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Bacteriological Profile and Their Antimicrobial Susceptibility Pattern of Urinary Tract Infection Patients Attending at the Nephrology Department of Enam Medical College and Hospital, Savar, Dhaka.

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Abstract

Introduction: *Urinary tract infection (UTI) is one of the common bacterial infections encountered by clinicians in clinical practice. Distribution and susceptibility of UTI-causing pathogens change according to time and place. Area-specific studies to gain knowledge about the type of pathogens and their resistance patterns may help the clinician to choose the proper antimicrobials for empirical treatment.* ***Objective:*** *This study was conducted to determine the distribution and antimicrobial susceptibility of uropathogens.* ***Materials and Methods:*** *This study was conducted in the Enam Medical College & Hospital, savar, Dhaka between January 2021 to June 2021 to identify the organisms causing UTI and their antibiotic susceptibility. Clean catch midstream urine samples were collected from 476 clinically suspected UTI patients and tested bacteriologically using standard procedures. Antimicrobial susceptibility test was performed by Kirby-Bauer disk diffusion method.* ***Results:*** *The prevalence of UTI was higher in females than in males. Out of the 170 culture positive bacterial isolates Escherichia coli was the most common 51.76% organism, followed by Staphylococcus aureus 28.82%, Staphylococcus saprophyticus 11.17%, Klebsiellaspp 8.23 % and Enterococcusspp 4.70%. Meropenem (100%) followed by Imipenem (92.86% to 100%) were found most susceptible drugs. While Trimethoprim-sulfamethoxazole and Cephradine were the most resistant drug against the isolated uropathogens.* ***Conclusion:*** *As bacterial drug resistance is an evolving process, routine surveillance and monitoring studies should be conducted to provide physicians knowledge on the updated and most effective empirical treatment of UTIs.*

Key words: *Urinary tract infection, Bacteriological profile and Antimicrobial resistance.*

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Introduction:

Urinary tract infection (UTI) is one of the most common bacterial infections seen in clinical practice, affecting more than 150 million people annually with a high rate of morbidity and financial cost[1]. UTI may be either symptomatic or asymptomatic. Symptomatic infection is associated with a wide spectrum of morbidity, from mild irritative voiding symptoms to bacteremia, sepsis and occasionally death[2]. Typical symptoms of UTI include the triad of urgency (the enhanced desire to void the bladder), frequency (increased frequency of urination) and dysuria (painful urination)[3]. Clinically, UTIs are categorized as uncomplicated or complicated. Uncomplicated UTIs typically affect individuals who are otherwise healthy and have no structural or neurological urinary tract abnormalities[4]. Several risk factors including female anatomy, age, sexual activity, vaginal infection, diabetes, obesity, certain types of birth control practice and genetic susceptibility are associated with uncomplicated UTI. Whereas complicated UTI may be defined as; UTIs associated with factors that compromise the urinary tract or host defense, including urinary tract abnormalities, urinary obstruction, urinary retention caused by neurological disease, immunosuppression, renal failure, renal transplantation, pregnancy and the presence of foreign bodies such as calculi, indwelling catheters or other drainage devices[4,5]. Complicated UTIs in particular constitute a huge burden on health-care systems as a frequent reason for hospitalization[6].

UTIs are usually caused by a single bacterial species but polymicrobial

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infections may also take place. Among the uropathogens, Escherichia coli (Esch. coli) is responsible for 75–90% infections[7]. Other organisms such as Klebsiella spp., Pseudomonas, Proteus spp., Enterococcus faecalis and Enterobacter account for a smaller number of infections. Staphylococcus saprophyticus is also responsible for approximately 5-15% UTI cases in young sexually active females[8,4]. Chronic Kidney Disease (CKD) is now a global problem. Infection is one of the major causes of greater morbidity and mortality in CKD patients[9]. Due to the structural and functional defect, incidence of UTI in CKD patients is higher compared to others. Increased risk of UTI in CKD patients includes; the impairment of host immunity, change in the composition of urine, oliguria, anuria and the resultant changes in urinary pH and osmolality. Furthermore, uremic condition may also inhibit the antimicrobial activity of granulocytes, macrophages and other defense reactions of the host. In the patients with CKD, urinary drug concentration may be too low to eradicate organisms completely[10].

