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Antibiotic sensitivity pattern of gram negative uropathogenic bacilli at a private hospital in Dhaka city

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Abstract: *Background:* Urinary tract infection (UTI) is one of the most common infections affecting different age group of the patients. *Objective:* The purpose of the present study was to find out the spectrum and antibiotic sensitivity pattern of uropathogens isolated from the UTI patients. *Methodology:* This retrospective study was conducted at a private clinic in Dhaka city during January to December, 2012 for a period of one year. Urine was collected from suspected cases of UTI patients. Isolation and identification was performed by standard methods. Antibiotic sensitivity and interpretation was done according to CLSI guidelines. *Result:* A total number of 501 clinical samples of urine were collected of which 141(28.0%) showed significant bacterial growth. The commonest bacterium isolated from the culture positive urine sample was *Klebsiella* species (41.8%) followed by *Escherichia coli* (39.7%), *Pseudomonas* species (15.6%) and *Proteus* species (2.8%). Members of the Enterobacteriaceae were 80-100% sensitive to imipenem while they were found variably sensitive to other commonly used antibiotics. Sensitivity pattern of *Pseudomonas* species were also varied. *Conclusion:* In conclusion *Klebsiella* species is the most common bacteria causing UTI followed by *E. coli* with varied sensitivity pattern.

Keywords: Urinary tract infection; UTI, *Escherichia coli*; *Klebsiella* species; antibiotic sensitivity pattern.

Introduction

Urinary tract infection (UTI) is the second most common infections after respiratory tract infections [1]. With the advent of novel antibiotics, though a significant reduction in the prevalence of infectious diseases is seen worldwide in the initial years, eventually a new form of infectious diseases caused by drug-resistant bacteria has evolved [2]. The irrational use of an antibiotic as well as prescribing of antibiotics without prior sensitivity testing is directly related with the subsequent development of resistance [1]. UTI was found as the most common cause of nosocomial infection among hospitalized patients [3].

It is well established that women are more prone to develop UTI [2]. Pregnancy also makes the women more susceptible to the infection [4]. It has been observed that about 20.0% of the women experienced a single episode of UTI during their lifetime, and 3.0% of women had more than one episode of UTI per year [5]. The incidence of UTI rises even in men due to prostate enlargement and neurogenic bladder with advancing age [6]. Catheter-associated UTI is a problem with about 10.0% of the patients developing bacteriuria [7]. In almost all cases of nosocomial UTI, there is a need to start treatment before the final microbiological results are available [1].

Studies from India [8], Bangladesh [9] and Nepal [10] have reported an increased resistance of the urinary pathogens to commonly used antibiotics. Area-specific monitoring studies aimed to gain knowledge about the types of pathogens responsible for UTIs and their resistance pattern may help the clinician to choose the correct empirical treatment [1].

Hence, this study was undertaken to find out the aetiology and sensitivity pattern of uropathogenic bacteria isolated from outpatients and inpatients with urinary tract infection in Dhaka city.

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Material and Methods

This retrospective study was carried out in the Department of Microbiology at a private hospital in Dhaka city having indoor and outdoor treatment facilities during the period of Jan 2012 to Dec 2012 for a period of one (01) year. All the adult male and female patients with an age of more than 18 years attended at the OPD and admitted at IPD with the clinical features of UTI were included for this study. The samples were midstream urine specimen, catheterized urine samples, supra-pubic aspirates collected in sterile universal bottles (approximately 15 ml) collected with standard procedure [11]. The urine samples were centrifuged at 3000 rpm for 15 minutes. Then the supernatant was discarded and one drop of the sediment was put onto the glass slide to examine the presence of significant pus cell in both male (3-5/HPF) and female (≥5/HPF) [1].

Absence of significant pus cell containing urine was discarded. The samples were inoculated on the Blood agar and MacConkey agar media as well as onto Cystine Lactose Electrolyte Deficient (CLED) agar by calibrated sterile wire loop. The inoculated culture plates were incubated at 37° C for 24 hours. The plates were observed for bacterial growth. The isolates were identified by observing colony morphology, Gram-stain characteristics and relevant biochemical tests [11]. Culture results were interpreted according to the standard criteria and a growth of $\geq 10^5$ colony forming units/ml was considered as significant bacteriuria [12]. Antibiotic susceptibility test was carried out by the Kirby Bauer technique and interpretations were made for each bacterial isolate following interpretative criteria recommended by the Clinical Laboratory Standard Institute [13]. Statistical analysis of the results was obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-15) (SPSS Inc, Chicago, IL, USA). The results will be presented in tables, figures, diagrams. Qualitative variables will be expressed as frequency and percentage and quantitative variables will be expressed as mean and standard deviation.

Results

A total number of 501 urine samples from indoor and outdoor patients had been collected of which 141(28.1%) showed significant growth of uropathogens and the rest 360(71.9%) showed no growth of bacteria (Table 1).

