

# Antimicrobial Sensitivity Pattern of the Common Uropathogens among Patients Admitted in A Tertiary Care Hospital in Bangladesh

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## Abstract

Urinary tract infection is one of the most common bacterial infections seen in clinical practice both in developed and developing countries. The causative agents of Urinary tract infection vary from place to place and they also vary in their susceptibility and resistance patterns. This descriptive study aimed to evaluate the antibiotic susceptibility patterns of pathogens isolated from routine laboratory specimens at Dhaka Medical College Hospital. A descriptive cross-sectional study was done from January 2018 to June 2018. A total of 100 mid-stream urine samples from the suspected UTI patients were tested microbiologically and antimicrobial susceptibility test were performed for the isolated pathogens using Kirby-Bauer disk diffusion method with positivity rate of UTI was 90% (90/100). *Escherichia coli* (39%) was the most UTI causing bacteria followed by *Klebsiella* 18(18%), *Acinetobacter* 12(12%), *Staphylococci*, 9 (9%), *Pseudomonas* 6 (6%), *Enterococcus* species 3 (3%) and *Proteus* 3 (3%). Female 83 (83%) were more affected in comparison with male. Adult female especially age range 18-30 years were found in high risk. Nitrofurantoin, Amikacin and Meropenem were recorded as most sensitive antibiogram for most of the bacteria's whereas cephalosporin showed increased resistance. However, for uncomplicated community acquired UTI, Nitrofurantoin (oral) and Amikacin (Injectable) can be chosen as first line medication.

**Key words:** Urinary Tract infection, Antibiogram, Etiological Pattern



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## Introduction

Urinary tract infections (UTI) is most common bacterial infections, affecting 150 million people each year worldwide, occurring from the neonate to geriatric age group.<sup>1</sup> Nearly 30-40% of women will have had at least 1 episode of UTI

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requiring antimicrobial therapy by the age of 24 years. Almost half of all women will experience one UTI during their lifetime, some 25%–50% experience recurrent episodes that result in repeated hospital visits, antimicrobial use and other morbidity and costs.<sup>2</sup> In Bangladesh, 20%-35% females experience at least one episode of UTI in their lives where prevalence of bacteriuria among the pregnant women in Bangladesh has been reported from 5 to 15.5%.<sup>3,4</sup> Urinary tract infection is a common contagion among men and women the prevalence is higher among sexually active women and during pregnancy 8. Similarly there are some other factors that increase the risk of developing urinary tract infection e.g. age, minor urethral trauma during sexual intercourse especially in female, kidney stone, tumours, urethral strictures, enlarged prostate, vesico-ureteric reflex, neurological diseases, catheterization, diabetes mellitus, immunosuppression etc.<sup>2</sup> Among the bacterial species *Escherichia coli* account to 80% to 85% of the infection followed by *Staphylococcus* species constitutes to 10%

to 15%. In addition, bacterial species *Klebsiella*, *Pseudomonas*, *Proteus* and *Enterococcus* species plays a minor role in conferring the infection.<sup>5</sup> Emergences of resistant bacterial strains in hospitals pose a continued challenge to treat and control the spreading of infections. Moreover, the indiscriminate use of antibiotics often results in the increased resistance of urinary pathogens to most commonly used antimicrobial drugs causing a serious public health issue, particularly in the developing world.<sup>6</sup> The successful management urinary tract infections & prevention of recurrence depends upon the identification of the types of organisms, drug sensitivities and risk factors responsible for bacterial invasion and the selection of an effective antibiotic according to culture sensitivity. There is a paucity of research addressing the aetiologies, risk factors and pattern of antibiotic resistance of UTI patients in most developing countries. Therefore, this study was done to identify the type of organism(s) responsible and its sensitivity pattern in patients presented with pyuria and also to find out the associated risk factors that may complicate the condition.

