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“The Culture And Sensitivity Pattern Of Escherichia Coli In Urinary Tract Infection”

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Abstract

Urinary tract infection is one of the most common ailments in medical practice affecting people of all ages from neonate to geriatric age group. UTI is due to an inflammatory response of urothelium to the invading pathogenic organisms. To Assess the Culture and Sensitivity Pattern of Escherichia coli in Urinary Tract Infections. This cross sectional study was carried out in Dhaka Medical College Hospital, Dhaka, Bangladesh during the period of July 2011 to June 2013. Sampling technique was purposive and sample size was 70. Data were collected by interview of the patients, clinical examinations and laboratory investigations using the research instrument. The culture method used was disc diffusion method. The antibiotics tested for sensitivity were amikacin, gentamycin, ciprofloxacin, levofloxacin, cotrimoxazole, ceftriaxone, ceftazidime, cefixime and nitrofurantoin. The demographic data and the degree of sensitivity to antibiotics, whether sensitive or resistant, were recorded. The data collected for the period of one year were analyzed. Descriptive statistics was used to analyze the sensitivity of E. coli. Data were processed and analyzed using software SPSS (Statistical Package for Social Sciences) version 11.5. Incidence of bacteriuria and urosepsis were measured according to urine and blood culture report. Sensitivity pattern was also observed. The antibiotics tested for sensitivity were amikacin, gentamycin, ciprofloxacin, levofloxacin, cotrimoxazole, nitrofurantoin, ceftazidime, ceftriaxone and cefixime. The sensitivity pattern of E.coli to antibiotics in UTI was Amikacin and Ceftazidime. 66.7% 10 Celepime and Gentamycin 58.3% to Cot-rimoxazole Ceftriaxone Cephradine and cefixime was last sensitive (16.7% and 83% respectively). E. coli in UTI was resistant to cefixime in 91.7%, to ciprofloxacin in 100.0% cases and to cotrimoxazole in 41.7% of cases. The study highlighted the marked resistance of E. coli to quinolones and third generation cephalosporins. Proper guidelines, supervision of antibiotic usage and constant information to the medical practitioners regarding the sensitivity pattern can help to prevent drug resistance.

Keywords: E coli, antibiotic sensitivity, Urinary tract infection **Corresponding**

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1 | INTRODUCTION

Urinary tract infection (UTI) is the invasion of a sterile urinary system by microorganisms. UTI has become one of the most prevalent diseases so far, as its incidence in the general population has been recorded to be 18 per 1000 (1, 2). Urosepsis accounts for approximately 25% of all sepsis cases and may develop from a community or nosocomial acquired urinary tract infection (UTI) or during the procedure of various urinary diseases, such as ureterorenoscopy (URS), percutaneous nephrolithotomy (PCNL), ESWL, push back stenting, even after perurethral catheterization. Urosepsis is associated with bacteriuria (3, 4). UTI has the tendency to equally affect both genders of any age. However, UTIs are more commonly seen in the female group of the population due to their anatomical structure or due to the huge bacterial load in the urothelial mucosa. Many other factors also contribute to the development of UTI in females such as sexual activity, urinary tract obstruction, and pregnancy. One in every two females contracts UTI at least once in her life. The incidence of UTI among children is reported to be 30% all over the world (5). The incidence of UTI is 1%-2% in boys and 3%-7% in girls in the US (6). The range of UTI prevalence is 2%-8% among children (7). In Iran, it has been reported that at least 1% of boys and 3% of girls have their first episode of UTI before reaching the age of 11 years (5). UTI in children needs to be diagnosed early, as it can lead to renal scarring, ultimately leading to end-stage renal disease (8). Urolithiasis is one of the most common urological diseases; it can be lethal if urinary tract infection associated with obstructed uropathy due to urinary tract calculi results in bacteremia and sepsis (5). In recent year, the incidence of sepsis and urosepsis has even increased, but the associated mortality has decreased suggesting improved management of patients (9). Various gram-positive, as well as gram-negative, organisms are culprits in UTI but the most common cause of UTI is a gram-negative, facultative uropathogenic anaerobe known as *Escherichia* (*E.*) *coli* (10). *E. coli* is considered to be the cause in more than 80% of female UTI cases between 18 and 39 years of age. A less commonly involved organism