Antibiotics are the cornerstone in treating UTI. Easy availability and non-judicious use of antimicrobial agents may contribute to the development of resistance against commonly used antibiotics[11]. As antimicrobial susceptibility test report is usually obtained after 48 hours, clinicians have to start an antimicrobial drug before getting the report. In these cases, the empirical choice of antibiotic is influenced by recent available data about the susceptibility pattern and the causative agent[8]. Unfortunately, UTI has been suffering a shift in the etiological agents and antimicrobial susceptibility in the last decade. Distribution of urinary pathogens and the susceptibility pattern to antimicrobial agents may vary in different places and in same place from time to time[12,11]. Thus empirical choice of antibiotics in UTI is not uniform and it depends on local guidelines, if available[11]. Therefore, it is necessary to have knowledge about the distribution of the pathogens and their susceptibility pattern to antibiotics in a particular setting to guide the initial empirical treatment[12].

There is a need to generate data in every institution that will guide the clinicians to select empirical choice of appropriate antimicrobial agent. Thus the present study was carried out to describe the bacteriological profile causing UTI and their antimicrobial susceptibility pattern. This study is important for clinicians in order to facilitate the effective treatment and management of patient with urinary tract infection.

Materials and Methods:

This cross sectional study was carried out in the department of Nephrology and Microbiology in Enam Medical College Hospital, Savar, Dhaka during the period of January 2021 to June 2021. Irrespective of age and sex of the patient, a total of 476 clean-catch midstream urine specimens were collected from the clinically suspected UTI patients with their written consent from the Nephrology department of Enam Medical College Hospital, Savar, Dhaka. The study was approved by the ethical review committee of the Enam Medical College.

After collection of specimen a loopful (0.01 mL) of urine was inoculated by calibrated wire loop on Blood agar and MacConkey's agar media and incubated aerobically at 37°C for 24 hours for the growth of bacteria. All the plates were inspected for growth and the isolates were identified by observing colony morphology, Gram-stain characteristics and relevant biochemical tests. Colony count $\geq 10^5$ colony /mL of urine were considered as significant bacterial growth. All the isolates were tested for susceptibility against Azithromycin, Ciprofloxacin, Amoxicillin-clavulonic acid, Cefixime, Cefuroxime, Cephradine, Nitrofurantoin, Trimethoprim-sulfamethoxazole, Ceftriaxone, Ceftazidime, Gentamicin, Imipenem and Meropenem antibiotics by Kirby Bauer disc diffusion technique on Mueller-Hinton agar media. Results were read according to the National Committee for Clinical Laboratory Standards guidelines[13,14].

Results:

The distribution of the infections according to the age and sex of the UTI patients are summarized in Table 1. Among 170 patients, majority were females 109 (64.11%) and the male to female ratio was 1: 1.79. Most of the patients 54 (31.77 %) were in the age group 50-59 years, followed by 33 (19.41%) in the 60-69 age group.

Table-I: Age and sex distribution of the UTI patients.

Age group	Male	Female	Total
< 20	-	02	02
20-29	02	05	07
30-39	05	16	21
40-49	06	17	23
50-59	23	31	54
60-69	13	20	33
≥ 70	12	18	30
Total	**61**	**109**	**170**

In the present study, we found that vomiting 82.35% was the commonest symptom followed by increased frequency of micturition 76.48%, supra-pubic pain 73.52%, dysuria/burning sensation 64.70%, incontinence 55.89%, urgency of urine 51.76%, fever 38.23% and loin pain in 17.64% cases (Fig: 1).

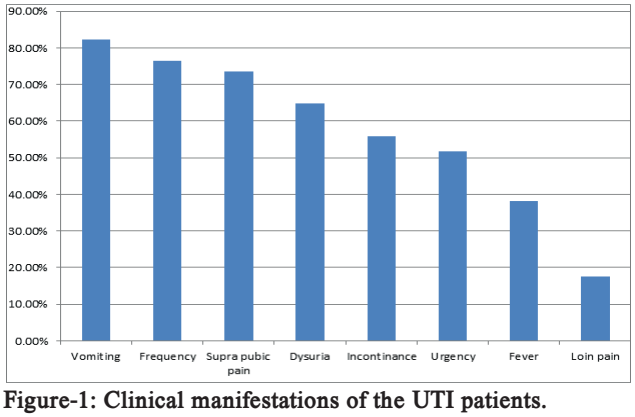

Figure-1: Clinical manifestations of the UTI patients.