### Methodology

This was a descriptive type of cross-sectional study, conducted in inpatient department of medicine of Dhaka Medical College Hospital starting from January, 2018 to June, 2018. All patients suspected as UTI by physician were included for this study. Patients were informed about the study. Morning midstream urine samples were requested or preferred before antibiotic administration. For those patients who were already with antibiotics we instruct them to wait to void urine till the next dose of antibiotic. All the patients were clearly informed to clean the genital area with soap before collecting the midstream urine. All samples were processed to test within one hour of the collection. Antibiotic discs for sensitivity were used as per CSLI guidelines to check sensitive, resistant and intermediate antibiotics patterns, which were measured by antibiotic zones scale. Qualitative data are described as frequency or percentage and quantitative data as mean (SD) or median (interquartile range) as appropriate. Continuous and categorical data will be compared using Student's t-test and chi-square test respectively. Comparison will be done by tabulation and graphical presentation in the form of tables, bar diagrams and charts. All statistics will be performed using Statistical Package for the Social Sciences (SPSS) software. A p-value of  $\leq 0.05$  will be considered as statistically significant. Ethical clearance was taken from ethical review committee of respective institute.

### Results

Out of 100 patients, 83 (84%) were female and male to female ratio was 1:4.88. Female are more frequently affected

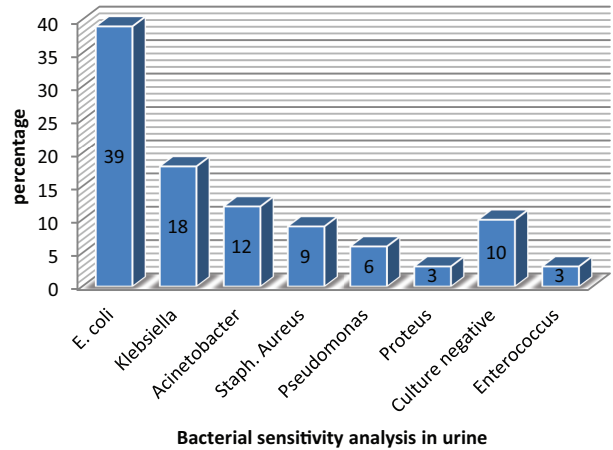
in all age group from very young to aged. The age range was 18 to 90 years and mean age was  $45 \pm 10.64$  years. Among 100 patients, 45 patients (45%) belong to 18-30 years followed by 18 (18%) from 31-45 years group, 21 (21%) in 46-60 years group whereas more than 60 years age group was 16% (Table 1). 92(92%) patients were symptomatic and rest of them were asymptomatic. Most common risk factor associated with UTI were DM 36 (36%) then menopause 18(18%), pregnancy 8(8%), catheter or stent 7(7%), renal stone 6 (6%), prostate pathology 6(6%) etc. However, 10% remains unknown (Table 2). Majority (85%) of patients had single risk factor, 5% had more than one and 10% had no risk factors at all. In bacterial strain analysis in urine most common pathogen found was *E. coli* 39(39%), *Klebsiella* 18(18%), *Acinetobacter* 12 (12%), *Staph aureus* 9 (9%), *Pseudomonas* 6 (6%), *Enterococcus* species 3 (3%) and *Proteus* 3 (3%). However, in blood culture of 100 patient only 4 (4%) had culture positive; those were *E. coli* (2) & *Staph. aureus* (2) (Figure 1). Moreover, isolation of more than one organism found only in 5 patients (5%). specially in diabetic & catheter induced UTI cases. *E-coli* was highly sensitive to Amikacin (96%), Meropenem (100%), Nitrofurantoin (92%) but for Ceftriaxone (72%), Quinolone (62%), Cefixime (69%), sensitivity was low for Cephadrine (38%), Co-trimoxazole (38%). However, *Klebsiella* was sensitive for Meropenem (100%), Quinolone (83%), Amikacin (83%) but for Ceftriaxone it was only 50%. 12(100%) of 12 patients with *Acinetobacter* were resistant to Ceftriaxone, Cefixime and Cephadrine (Table 3). All were sensitive to Ceftazidime, Cefipime and Meropenem/Imipenem. 9(75%) patients were sensitive to Quinolone and Amikacin /gentamicin. Almost 9(100%) of 9 patients of *Staphylococcus Aureus* (MSSA) group were sensitive to Cloxacillin, Linezolid, Cephadrine. All of the *pseudomonas* group were sensitive to Quinolone and Amikacin /gentamicin and also to Ceftazidime, Cefipime, Meropenem/Imipenem (Table 3)

