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**Original Article**

# Study of Bacterial pathogens in Urinary Tract Infection and their antibiotic resistance profile in a tertiary care hospital of Bangladesh

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**Abstract:**
Analyzing antibiotic susceptibility pattern of uropathogens help to overcome the therapeutic difficulties created by the rising antimicrobial resistant bacteria and guides in choosing appropriate antibiotics. Hence, we aimed at evaluating the pathogens causing UTI and study their antibiogram. Midstream urine samples were collected, cultured and appropriate biochemical tests were performed for proper identification of urinary pathogens in BSMMU from January 2013 to December 2013. The most common isolated Gram negative uropathogens were *Escherichia coli* (63.93%) followed by *Klebsiella pneumoniae* (17.09%), other bacterial species, named *Pseudomonas spp. Enterobacter Acinetobacter spp. Citrobacter spp Proteus spp. Morganella*. Among Gram positive organism *S. aureus* S. *saprophyticus S. agalectiae and Enterococci* were found. Urinary tract infections were more prevalent in women than men (61.68% vs. 38.32%). High level of sensitivity was found to imipenem, amikacin, nitrofurantoin, ceftriaxone, gentamicin, cefuroxime in most of the isolates. Almost all the test organisms exhibited multiple antibiotic resistances. The high multiple antibiotics resistance identified makes it necessary for antibiotic susceptibility testing to be conducted prior to antibiotic(s) prescription.

**Key words:** Antibiotic, Resistance, Susceptibility, Urinary tract infection, Uropathogens.

## Introduction:

The second most common bacterial infection in human population is Urinary tract infection (UTI). It is also one of the most frequently occurring nosocomial infections[1] .The annual global incidence of UTI is of almost 250 million. Approximately 35% of all hospital-acquired infections are contributed by UTI[1,2]. It is the most Common bacterial infections ranging from asymptomatic to severe sepsis. Bacteria are the primary organisms that causes UTI. In acute infection, *E.coli* is the most frequent infecting organism. But the prevalence of other antibiotic resistance organisms such as *Klebsiella, Proteus, Serratia, Enterobacter ,Pseudomonas* increases in complicated UTI. Among gram positives, *S. saprophyticus,E. faecalis, S. agalactiae, S. pyogenes, S. aureus*, are usually prevalent and are resistant to a variety of different antibiotics. There are many types of antibiotics are available for UTIs and the choice is depend upon many factors including severity of infection and acute or recurrent infection[3,4].

Development of resistant strain is a common problem in antimicrobial chemotherapy. The rate of resistance is high among uropathogens. Frequency of resistance to antibiotics and drug is directly linked to consumption of antibiotics. Often Treatment of UTI is started empirically and therapy is based on information determined from the antimicrobial sensitivity pattern of the urinary pathogens of a given community[5]. Due to aberrant use of antibiotics in practice the prevalence of antimicrobial resistance among urinary pathogens has been increasing worldwide[6,7]. Distribution of urinary pathogens and their susceptibility to antibiotics varies regionally. So it becomes necessary to have knowledge of distribution of these pathogens and their susceptibility to antibiotics in a particular setting[8,9]. The aim of this study

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was to determine recent bacterial etiologic agents responsible for urinary tract infection and to evaluate their resistant pattern to commonly used antimicrobial agents in Bangabandhu Sheikh Mujib Medical University (BSMMU). This study is important for clinicians in order to facilitate the effective treatment and management of patient with symptoms of urinary tract infection.

**Materials and methods:**

A retrospective study was done in the dept. of microbiology BSMMU, Shahbag, Dhaka with objectives to determine the etiological bacterial pathogens of the UTI and to determine the antibiotic sensitivity pattern of pathogens isolated. The study duration spanned from January 2013 to December 2013. Study population consisted of all urine samples send to the laboratory for urine culture examination. Our exclusion criteria consisted of those patients who were already on antibiotic treatment. Total 24868 samples were collected during this study period. For collection of urine samples patients were advised to collect a clean catch midstream urine specimen in a sterile, wide mouthed leak proof container supplied by the laboratory and bring to the laboratory as early as possible. Guidelines for proper specimen collection were given to all patients on a printed card. Isolation and identification of bacterial pathogens was done by microscopy and culture methods. Bacterial isolates were identified generally using conventional biochemical tests[10,11].