Out of 170 culture positive samples Escherichia coli was found to be most commonest 88 (51.76%) organism, followed by Staphylococcus aureus 49 (28.82%), Staphylococcus saprophyticus 19 (11.17%), Klebsiellaspp 14(8.23 %) and Enterococcusspp 8 (4.70%).

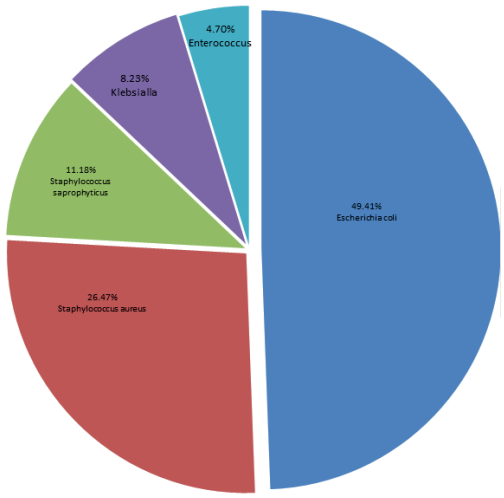

Figure-2: Bacteriological patternisolated from the urine samples (n=170).

The susceptibility pattern of the commonly used antibiotics are summarized in table- III. In our study susceptibility pattern of Esch. coli showed lowest Trimethoprim-sulfamethoxazole 10.71%, and followed by Cefixime 21.42% sensitive. Meropenem was found to be 100% sensitive, followed by Imepenem95.23%, Ceftazidime89.29% andCeftriaxone were 84.52% sensitive.

Staphylococcus aureus exhibited low level of sensitivity against Trimethoprim-sulfamethoxazole 10.71%, Cephradine20.23%, Cefuoxime 22.61% and Cefixime 31.11%. Average sensitivity were observed against Ciprofloxacin 48.89% and Azithromycin 64.44%. While high level of sensitivity showed against Imipenem 93.33%, Gentamicin 91.11%, Ceftazidime 89.29% and Ceftriaxone 84.44%. Meropenemwas found to be 100% sensitive.

Sensitivity pattern of Staphylococcus saprophyticus showed lowest against Trimethoprim-sulfamethoxazole 15.17% followed by Cephradine 31.58% and Ciprofloxacin 42.11%. While Nitrofurantoin and Amoxicillin-Clavulonic were found 78.94% sensitive. Imipenem 94.73%, Ceftazidime 89.48% and Ceftriaxone 84.21% sensitive. Meropenem showed 100% sensitive.

Klebsiella spp. showed sensitivity level against Trimethoprim-sulfamethoxazole 7.16% followed byCephradine 28.58% and Ciprofloxacin 35.71%. Imipenem, Ceftazidime, Ceftriaxone,Nitrofurantoin and Amoxicillin-Clavulonic were found 92.86%, 85.71%, 85.71%, 78.58% and 71.42% sensitive respectively. While Meropenem showed no resistance.

Enterococcus spp. showed lowest 00% sensitivityagainst Trimethoprim-sulfamethoxazole and highest 100% sensitive against Meropenem and Imepenem. Moderately sensitive were found against Azithromycin 75.00%, Amoxicillin-Clavulonicacid75.0% and Nitrofurantoin 62.5%. While Ceftazidime and Ceftriaxone were 87.5% and 87.5% sensitive respectively.

Table-III: Antimicrobial susceptibility pattern of the bacterial isolates.

Antibiotics	Esch. coli	Staph. aureus	Staph. saprophyticus	Klebsiella spp	Enterococcus spp
Trimethoprim-sulfamethoxazole	10.71%	10.71%	15.17%	7.16%	00%
Cephradine	20.23%	20.23%	31.58%	28.58%	12.5%
Ciprofloxacin	32.14%	48.89%	42.11%	35.71%	37.5%
Azithromycin	70.23%	64.44%	52.64%	64.29%	75.00%
Cefixime	21.42%	31.11%	42.10%	42.86%	50%
Cefuoxime	22.61%	22.61%	42.10%	64.29%	37.5%
Amoxicillin-Clavulonic acid	69.04%	69.04%	78.94%	71.42%	75.00%
Nitrofurantoin	82.14%	82.14%	78.94%	78.58%	62.5%
Ceftazidime	89.29%	89.29%	89.48%	85.71%	87.5%
Ceftriaxone	84.52%	84.44%	84.21%	85.71%	87.5%
Gentamicin	76.20%	91.11%	84.21%	71.42%	50%
Imipenem	95.23%	93.33%	94.73%	92.86%	100 %
Meropenem	100%	100%	100%	100%	100%

Discussion:

UTI is one of the most common a common clinical problem seen in clinical practice both in outpatient and inpatient department. Epidemiologically UTIs account for more than 150 million cases annually with a high rate of morbidity and financial cost.