is *Staphylococcus* (*S.*) *saprophyticus* and is thought to be involved in 15%-20% of the cases. Other less common organisms involved in UTI are *Enterococci*, *Enterobacter*, *Pseudomonas*, *Proteus*, and *Klebsiella*. Other studies have shown that the most commonly isolated organisms from urine cultures are *E. coli* (66.3%), *S. saprophyticus* (14.9%), and *Klebsiella* (11%), and they were most sensitive to nalidixic acid (70%), co-amoxiclav (29.9%), and co-trimoxazole (16.4%) (5, 11). UTIs are being treated on an empirical basis, which has led to antibiotic resistance among the organisms (12, 13). Therefore, treatment should be targeted and based on the available local data, regarding the sensitivity of the organisms (14). The current study is aimed at isolating microorganisms from the urine cultures of the samples of the patients suffering from complicated UTIs. The culture of the samples will also determine the susceptibility of specific organisms to the antibiotics. As the local data is deficient, the results of the current study will help medical practitioners choose the best antibiotics for the treatment of complicated UTIs. This study has been designed to evaluate the pattern in Dhaka Medical College & Hospital, Dhaka, Bangladesh.

2 | MATERIALS AND METHODS

This cross sectional study was carried out in Department of Urology, Dhaka Medical College Hospital, Dhaka, Bangladesh during the period of July 2011 to June 2013. Sampling technique was purposive and sample size was 70. Data were collected by interview of the patients, clinical examinations and laboratory investigations using the research instrument. The culture method used was disc diffusion method. The antibiotics tested for sensitivity were amikacin, gentamycin, ciprofloxacin, levofloxacin, cotrimoxazole, ceftriaxone, ceftazidime, cefixime and nitrofurantoin.

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toin. The demographic data and the degree of sensitivity to antibiotics, whether sensitive or resistant, were recorded. The data collected for the period of 6 months were analyzed. Descriptive statistics was used to analyze the sensitivity of *E. coli*. Incidence of bacteriuria and urosepsis were measured according to urine and blood culture report. Sensitivity pattern was also observed.

Inclusion Criteria:

Urine culture positive reports showing purely the growth of *E. coli* and their sensitivity pattern with the following criteria were included in the study

- All Age Groups.
- Both Sex.
- Both Inpatients and Out Patients.

Exclusion Criteria:

2.1 | Urine culture report showing mixed organisms were excluded from the study

Data processing and statistical analysis: Statistical analysis of the result was performed by using window based computer software device with statistical packages for social science (SPSS-17) (SPSS Inc, Chicago, IL, USA). The results were presented in tables, figures, and diagrams. Chi square test were used for calculating the significance of difference. A p-value <0.05 was considered as level of significance.

3 | RESULTS

The findings of the study derived from data analysis are presented below. **Age distribution:** shows the distribution of patients by age. Mean age was 36.97 years with a SD of ± 13.48 years. Age group <30 years lead the tally with about 43% representation. The next leading age group was 45-55 years (31.4%). In all, 70 urine culture positive reports of *E. coli* and their sensitivity pattern pertaining to a period of 1 year (July 2011 to June 2013) were analyzed. We noted that UTI caused by *E. coli* was more common in females of age group 20-40 years in the subjected cases. In males it was commonly seen in age group 70 years and above (Fig-1). Based on the present study

it was noted that UTI caused by *E. coli* was mostly sensitive to amino glycosides.

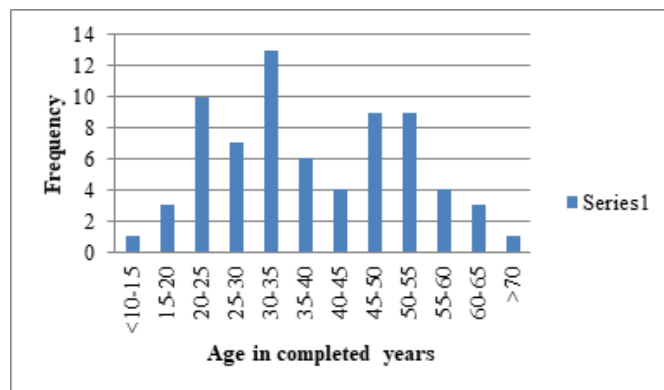


FIGURE 1: Histogram showing the distribution of patients by age.