**Table I :** Age & Sex distribution of 100 patients presented with UTI

Age group (years)	Male (n=17)	Female (n=83)	N (%)
18-30	4	41	45(45%)
31-45	2	16	18(18%)
46-60	5	16	21(21%)
61 – 75	4	8	12(12%)
76 – 90	2	2	4(4%)

**Table II:** Common risk factors found in 100 UTI patients

Risk factor	Frequency (%)
Diabetes	36(36%)
Presence of Catheter(6) or stent (1)	7 (7%)
Renal stone disease	6 (6%)
Post-menopausal	18(18%)
Pregnancy	8 (8%)
Prostatic enlargement	6 (6%)
Carcinoma prostate	1 (1%)
Neurological disorder	2 (2%)
History of previous UTI	6 (6%)
Unknown	10(10%)



**Fig-1:** Bacterial strain analysis from urine sample among 100 UTI patients

**Table-III:** Percentage of in vitro antibiotic sensitive pattern of most frequently isolated microorganisms

Antibiotics	E. coli(%)	Klebsiella (%)	Acinetobacter (%)	Staph. aureus (%)	Pseudomonas (%)	P value
Nitrofurantoin	92	67	100	75	Not done	<b>0.02</b>
Amikacin	100	83	75	75	83	<b>0.01</b>
Ciprofloxacin	62	83	75	Not done	83	0.28
Co-trimoxazole	38	83	75	50	Resistant	0.97
Cephadrine	38	Resistant	Resistant	100	Not done	0.65
Cefixime	69	16	Resistant	Not done	Not done	0.21
Ceftriaxone	72	50	Resistant	Not done	50	0.43
Ceftazidime	92	72	100	Not done	83	<b>0.04</b>
Meropenem	100	100	100	100	100	<b>0.0001</b>

**Discussion**

The present study was undertaken on 100 consecutive patients of both sexes presented with pyuria. Among them 83(83%) were female. Male-female ratio was 1:4.88. A large study was conducted on 2013 at Dhaka city reveals 79% female were suffering from culture positive UTI and remaining 21% was male.<sup>7</sup> Several studies shows that UTIs are most commonly seen in sexually active young women.<sup>8</sup> High prevalence of UTI among female population may be due to short and wide urethra and proximity to anus that makes easy for bacteria to ascend in the urinary tract and decrease of normal vaginal flora (Lactobacilli). Other factors that may contribute to develop UTI in women include urethral injury during sexual intercourse, diaphragm-spermicide use, voiding behaviour & poor hygienic conditions especially in low income society.<sup>7</sup> Female may be affected with UTI at any age from reproductive age to

elderly aged group. In my study population, the age range was 18 to 90 years and 63% of whom belong to women of reproductive age range from 18-45 years. It is very similar to a study conducted in Bangladesh shown women has the age group 16 - 45 years are most likely to suffer from UTI.<sup>7, 9</sup> In our study, Diabetes was found in 36 patients (36%) and many of them had have recurrent UTI, among them 17 had uncontrolled DM. A large study was conducted in Kuwait, where most of the UTI cases (78.2%) were found in the diabetic patients with uncontrolled glycaemia.<sup>10</sup> Moreover, we observed 8 cases (8%) found to have pregnancy. Pregnancy is an independent risk factor of Urinary tract infection. In a study at Pakistan it shows 5% cases were found where risk factor was pregnancy.<sup>8</sup> Another study in Bangladesh show prevalence of UTI in pregnancy was 26%. Individuals of the age group 21-25 years had the highest incidence of infection(44.61 %) among them 76% infection

occur at third trimester.<sup>11</sup> However, present study showed low prevalence probably due to reduced admission in medicine ward. Here, 18 (18%) postmenopausal women were suffering from UTI (Table 3). During menopause, the level of oestrogen decreases which cause changes in the tissues around the urethra and loss of protective vaginal flora and reduction of vaginal P<sup>H</sup> can lead to UTI.<sup>12</sup> In this study, 6 UTI cases (6%) was due to prostatic enlargement. In another study showed, 8-10% cases occur due to Prostate pathology.<sup>13, 14</sup>

