

Antibiotic Resistance Pattern of Escherichia Coli Causing Urinary Tract Infection

*Azad MK,¹ Abedin MZ,² Sultana S,³ Das S,⁴ Elahi MN⁵

Urinary tract infection is a very common disease that can affect anyone at any age where the infections rate is higher in women than man. This study aimed to ascertain the current situation of urinary tract infection (UTIs) and drug resistance determination caused by Escherichia coli in different age group of patients. A retrospective data analysis of culture result of urinary pathogens was performed. This study determined the antibiotic susceptibility of 134 isolates of in which 38 were Escherichia coli from the urine culture of 497 patients. Urine samples were aseptically collected in sterile containers and then cultured, susceptibility to 13 antibiotics were tested by the disc diffusion technique. Among 134 cultured confirmed patients 69% were females and 31% were males. It state that female are more vulnerable to UTI than male ($P < 0.001$). The onset of UTIs in female was high at the age between 21-40 years (17.2%). Studies revealed that the most resistance rate for Escherichia coli from urine culture were amoxicillin, ciprofloxacin and cotrimoxazole. Whereas meropenem was found to be the most effective against the Escherichia coli followed by amikacin.

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Introduction

Urinary tract infection (UTI) is one of the most common bacterial infections in many developing countries like Bangladesh where proper sanitation is not maintained adequately. Each year upto 150 million individuals are affected by UTIs worldwide, costing global economy in excess of 6 billion US dollars.¹ Although UTIs occur in all age groups including men and women, clinical studies suggests that the overall prevalence of UTI is higher in women. An estimated 50% of women experience at least one episode of UTI at some point of their life time and between 20% and 40% of women can have recurrent episodes.^{2,3} Approximately

20% of all UTIs occur in men.⁴ UTI is defined as bacteriuria along with urinary symptoms.⁵ In the third world, causative factors for UTI include poor hygiene, long time catheterization, uncontrolled sexual intercourse, pregnancy and spermicidal contraception.⁶ Colonization of normal and opportunistic microflora is a main causal agent for UTIs. UTI can be caused by Gram-negative bacteria such as Escherichia coli, Klebsiella species, Enterobacter species, Proteus species and Gram-positive bacteria like Enterococcus species and Staphylococcus saprophyticus. E. coli is the most common organism causing both community as well as hospital acquired UTI.⁷

1. *Dr. Mohammad Abul Kalam Azad, Assistant Professor, Department of Medicine, Shaheed Syed Nazrul Islam Medical College, Kishoreganj. drmakazad80@gmail.com
2. Dr. Md. Zoynal Abedin, Assistant Professor, Department of Medicine, Shaheed Syed Nazrul Islam Medical College, Kishoreganj.
3. Dr. Safia Sultana, Assistant Professor, Department of Microbiology, Shaheed Syed Nazrul Islam Medical College, Kishoreganj
4. Dr. Sujit Das, Assistant Professor, Department of Pediatrics, Shaheed Syed Nazrul Islam Medical College, Kishoreganj.
5. Dr. Mohammad Niamat Elahi, Assistant Professor (Skin & VD), Shaheed Syed Nazrul Islam Medical College, Kishoreganj.

*For correspondence

Unfortunately, several studies have reported that *E. coli* may become resistant to a wide range of antibiotics due to abuse, over dosage use, non-prescribed use, incomplete dosages and ease of access to antimicrobial drug.⁸ Increasing antibiotic resistance in pathogens is a worldwide concern. The resistance rates of uropathogenic *E. coli* to various antibiotics have been reported. UTI due to multi drug resistant (MDR) *E. coli* increase the cost of treatment, morbidity and mortality especially in developing countries like Bangladesh.^{9,10} This present study was undertaken to find out the resistance pattern of *E. coli* causing UTI to commercially available antibiotics that are often prescribed in UTI cases.

Method

This is a retrospective study of the antimicrobial resistance profile of 134 positive urine culture in which 38 were *E. coli*, samples from 497 urine samples over a period of 6 months (From January, 2017 to June 2017) at 250 Bed District Hospital, Kishoreganj, Bangladesh. Patients were identified and data were extracted using the hospital information and support system.

Laboratory techniques

As there is no facility to culture in 250 Bed General Hospital, culture is done in private hospital, Kishoreganj. In brief, one calibrated loopful urine samples were streaked on to MacConkey agar (MAC) and Blood agar media and incubated aerobically at 37°C for 24 hours for isolation and identification of urinary pathogens. The colonies characteristics were then examined. The pink colonies on MAC were lactose fermenters and most likely to be *E. coli*. If colonies were colorless, they were lactose non-fermenters. The clinical isolates were characterized by Gram-stain, oxidase test, motility, citrate utilization and biochemically for species identifications.¹¹

Antibiogram

Bacterial susceptibility to antimicrobial agents was determined in vitro by using agar disc diffusion method following CLSI guidelines.¹² The following antibiotic discs were used : amikacin (30 µg), amoxicillin (10 µg) , azithromycin (15 µg), cefixime (5 mg), ceftriaxone (30 µg), ciprofloxacin (5 µg), cotrimoxazole (25 µg), gentamycin (10 µg), nitrofurantoin (30 µg), meropenem (10 µg), cefuroxime (30 µg), linezolid (30 µg), ceftazidime (30 µg). After incubation at 37°C for 24 hour, the diameter of inhibition zone was measured by digital slide calipers and interpreted as “Sensitive”, “Intermediate” or “Resistant” according to CLSI standard interpretative charts.