Sex distribution: The pie chart below depicts the distribution of the patients by sex. Oct of respondents 70% (49) were male and the rest 30% (21) were female (Fig. 2).

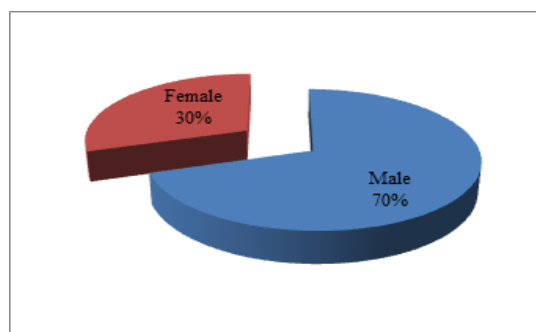


FIGURE 2: Pie chart showing the distribution of patients by sex.

TABLE 1: 1: Distribution of patients by investigations.

Investigations		Frequency	Percentage
Bacterial growth on urine culture (n=70)	Positive	12	17.1
	Negative	58	82.9

Pathogens isolated in urine culture: Table 6 shows that most (83.4%) of the urine infections were caused by *E. coli*. Only one instance of *Pseudomonas aeruginosa* and *Proteus* infection was reported (Table 5).

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TABLE 2: 2: Distribution of patients by pathogens isolated (urine culture).

Pathogens isolated	Frequency	Percentage
E. coli	10	83.4
Pseudomonas aeruginosa	1	8.3
Proteus	1	8.3

Sensitivity Pattern in Urine Culture: Sensitivity pattern of microorganisms demonstrates that out of 12 urine culture positive patients. 100% was sensitive to Tobramycin 75% to Amikacin and Ceftazidime. 66.7% 10 Celepime and Gentamycin 58.3% to Cotrimoxazole Ceftriaxone Cephadrine and cefixime was last sensitive (16.7% and 83% respectively). Amoxicillin Cephalixin and Ciprofloxacin were not at all sensitive. E. coli in UTI was resistant to cefixime in 91.7%, to ciprofloxacin in 100.0% cases and to cotrimoxazole in 41.7% of cases.

Table: 3: Distribution of patients by Sensitivity pattern (urine culture).

Name of antibiotics	Sensitivity pattern	Frequency	Percentage
Amikacin	Sensitive	9	75.0
	Resistance	3	25.0
Amoxycillin	Resistant	12	100.0
Cefepime	Sensitive	8	66.7
	Resistant	4	33.33
Cefixime	Sensitive	1	8.3
	Resistant	11	91.7
Ceftazidime	Sensitive	9	75.0
	Resistance	3	25.0
Ceftriaxone	Sensitive	1	8.3
	Resistant	11	91.7
Cephalexin	Resistant	12	100.0
Cephadrine	Sensitive	2	16.7
	Resistant	10	83.3
Ciprofloxacin	Resistant	12	100.0
Cotrimoxazole	Sensitive	7	58.3
	Resistant	5	41.7
Gentamycin	Sensitive	8	66.7
	Resistant	4	33.3
Nitrofurantoin	Sensitive	10	83.3
	Resistant	2	16.7
Tobramycin	Sensitive	12	100.0