Most hospital-acquired UTIs are associated with urinary catheters, a commonly used device among hospitalized patients. Up to 25% of hospitalized patients have a urinary catheter placed during their stay.<sup>15, 16</sup> We found 6(6%) cases are due to catheter associated UTI that is 6(35%) out of 17 male patients suffering from UTI having urinary catheter. In this study, 5 patients had more than one risk factor like neurological disorder with CAUTI in 2 patients, postmenopausal status with diabetic complications in 3 patients. There is a large group 10% in where we could not find out any identifiable risk factor. A total of 7 types of bacterial pathogens were isolated from urine culture. *Escherichia coli* 39 (39%) was the commonest bacterial pathogens in both symptomatic & asymptomatic groups. Other pathogens were *Klebsiella* spp. 18(18%) and most *Acinetobacter* spp. (12%), *Staph. aureus* 9(9%), *Pseudomonas* 6(6%), *Enterococcus* species 3(3%) and *Proteus* 3(3%) etc. So, gram negative bacilli were 88% of total uropathogens and remaining 12% were gram positive organisms included *Staph. Aureus* and *Enterococcus* spp. Akram M. et al.<sup>3</sup> (2007) showed growth of pathogens among which the most prevalent were *E. coli* (61%) followed by *Klebsiella* spp. (22%). Forty two percent (42%) of isolates were detected to produce ESBL among which 34.42 % were *E. coli* isolates. Another study in North West India showed the showed that maximum patients were infected by *Escherichia coli* followed by *Klebsiella*, *Staphylococci*, *Enterococci* and *Proteus* species.<sup>17, 18</sup> However, two patients had both simultaneous infection in blood and urine. *E. coli* and *Staph. aureus* were causative organism. One of them was associated CAUTI and another one were associated with DJ stent in situ. Only 24(62%) patients of 39 infected with *Escherichia coli* was sensitive to Quinolone group of antibiotic but 36(92%) patients were sensitive to Nitrofurantoin . 72% patients were sensitive to ceftriaxone , 69% to Cefixime but only 38% were sensitive to Cephadrine as well as Co-trimoxazole. All were sensitive to Amikacin and Meropenem/Imipenem. 15(83%) patients of 18 infected with *Klebsiella* spp. were sensitive to Quinolone group of antibiotic and also to Co-trimoxazole but only (83%)

patients were sensitive to Amikacin. All were sensitive to Meropenem/Imipenem. Only 50% patients were sensitive to ceftriaxone but all were resistant to Cephadrine. Very similar to a study from India, *E. coli* and *Klebsiella* were sensitive to Amikacin (97.1%), Nitrofurantoin (90.7%), Gentamycin and Imipenem. Both organisms were resistant to Ampicillin (> 70-90%).<sup>19, 20, 21</sup>

### Limitations

The study had the following limitations. The study period was short, sample size was small, no control group, single centred study. So it may not represent the scenario of whole country. These should be kept in mind while deciding on the implications of the findings of the study.

### Conclusion:

Urinary tract infection is very common infection among the sexually active adult especially in women, can endanger life if neglected and if associated with anatomical risk factors and comorbidities. Antibiotic usage has proven value in encountering the infection. Identification of bacteria by culture sensitivity should be done in patient with non-responsiveness to treatment and in case of recurrence, immunosuppression, pregnancy or complicated UTI. *Escherichia coli* remains the predominant uropathogen in acute community-acquired uncomplicated UTIs. Nitrofurantoin may be useful as a first-line oral antibiotic. If there is no contraindication, Amikacin can be first choice injectable antibiotic as most of the common uropathogens are sensitive to it. Identifying risk factor causing UTI is also important. Simple preventive measures may have important role in preventing recurrence of infection. We advise for a large scale multicentre study to evaluate the actual picture of sensitivity pattern of antibiotics in UTI.

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### Conflict of Interest:

The authors declare that there is no conflict of interests regarding the publication of this paper.

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