Statistical Analysis

The data were analyzed using SPSS version 16 statistical software for Confidence Interval (CI) and P value. Statistical significance was defined when P value is <0.05. The confidence interval was set at 95% level of significance for all the proportions.

Results

A total of 134 UTIs caused by uropathogens, in which 38 were *E. coli*, confirmed on urine culture of 497 patients. Among them 69% patients were female (93) and 31% were male (41). It revealed that female were more vulnerable to UTI than male (P<0.001). To analyze the prevalence of UTI at different age group, a gender based age group variation of UTI was analyzed. It was observed that, in each and every age group the percentage of female patients were higher than male. The percentage of male and female patients was highest in the age group above 50 years which was 14.9% and 16.4%, respectively. The lowest percentage of male and female patients was in the age group <10 years which was 0.75% and 3% respectively. The present data stated that, the onset of UTIs in female were

higher at the age between 21-40 years 17.2%(Figure – 1).

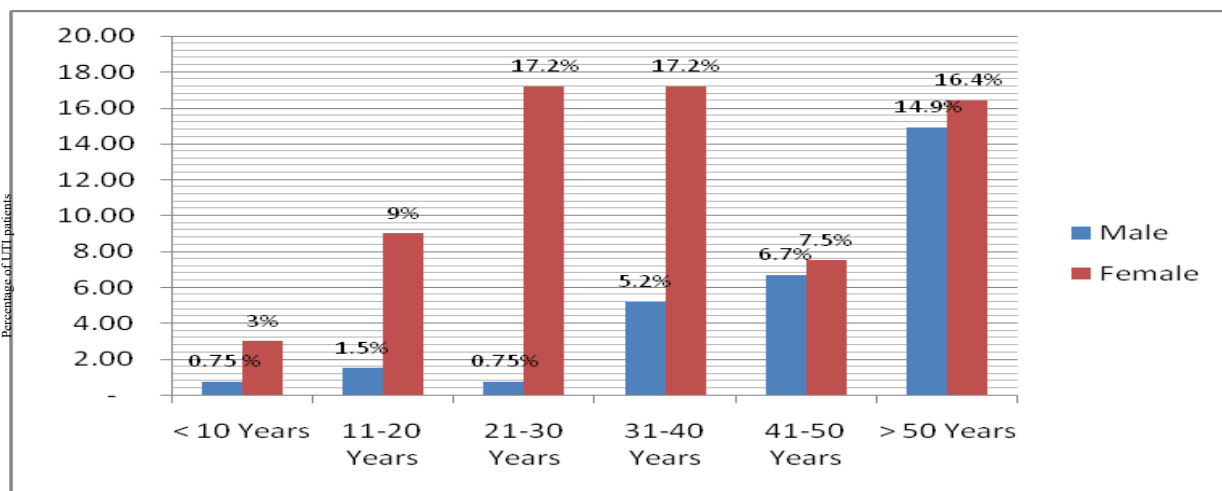


Figure 1. Percentese of male and female UTI patients in different age groups in this study.

The number and percentage of each uropathogens isolated from urine samples are shown in figure 2.