In the present study, we found 109 (64.11%) were females and the male to female ratio was 1: 1.79. Most of the patients 54 (31.77 %) were in the age group of 50-59 years. Similar finding had been observed in a study done by Ahmed F et al. in Bangladesh which reported 67% were females and the male to female ratio was 0.49:1. The most common age group was 46–60 years (34%)[15]. In another study by Rahman MR et al. also showed that out of 103 patients females were (69) more than male (34) with a male to female ratio of 1:2. Mean age was 57.5±9.5 (range 19-80) years[11]. Female predominance were observed in the present and other studies. The reason behind this high prevalence of UTI in females is due to proximity of the urethral meatus to the anus, shorter and wider urethra, sexual intercourse, incontinence and less acidic pH of vaginal surface and poor hygienic conditions. The incidence of UTI increases with age[15].

In the present study, we found that vomiting 82.35% was the commonest symptom followed by increased frequency of micturition 76.48%, supra-pubic pain 73.52%, Dysuria/Burning sensation 64.70%, incontinence 55.89%, urgency of urine 51.76%, fever 38.23% and loin pain in 17.64% cases In a study done by Raman MR et al. found Fever 93.2% was the most common symptom followed by increased urinary frequency 46.6%, Dysuria 79.6%, loin

pain 30.1%, supra-pubic pain 45.6%, incontinence 7.8% and vomiting in 40.8% patients[11]. In other study Ahmed F et al. showed most of the patients had fever 55%, followed by loin pain 37%, burning and increased frequency of micturition 32%, vomiting 28%, urgency of urine 23%, delirium 15% and incontinence in 18% patients[15].

In our study we found Escherichia coli to be most common 88(51.76%) organism, followed by Staphylococcus aureus 49(28.82%), Staphylococcus saprophyticus 19(11.17%), Klebsiellaspp 14(8.23 %) and Enterococcusspp 8(4.70%) cases. In a study Saber S et al revealed that E. coli (64%) was the most common organism and Staphylococcus spp. 19%, Proteus 12 % and Klebsiella 5%were the other organisms[3]. Setu SK et al. showed that among the gram negative organisms E. coli 63.93% was the most common followed by Klebsiellaspp 17.09%, Pseudomonas 5.59%, Enterobacter (5.28%) were the other isolates. While Enterococci 75.07% was the predominant followed by Staphylococcus aureus 12.88% among the gram positive organisms[16]. In another study by Nazme NI et al. found E. coli was the commonest isolate 62.1% followed by Enterococcus 19.2%, Klebsiella 10.2%, Pseudomonas 3.4%, Acinetobacter 3.4% and Proteus 1.7%[17]. It is observed that although Esch. coli was the most frequent pathogen in all study results but there are variations in other organisms among different studies. The dissimilarities of the rate of isolation and isolated bacterial species between the present study and other studies may be due to the geographical variation, difference among sexes, various personal, educational and overall socioeconomic status, availability of medical facilities, method of collection of urine samples etc[12].

Regarding the susceptibility pattern of antibiotics, it was observed that the Meropenem 100% followed by Imipenem (E. coli- 95.23%, Staph. aureus-93.33%, Staph. saprophyticus-94.73%and Klesiella spp-92.86%) were the most effective antibiotic in our present study.

In our present study susceptibility pattern of Esch. coli showed lowest Trimethoprim-sulfamethoxazole 10.71% and followed by Cefixime 21.42% sensitive. Meropenem was found to be 100% sensitive, followed by Imepenem 95.23%, Ceftazidime 89.29% and Ceftriaxone were 84.52% sensitive. In a study done by Shill MC et al showed that Esch. coli exhibited high resistance with amoxicillin and ciprofloxacin with 94% and 79% resistance respectively. All the Cephalosporins showed moderate activity against the Esch. coli infection; Cephradine, Cefixime, Ceftriaxone and Cefepime exhibited 68.7%, 62.7%, 61.2% and 46.3% resistance respectively. Gentamicin demonstrated only 26.9% resistance while Meropenem showed no resistance at all. Amikacin also proved to be very active against Esch. coli with only 3% resistance and so did nitrofurantoin with just 11.9% resistance[18]. In another study Hossain Get al. showed that Esch. coli was most sensitive to Nitrofurantoin (92.5%), Meropenem 92.5%, Amikacin (84.6%) and Gentamycin 71.8% and resistant to most commonly used drugs like Cefixime 78%, Cefuroxime 77.5%, Ciprofloxacin 62.5%, Ceftriaxone 62.5%[19].

