24] and many other countries, such as USA (19.1%), Belgium (62%), and Italy (62%), Nepal (40.1%, 64.04%). [25,26,27,28,29] However, it was lower than reports from different parts of Ethiopia such as Gondar (93.5%), Bahirdar (95.6%), and Jimma (100%). [30,31,32] The variation in prevalence of MDRE isolates could be due to increase trend of MDR strains with time, difference in study period and study population.

The present study showed that, *Staphylococcus* (100%) and *E.coli* (93.4%) were found to be the principal MDR isolates. Although the rate of proportion of MDR is different in different area similar group of bacteria were reported in Bahirdar, Ethiopia *E.coli* (94.6%) & *K. pneumoniae* (80%) [31] and Nepal, *E.coli* (74%) and *K. pneumoniae* (44%) and Dakar, *E. coli* and *K. pneumoniae* (89%) [33] were the predominant MDR uropathogens. [30] These pathogens are the most common isolates in both hospital and community acquired urinary tract infections. Besides, these bacteria are frequently difficult to treat because of both their intrinsic and acquired resistance to multiple groups of antimicrobial agents. [3,4]

5. Conclusion

In this study, culture positive rate for uropathogens was high, with the majority coming from adult female patients. *E.coli* was the most common etiological agent and remains susceptible to Amikacin. Findings of present study suggest that the further regular monitoring is required for patient management and susceptibility pattern

of urinary pathogens also very important for optimal therapy of patients with UTI.

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