Table-1: Growth of Urine culture among the Study Population (n=501)

Growth	Frequency	Percentage
Positive	360	71.9
Negative	141	28.1
Total	**501**	**100.0**

Considering age distribution of the culture-positive cases, most of the patients were in the age group of 20 to 40 years which were 45 cases; among them 36(80.0%) cases were female and the rest 9(20.5%) cases were male. In the age group of 40 to 60 years and more than 60 years the number of patients was 38 cases on each. In these two age groups female was predominant than male. In the age group of less than 20 years female is also predominant than male which is 12(60.0%) cases and 8(40.0%) cases respectively. Overall female is more common than male. The ratio of male and female is 1:2.2. The mean age ± SD of the culture positive study population was 45.56 ± 22.55 years with a range of 1 to 93 years (Table 2).

Table-2: Age and Sex Distribution of UTI Positive Patient (n=141)

Age Group	Sex		Total	P value
	Male	Female		
Less than 20 Years	8(40.0%)	12(60.0%)	20(100.0%)	0.136
20 to 40 Years	9(20.5%)	36(80.0%)	45(100.0%)	
40 to 60 Years	11(28.9%)	27(71.1%)	38(100.0%)	
More than 60	16(42.1%)	22(57.9%)	38(100.0%)	
Total	**44(31.2%)**	**97(68.8%)**	**141(100.0%)**	

*Chi-square test has been done; male: female=1:2.2. *Mean Age ± SD=45.56±22.55 (18 to 93 years)

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The commonest bacteria isolated from the culture positive urine sample was *Klebsiella* species which was 59(41.8%) followed by *Escherichia coli*, *Pseudomonas* species and *Proteus* species which were 56 (39.7%) cases, 22(15.6%) cases and 4(2.8%) cases respectively (Table 3).

Table-3: Distribution of Bacteria isolated from Culture Positive Patient (n=141)

Name of Bacteria	Frequency	Percent
Klebsiella Species	59	41.8
Escherichia coli	56	39.7
Pseudomonas species	22	15.6
Proteus species	4	2.8
Total	**141**	**100.0**

E. coli were found highly sensitive to imipenem (87.2%), amikacin (73.1%) and nitrofurantoin (65.8%); however, ceftriaxone (33.3%), co-trimoxazole (25.5%), pefloxacin (24.5%) and nalidixic acid (15.7%) were less sensitive. In addition to that gentamicin (44.4%), ciprofloxacin (29.6%) and netilmycin (57.7%) were also low sensitivity in varied percentage. *Klebseilla* species was found highly sensitive to imipenem (85.1%), amikacin (78.4%) and nitrofurantoin (61.2%). Interestingly very low sensitivity was detected to ceftazidime (13.0%), co-trimoxazole (13.5%) and nalidixic acid (15.7%). *Proteus* species was sensitive to netilmycin (75.0%) and cefipime (66.7%). *Pseudomonas* species was sensitive to nalidixic acid (94.7%); however, amikacin (47.6%) was almost resistant (Table 4).

Table-4: Sensitivity Rate of Isolated Gram Negative Bacilli (n=141)

Antibiotic	*E. coli*	*Klebseilla* spp.	*Proteus*	*Pseudomonas*
	No. (%)	**No. (%)**	**No. (%)**	**No. (%)**
Azithromycin	14(28.0)	22 (40.7)	-	-
Ciprofloxacin	16(29.6)	22 (38.6)	2 (50)	1 (4.5)
Ceftriaxone	17(30.3)	19 (33.9)	2 (50)	3 (13.6)
Pefloxacin	12(24.5)	22 (40.0)	1 (25)	1 (4.8)
Nitrofurantoin	25(65.8)	30 (61.2)	-	-
Netilmycin	30(57.7)	38 (69.1)	3 (75)	-
Nalidixic acid	8(15.7)	6 (10.2)	-	18 (81.8)
Ceftazidime	14(26.9)	6 (13.0)	1 (50)	2 (9.5)
Amikacin	38(73.1)	40 (78.4)	2 (50)	10 (47.6)
Cefipime	7(28.0)	9 (30.0)	2 (66.7)	1 (12.5)
Co-trimoxazole	13(25.5)	7 (13.5)	1 (25)	-
Imipenem	41(87.2)	40 (85.1)	2 (66.7)	-
Gentamicin	20(44.4)	26 (54.2)	1 (25)	3 (15.8)
Total	**56**	**59**	**4**	**22**

*Parenthesis within the bracket indicates the percentage.

Discussion

Urine culture is very much important for treatment of UTI in both male and female. It is also very much essential to isolate and identify the bacteria which cause urinary tract infection. In addition to that the susceptibility pattern of these bacteria is very important to avoid the development of drug resistant [14]. In the present study, isolation and identification of uropathogens were performed and some 141(28.0%) urine sample showed significant growth of bacteria. So, remaining majority (72.0%) of the cases showed either insignificant bacteriuria or no growth with urine from the suspected cases of UTI.