4 | DISCUSSION

The prevalence of urosepsis in urological patients with nosocomial UTI was high and was in one study on average about 12%, whereas in patients with nosocomial UTI treated in other specialties the prevalence for severe sepsis was 2% and for septic shock 0.3%. Wagenlehner, Pilatz and Weidner et

al., (15) patients were included in this study according to selection criteria. Meenage was 36.97 years with a SD of ± 13.48 years and peak incidence was found in young adult whose age 30 or less. The study shows that UTI caused by E.coli is high among females in reproductive age groups, 20- 40 years. Short urethra, close proximity of female urethral meatus to anus, and sexual activity influence higher prevalence of UTI in women of reproductive age group. Among males, UTI caused by E. coli was high in elderly age group of 70 years and above, probably due to co morbid conditions like prostatic disease and diabetes. In the present study E. coli has been found to be more sensitive to amikacin, gentamycin and nitrofurantoin than other antibiotics used in the sensitivity test. E.coli is highly resistant to third generation cephalosporins, quinolones and cotrimoxazole. Among the amino glycosides resistance is more to gentamycin than to amikacin. The above mentioned resistance pattern is similar to a study by Durgesh et al., which showed UTI caused by E. coli was resistant to ciprofloxacin 80%, ceftriaxone 80% and cotrimoxazole 61% (16, 17). Inadequately treated UTI, besides extensive and inappropriate use of antibiotics and usage of spurious drugs has led to the development of organisms resistant to antibiotics. Choice of treatment of E. coli in UTI gets narrowed due to emerging resistance to drugs used previously. The high level of susceptibility of E. coli to nitrofurantoin may be due to nitrofurantoin's narrow spectrum of activity, limited indication like treatment of acute cystitis, narrow tissue distribution (18). The results are supported by a previous study from Nigeria in which E. coli showed sensitivity to nitrofurantoin 76% (present study 70.67%) and differed by another study by Shalini from India showed that 93.48% of E. coli in UTI are sensitive to nitrofurantoin (18), (19). Re-emergence of E.coli sensitivity to amino glycosides and nitrofurantoin is probably due to non-usage of the drugs for a long period of time. This study 100% was sensitive to Tobramycin 75% to Amikacin and Ceftazidime. 66.7% 10 Celepime and Gentamycin 58.3% to Cotrimoxazole Ceftriaxone Cephadrine and cefixime was last sensitive (16.7% and 83% respectively). Amoxicillin Cephalixin and Ciprofloxacin were not at all sensitive. E. coli in UTI was resistant to cefixime in 91.7%, to ciprofloxacin

in 100.0% cases and to cotrimoxazole in 41.7% of cases. Amino glycosides are nephrotoxic and should be given parenteral, so not preferable in outpatients and renal failure cases. Nitrofurantoin has been less commonly used in the treatment of uncomplicated UTI in recent years. Earlier usage of monohydrate formulations of nitrofurantoin required dosing administration four times a day and data from literatures suggested that three day course of nitrofurantoin was not as effective as quinolones and cotrimoxazole. So until recently nitrofurantoin was considered as an inferior agent for uncomplicated UTI. But, currently available macrocrystal formulation of nitrofurantoin can be given as twice daily regimen (20). The increased sensitivity of *E. coli* to nitrofurantoin has made three day treatment of nitrofurantoin the current treatment of choice. The study shows that the organism *E. coli* in UTI is resistant to commonly prescribed drugs like quinolones. The drug quinolone is commonly prescribed because it achieves high concentration in urine. Over use of quinolone has led to increased prevalence of *E. coli* resistance to it (18). *E. coli* has developed resistance to third generation cephalosporins, quinolones, and cotrimoxazole and so they cannot be considered for treatment in UTI caused by *E. coli*. This result correlates with international study. Most (83.4%) of the urine infections were caused by *E. coli*. Injudicious use of anti-microbial agents is a growing concern all over the world. This was also depicted in our study findings. Some widely used antibiotics like Amoxicillin, Cephalexin and Ciprofloxacin were found 100% resistant in urine culture. Few sensitive antibiotics were Tobramycin (100 %), Amikacin and Ceftazidime (75%). Almost same sensitivity pattern was found in blood culture. These findings supported by few international studies as well (21).

4.1 | Conclusion

This study highlighted the recurrence of *E. coli* sensitive to amino glycosides and nitrofurantoin and increasing resistance to quinolones and third generation cephalosporins. Constant surveillance of antibiotic sensitivity pattern will help the medical practitioners to use safe and effective therapy within the management of UTI caused by *E. coli*. Proper guidelines, supervision of antibiotic usage and constant in-

formation to the medical practitioners regarding the sensitivity pattern can help to stop drug resistance.

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