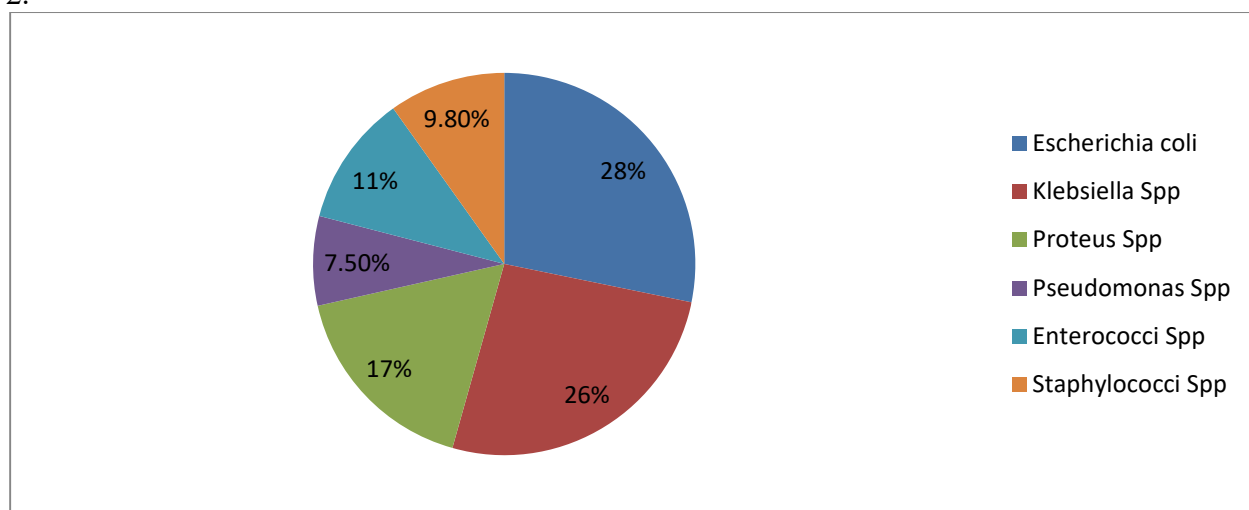


Figure 2. Comparative prevalance of bacterial species in urine sample.

Among the 134 isolates Escherichia coli was found to be the most frequently isolated organism 38 (28%), followed by Klebsiella Spp 35 (26%), Proteus Spp 23 (17%), Enterococci Spp 15 (11%), Staphylococci Spp 13 (9.8%) and Pseudomonas Spp 10 (7.5%). Antibiotic resistance pattern of E. coli isolated from this study was shown in Table I.

Table I: Antibiotic resistance pattern of E. coli isolate

Bacteria	Antibiotic Used (in %)												
	Amoxi	AK	AZ	Cipro	Cot	CFM	Cro	Cefu	Nit	Linez	MP	Gen	Caz
Escherichia Coli	79.94	0	0	65.79	65.79	60.5	47.35	0	13.16	2.6	0	28.95	7.9

Abbreviations: Amoxi – Amoxicillin, AK – Amikacin, AZ – Azithromycin, Cipro – Ciprofloxacin, Cot – Cotrimoxazole, CFM – Cefixime, Cro – Ceftriaxone, Cefu – Cefuroxime, Nit – Nitrofurantoin, Linez – Linezolid, MP – Meropenem, Gen – Gentamycin, Caz – Ceftazidime.

E. coli showed highest resistance to amoxicillin (78.94%), ciprofloxacin (65.79%), cotrimoxazole (65.79%) and cefixime (60.5%) but *E. coli* showed no resistance to amikacin, azithromycin, cefuroxime and meropenem.

Discussion

Among all infectious diseases urinary tract infections (UTIs) represent one of the most common disease in both developed and developing countries causing a large number of morbidity in different age group.¹³ In this study, from the screened cases 134 were confirmed with UTIs, where *E. coli* was mostly the etiologic agent (28%). The finding of this study is in concordance with that of others showing *E. coli* 47.6% and 49.4% as the predominant organism respectively.^{14,15} Among 134 UTIs patients the percentage of female (69%) were more compared to male patients. The finding of this study is in similar with that of other.¹⁶ The prevalence of UTIs in female was higher in the age group between 21-40 years (17.2%). The lowest percentage of female patients was in the age group <10 years (3%). Among the female patients adult women were observed to be very much prone to UTIs. The similar finding was also shown in various earlier study.¹⁷ Antibiotic resistance is a major clinical problem in treating infections caused by microorganisms. The resistance to the antibiotic has increased over the years. In this study, the range of resistance of *E. coli* to amoxicillin was 78.94% and that for cotrimoxazole was 65.79%. This resistance were higher than those in studies from

developed countries.¹⁸ On the other hand, similar rate have been found in other studies.¹⁹ Therefore these drugs should no longer be prescribed as initial empirical therapy in our region. The susceptibility pattern of *E. coli* to meropenem and amikacin was very significant. The resistance rate of *E. coli* to ceftriaxone (47.35%) and cefixime (60.5%), which is contrary to other community acquired UTI studies in Europe and USA.²⁰

Increasing resistance rate to all antibiotic used in this study with the exception of amikacin and meropenem, may be explained as uncontrolled consumption of these antibiotics during the past decade in our region.²¹

Finally it can be concluded that the present study demonstrate that the *E. coli* have shown various trends in isolation rate and resistances to various classes of antibiotics. In addition, multidrug resistant *E. coli* can be expected to cause serious treatment problems. As the antibiotic resistance is an important factor, urine culture and antibiotics sensitivity test should be routinely performed in all UTIs patients, depending on the antibiotic susceptibility therapy should be designed of an antibacterial agent with the narrowest spectrum, least cost and few adverse effects.

Conclusion

It is quite alarming to note that isolate in this study was found resistant to multiple drugs (Four or more antibiotics). Antibiotic resistance has been emerged as a major problem in the management of hospitalized patients as well those with chronic conditions and adds considerably to health care cost. Our research has been confined to a particular region of Bangladesh. Larger samples sizes from other regions of Bangladesh can lead to more significant results. Therefore, it is increasingly important to study the resistant

E. coli, including mechanisms of resistance, in order to develop effective future drugs.

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