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The reason of low growth rate may be due to irrational use of antibiotic which is available in the local market in this country and these are given without prior culture and antibiotic sensitivity pattern. In addition to that, incomplete dose is another factor. Prior antibiotic therapy before sending urine samples for culture and sensitivity and other clinical conditions like non-gonococcal urethritis could be the factors responsible for insignificant bacteriuria or no growth [15].

The age and sex distribution of the patients diagnosed with UTI among the hospitalized patients and those attending the outpatient department followed the natural epidemiological pattern of UTI [9]. There were a higher number of young adult female patients diagnosed as UTI cases. The ratio is more than two times more frequent in female than male (ratio male: female=1:2.2). It is well established that female are more commonly infected with UTI than male due to anatomical position of urethra, influence of hormone and pregnancy [16]. The international studies have shown that UTIs in women are very common; therefore, one in five adult women experience UTI in her life and it is extremely common, clinically apparent, worldwide patient problem [17].

In this present study, the Enterobacteriaceae group of bacteria were detected which causes UTI. Among these isolates *Klebsiella* species (41.8%) is the most common bacteria. *Escherichia coli* (39.7%) is next to this isolates. *Proteus* species (2.8%) and *Pseudomonas* species (15.6%) were also identified. The isolation rate of urinary pathogens of the present study is consistent with reports of the studies published elsewhere [8, 18]. Behzadi et al [14] reported that *Klebsiella* species and *Escherichia coli* are the most common bacteria isolated from UTI which is consistent with the present study result. In addition to that several authors around the world have been reported that the Gram negative bacteria of *Klebsiella* spp. and *E. coli* are the most frequent organisms isolated from UTI patients and this is similar to the present study result [17].

Escherichia coli were found highly sensitive to imipenem (87.2%), amikacin (73.1%) and nitrofurantoin (65.8%). This is consistent with reports from different countries [19-20]. However, resistant to ceftriaxone (33.3%), co-trimoxazole (25.5%), pefloxacin (24.5%) and nalidixic acid (15.7%) were also noticed. Gentamicin (44.4%), ciprofloxacin (29.6%) and netilmycin (57.7%) were also found resistant. In another study from Bangladesh it has been reported that an increased resistance of the uropathogens to ciprofloxacin, netilmycin and gentamicin are found [21].

Klebsiella species was found highly sensitive to imipenem (85.1%), amikacin (78.4%) and nitrofurantoin (61.2%). Similar to the present result Gupta et al [12] has reported that *Klebsiella* species is found high susceptibility to imipenem (100%) and amikacin (85%); however, these species are relatively resistant to commonly used antibiotics. Conversely, resistant was detected to ceftazidime (13.0%), co-trimoxazole (13.5%) and nalidixic acid (15.7%). *Proteus* species was sensitive to netilmycin (75.0%) and cefipime (66.7%). Similar result has been reported by Pai and Nair [1] and has mentioned that *Proteus* species are susceptible to netilmycin and cefipime. In India Manjula et al [22] has also got a similar result. This finding is comparable to Shilpi et al [23] in Bangladesh who has found that members of *Enterobacteiacaee* variably sensitive to different antibiotics. Similar susceptibility pattern was also reported by Sultana et al [24].

Pseudomonas species was sensitive to nalidixic acid (94.7%); however, amikacin (47.6%) was almost resistant. *Pseudomonas* species is a common cause of hospital-acquired UTI [25]. It has been found less sensitive to the common antibiotics [1]. Similar results were reported by investigators by Shilpi et al [23] and Obiogbolu et al [24]. It has been reported that *Pseudomonas* species were relatively susceptible to the anti-pseudomonas drugs and most of these were associated with high-level resistance to the first-line antibiotics investigated [26].

This may be due to widespread use of common antibiotics in the hospital and cross-resistance among different bacteria [1]. The results of the present study has shown that sensitivity rate of the uropathogens are low for

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co-trimoxazole and ampicillin. This low sensitivity could be due to widespread use of the antibiotics in the community. It is possible that the low sensitivity is present among uropathogens of the nosocomial as well as community-acquired UTI [27]. The patients attending outpatient department and some of the hospitalized patients may be having community-acquired UTI [2].

In the present study, community-acquired UTI and nosocomial UTI were not been distinguished. This was the main limitation of the study.

Conclusion

In the conclusion, from this study, it has been found that Gram-negative bacteria are the commonest organisms isolated from UTI patients among which *Klebsiella* species and *E coli* are the two principal urinary pathogens. This present study indicates that antibiotics commonly used for the treatment of UTIs are less effective. Since this was a cross-sectional study, further regular monitoring is required to establish reliable information about susceptibility pattern of urinary pathogens for optimal therapy of patients with UTI.

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