**Antibiotic susceptibility testing**

In the present study antimicrobial susceptibility testing was done on Mueller- Hinton agar using disk diffusion (Kirby Bauer's) method according to the Clinical and Laboratory Standards Institute (CLSI) guidelines using the following antimicrobial drugs: Amoxycillin, Cephradine, Nalidixic acid, Mecillinam, Ceftriaxone, Cefuroxime, Amikacin, Gentamicin, Ciprofloxacin, Imipenem, Nitrofurantoin and Cotrimaxozole for both Gram positive and negative Bacterial isolates.

**Results**

In this study, 2287(9.1%) patients out of 24868 were showed to be urine culture positive (their colony count was equal or more than 105). There were 15341(61.68%) females and 9527(38.32%) males in patients with urine positive culture. Gram-negative bacilli isolated accounted for 1930(84.39%) of the positive cultures, while Gram-positive cocci were 357 (15.617%). The most common isolates in this study have been the Gram negative bacilli which accounts for 84.39% of the total positive isolates. In the gram negative bacilli, the predominant isolate was the *E.coli* (63.93%) followed by other bacilli like *Klebsielle spp* (17.09%), *Pseudomonas* (5.59%) and Enterobacter (5.28%) among the major isolates. In the gram positive bacteria, the main organism identified was *Enterococci* (75.07%) followed by *Staphylococcus aureus* (12.88%). Table 1 shows the detailed frequency of all the isolates identified. The percentages of resistance of all isolates to the antimicrobial agents were shown in table 2.

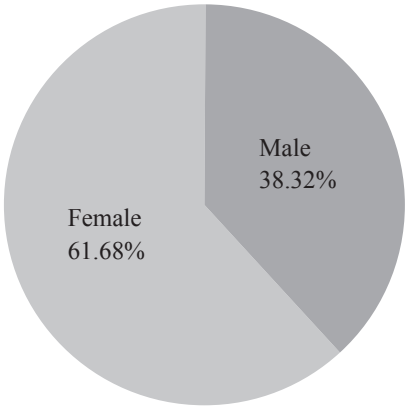


Fig-1: Distribution of patient with positive culture

Table: 1 Distribution of positive isolates identified from the urine samples (N=2287)

| *Name of isolates* | | Number of organisms isolated | Percentage (%) |
|---|---|---|---|
| Gram negative organisms n=1930(84.39%) | *E. coli* | *1234* | *63.93* |
| | *Klebsiella spp.* | *330* | *17.09* |
| | *Pseudomonas spp.* | *108* | *5.59* |
| | *Enterobacter* | *102* | *5.28* |
| | *Acinetobacter spp.* | *78* | *4.04* |
| | *Citrobacter spp* | *34* | *1.76* |
| | *Proteus spp.* | *26* | *1.34* |
| | *Morganella* | *18* | *0.93* |
| Gram positive organisms n=357(15.61%) | *S. aureus* | *46* | *12.88* |
| | *S. saprophiticus* | *10* | *2.80* |
| | *S. agalectia* | *12* | *3.36* |
| | *Enterococci* | *268* | *75.07* |

Table: 2 percentage of resistance to the antimicrobial agents

| Antimicrobial agents | Sensitive | Resistant | Percentage Resistance |
|---|---|---|---|
| Amoxicillin | 523 | 1764 | 77.12 |
| Cephradin | 891 | 1396 | 61.04 |
| Cotrimoxazo | l962 | 1325 | 57.94 |
| Ciprofloxacin | 1385 | 902 | 39.45 |
| Nitrofurantoin | 1759 | 528 | 23.08 |
| Nalidixic acid | 839 | 1448 | 63.31 |
| Ceftriaxone | 1001 | 1286 | 56.23 |
| Gentamycin | 1640 | 647 | 28.29 |
| Cefuroxim | 1322 | 965 | 42.20 |
| Amikacin | 2129 | 158 | 06.91 |
| Imipenem | 2234 | 53 | 02.32 |