In our study Staph. aureus exhibited low level of sensitivity against Trimethoprim-sulfamethoxazole 10.71%, Cephradine 20.23%, Cefuoxime 22.61% and Cefixime 31.11%. Average sensitivity were observed against Ciprofloxacin 48.89% and Azithromycin 64.44%. While high level of sensitivity showed against Imipenem 93.33%, Gentamicin 91.11%, Ceftazidime 89.29% and Ceftriaxone 84.44%. Meropenem was found to be 100% sensitive. The study done by Haider JSet al.found that the Gram positive isolates including Staph.aureus showed highly sensitive 100 % to Nitrofurantoin, Deptomycin and Linezolid followed by Teicoplanin 90.5% and showed low response to Cefoxitin 9.5%, Cefotaxime, Imipenem and Oxacillin showed 14.3%, Erythromycin and Ampicillin showed 28.6% and Amoxicillin-clavulanae 33.3% and Penicillin G 38.0%[20]. We found Sensitivity pattern of Staphylococcus saprophyticus lowest against Trimethoprim-sulfamethoxazole 15.17% followed by Cephradine 31.58% and Ciprofloxacin 42.11%. While Nitrofurantoin and Amoxicillin-Clavulonic acid were found 78.94% sensitive. Imipenem 94.73%, Ceftazidime 89.48% and Ceftriaxone 84.21% sensitive. Meropenem showed 100% sensitive. In a study done by Haque R et al. found Trimethoprim-sulfamethoxazole 73.68%, Cefaclor 73.68%, Amoxicillin 71.05%, Cephalexin 65.79%, Ciprofloxacin 63.16%, Ceftriaxone 44.74%, Cefuroxime 39.47%, Gentamicin 47.37% and Nitrofurantoin 18.42%, resistance against Staph. saprophyticus[7]. In our study Klebsiella spp. showed low of sensitivity level against Trimethoprim-sulfamethoxazole 7.16% followed by Cephradine 28.58% and Ciprofloxacin 35.71%. Imipenem, Ceftazidime, Ceftriaxone, Nitrofurantoin and Amoxicillin-Clavulonic acid were found 92.86%, 85.71%, 85.71%, 78.58% and 71.42% sensitive respectively. While Meropenem showed no resistance. Study done by Mollicket al. showed the sensitivity pattern of Klebsiella spp. They found Cephradine 22.23 %, Ceftriaxone 44.44 %, Cefixime 44.44%, Ceftazidime 55.56%, Cotrimoxazole 44.44%, Ciprofloxacin 66.67%, Nitrofurantoin 72.22%, Gentamicin 77.77% and Amikacin 88.89%, Meropenem 94.44% and Imipenam 100% sensitive[12]. In a study done Ahmed F et al. showed that as a whole all organisms are mostly sensitive to Meropenem 93.1%, Nitrofurantoin 86.2%, Amikacin 77.2% and Gentamycin 64.9% and mostly resistant to Cefixime 83.3%, Cefuroxime 81.4% and Ceftriaxone 66.9%[15]. From the analysis of the results of the antimicrobial susceptibility pattern of the present and other studies it revealed that the susceptibility pattern of some antibiotics are seems to be similar or closure to our study and some are quite dissimilar. It may due that the resistance pattern of uropathogens is changing drastically, because of uncontrolled-widespread use of antibiotics[1] and it may also vary in different places andeven in same place from time to time or even institution to institution[11,8].

Conclusion:

Pattern of uropathogens vary in different settings and the increasing antimicrobial resistance is a great concern in developed and developing countries. Wherever possible,

urine culture and sensitivity of micro-organisms should be done before prescribing antibiotics and the empirical therapy must be considered on the recent antibiogram of a particular geographical area.

Conflict of Interest: None.

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