**Discussion:**

Urinary tract infections (UTI) are amongst the most common infections encountered in clinical practice and are a common clinical condition worldwide. But the pattern of antimicrobial resistance varies in different regions. The sex distribution of patients in our study is analogous with those of other reported studies in our country showing a predominance of females (64.5%) with UTI[12,13,14]. The elevated incidence of infection among females is related to the differences between male and female genitourinary systems in anatomy and host factors such as changes in normal vaginal flora[15] .The Gram negative bacteria were the most common microorganism isolated of Urinary tract infection in present study accounting 84.39 % of total isolated bacteria. The findings are similar to studies done by others[16] .The most common uropathogens in our study were *E. coli* (63.93%) and *Klebsiella spp*. (17.09%). It supports the previous findings indicating that *E. coli* is the principal etiological agent of UTI, accounting for 60.02% of the cases[14]. In another study, it was reported that predominant uropathogens are *E. coli* followed by *Klebsiella species* which also support our study[17]. Infection frequency of *Citrobacter spp, Proteus spp, Morganella spp*. were found to be very few in this study (Table-1) which is also be affirmed by another work[14]. In our study, Gram positive organism accounted for a total of 15.61% of urinary tract infections (357 out of 2287). This finding is similar to other studies[18,19]. However, different results have been reported. The similarities and differences in the type and distribution of uropathogens may result from different environmental conditions and host factors, and also from some practices such as healthcare and education programmers, socioeconomic standards and hygiene practices in each country[20]. Antibiotic resistance among uropathogens has become a public health concern in Bangladesh[21]. The increasing antimicrobial resistances throughout the world make the treatment of UTIs difficult every passing day. The reasons for antibiotic resistance may be the improperly adjusted treatment doses or frequent use of antibiotics in the treatment of various infections, as well as the acquisition of resistance in bacteria with low susceptibility by selection / spontaneous mutation or development of resistance in enteric bacteria by R plasmids responsible from multiple drug resistance. The present study evaluated the prevalence of micrograms implicated in UTI to ascertain their antimicrobial resistance patterns. In our study, high drug resistance was noted to amoxicillin (77.13%), Nalidixic acid (63.31%), Cotrimoxazole (57.94%), Cephradin (61.04%). Saleh et a (2000). [14] reported similar findings. Many authors have reported a high degree of these drug resistances in their studies[19,22,23,24]. A significant increase in resistance of pathogenic strains to Amoxicillin, Cotrimoxazole and Cephradin has been found worldwide[25].

Fluoroquinolones are one of the most widely accepted antibiotic families for treating UTIs, even in complicated cases, given their broad-spectrum action, bactericidal potency, excellent oral bioavailability, good tolerance, and marked post antibiotic effect[26,27] . However, various studies have reported high resistance rates to these antibiotics[28]. Our study showed Ciprofloxacin resistant was 39.45%. Other studies from Bangladesh has been reported similar resistance pattern to ciprofloxacin[29,30] In this study Cefuroxime exhibited poorer activity (42.20%) toward the uropathogens. These data are different from previous study done in BSMMU[14]. In recent years Cefuroxime have been used extensively in our hospitals may be a clue for poor activity of the drug. The resistance rate depends on local antibiotic prescription practice. Nitrofurantoin was reported resistant only in 23.08%, hence proving as suitable alternatives oral drug for treating urinary tract infection. Nitrofurantoin has conventionally been considered an excellent therapeutic option for uncomplicated cystitis in the United States and in some southern European countries, where isolates from urine have shown high resistance rates to fluoroquinolones and co-trimoxazole[31,32]. The present study found resistance rate of 56.23% to Ceftriaxone. This finding is supported by the other studies[14,33,34]. The most effective antimicrobial agents in our study were imipenem, and amikacin (Table-II). It has been reported that amikacin and Imipenam are the most effective antibiotic against uropathogen[35]. Our result was further supported by another study where the susceptibility rate of uropathogen to amikacin and Imipenam remained 93-100%[36]. The low resistance rates detected for these antimicrobials may be attributed to their uncommon use in the empirical treatment of UTIs, and the use of these antibiotics only in hospitalized patients according to culture results.

In our study Gram negative bacteria showed highly resistance to most of the antibiotics, whereas Gram positive bacteria exhibited sensitive to Cephradin, Cotrimoxazole, and Gentamycin. The findings of this study coincide with other findings[37]. The pattern of antimicrobial resistance of the micro-organisms causing UTI infections vary in their susceptibility to antimicrobials from place to place and from time to time[38].

The main limitation of the present study was our lacking of clinical information. This study was based on retrospective laboratory data only so we failed to provide information on categorization of UTI patients whether symptomatic or asymptomatic, complicated or uncomplicated. Further, distribution of patients based on the sources of infection like catheter-associated, community acquired or nosocomial also could not be mentioned.

**Conclusion:**

As drug resistance among bacterial pathogens is an evolving process, regular surveillance and monitoring is necessary to provide physician's knowledge on the updated and most effective empirical treatment of UTIs. Periodic reassessment of *in vitro* susceptibility pattern of urinary pathogens to serve as a guide for antibiotic therapy since these organisms exhibit resistance to first-line drugs used for UTI infection. In order to prevent or decrease resistance to antibiotics, the use of antibiotics should be kept under supervision, should be given in appropriate doses for an appropriate period of time.

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