Original Article

Antibiotic sensitivity pattern of urinary tract infection at a tertiary care hospital

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Abstract:

Background: Urinary tract infections (UTIs) remain the common infections in outpatients as well as hospitalized patients. Current knowledge on antimicrobial sensitivity pattern is essential for appropriate therapy. The aim of the study is to determine the changing pattern of antibiotic sensitivity among uropathogens causing UTI.

Methods: Urinary isolates from symptomatic UTI cases attending in Square hospital were processed in the Microbiology lab. Antimicrobial susceptibility testing was performed by Kirby Bauer's disc diffusion method. Extended spectrum beta lactamase (ESBL) production was determined by double disk synergy test method.

Results: Of the 200 tested sample 110 samples showed growth of pathogens among which the most prevalent were E.coli (58.18%) followed by Enterococci (13.6%). The majority (68.18%) of the isolates were from female. ESBL production was observed in 46.87% o E.coli strains and 25% of Klebsiella strains. More than 98% of the isolates are sensitive to Imipenem, Meropenem , while 86.36% are sensitive to Amikacin , 73.63% to Nitrofurantoin and 74.54% to Gentamicin. Very high rate of resistance is seen against amoxicillin (88.19%), cefixime (65.46%), cotrimoxazole (68.19%) and ceftriaxone (63.63%). E. coli showed high sensitivity to meropenem, imipenem and amikacin (100%) followed by Gentamicin (94.1%).

Conclusion: The study revealed that E.coli was the predominant bacterial pathogens of UTIs. An increasing trend in the production ESBLs among UTI pathogens in the community was noted. Nitrofurantoin should be used as empirical therapy for primary, uncomplicated UTIs.

Key Words: Urinary Tract Infection, Antibiotic Sensitivity.

Introduction:

Urinary tract infections (UTIs) are a major public health problem in terms of morbidity and financial cost, and incur the highest total health care cost among urological diseases, exceeding that of chronic renal failure even when renal dialysis and renal transplantation are included.[1] UTI represents one of the most common diseases encountered in medical practice today with an estimated 150 million UTIs per annum worldwide.[2]

Although UTIs occur in both men and women, clinical studies suggest that the overall prevalence of UTI is higher in women. Uncomplicated UTIs in healthy women have an incidence of 50/1000/year.[3]An estimated 50% of women experience at least one episode of UTI at some point in their lifetime and between 20% and 40% of women have recurrent episodes.[4,5] Approximately 20% of all UTIs occur in men.[6]

UTI is said to exist when pathogenic organisms are detected in the urine, urethra, bladder, kidney or prostate. In most instances, growth of more than 10^5 organisms per milliliter from a proper collected midstream clean-catch urine sample indicates infection. However significant bacteriuria is lacking in some cases of true UTI. Especially in symptomatic patients, a smaller number of bacteria (10^2 to 10^4/ml) may signify infection. In urine specimens obtained by suprapubic aspiration or in-and-out catheterization and in samples from a patient with an indwelling catheter, colony counts of 10^2 to 10^4/ml generally indicate infection. Conversely colony counts$>10^5$/ml of midstream urine are occasionally due to specimen contamination, which is specially likely when multiple species are found.[7] The vast majority of uncomplicated UTIs are caused by Escherichia coli, with other pathogens including enterococci, Staphylcoccus saprophyticus, Klebsiella spp. And Proteus mirabilis.[8] The extensive and inappropriate use of antimicrobial agents has invariably resulted in the development of antibiotic resistance which, in recent years, has become a major problem worldwide.[9] To ensure appropriate treatment, knowledge of the organisms that cause UTI and their antibiotic susceptibility is mandatory.[10]The aim of the study was to

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assess the changing susceptibility of urinary pathogens to antimicrobial agents in UTIs.

Materials and methods:

This study was conducted on patients admitting in Square hospital, Dhaka between November 2011 and February 2013. Clean–catch midstream urine specimens from patients diagnosed clinically to be having UTI on the basis of symptoms were inoculated on Blood agar and McConkey Agar plates, which were incubated aerobically at 37°C

overnight. Plates showing growth suggestive of significant bacteriuria, with colony count exceeding 10^5cfu/ml were subjected to standard biochemical tests for identification. Antimicrobial sensitivity testing was performed using Kirby Bauer disc diffusion method as described by the National Committee for Clinical Laboratory Standard (presently called Clinical Laboratory Standard Institute).[11] Interpretation as Sensitive or Resistant was done on the basis of the diameters of zone of inhibition of bacterial growth as recommended by disc manufacturer. The ESBL phenotypic confirmatory test was performed by disk diffusion method on Muller-Hinton agar plates. The antibiotics used for susceptibility testing were Amoxycillin, Ciprofloxacin, Cefixime, Ceftriaxone, Cefepime, Gentamicin, Amikacin, Nitrofurantoin, Cotrimoxazole, Imipenem and Meropenem.

Results:

Of the 200 urine samples processed 110 (55%) gave significant growth of pathogens

Table 1 outlines the demographic profile of UTI. The patients were between 18 and 90 years of age. The prevalence of UTI is high among females (68.18%) than males (31.82%). Females of the reproductive age group (18-49years) constituted 56.37% of the total patients with UTI. However, elderly (50-90years) males had a higher incidence of UTI (23.64%) compared to the elderly females (11.81%).

Table 1: Age and sex distribution of patients with urinary tract infections

Age group (in years)	Females No (%)	Males No (%)
18-29	23(20.91%)	2(1.82%)
30-49	39(35.46%)	7(6.36%)
50-90	13(11.81%)	26(23.64%)

The commonest isolates were Escherichia coli, Enterococci, Pseudomonas, Proteus, Staphylococcus aureus and Klebsiella pneumoniae. (These represented 58.18%, 13.63%, 9.09%,

8.18%, 4,54% and 3.63% of isolate respectively). Pie chart showed the distribution of organisms.
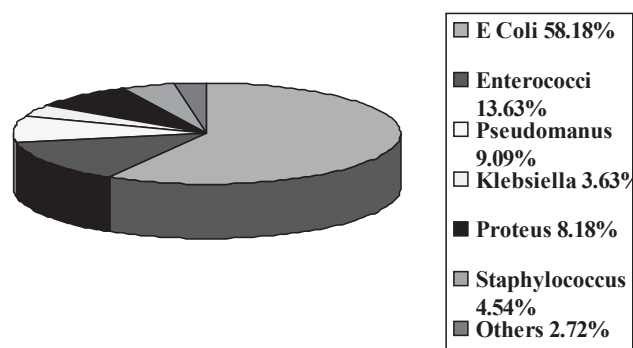
Figure 1: The pie chart showing organisms isolated

Table 2 depicts the frequency of isolation of ESBL producing organisms over the study period. Extended spectrum beta lactamase production was observed in 46.87% of E. coli strains and 25% of Klebsiella strains.

Table 2: Percentage distribution of extended spectrum beta lactamase producing uropathogens

Total no. of E. coli isolated	ESBL producing E.coli No.(%)	Total no. of Klebsiella spp.	ESBLproducing Klebsiella spp. No(%)
64	30 (46.87%)	04	1 (25%)

The antimicrobial potency and spectrum for 11selected antimicrobial agents of different classes against the five most frequent UTI pathogens are summarized in table 3. Sensitivity to Nitrofurantoin to pseudomonas were not tested as they have intrinsic resistance to that drug. E. coli showed high sensitivity to meropenem, imipenem and amikacin (100%) followed by Gentamicin (94.1%), Cephalosporin group (82.35%) with good susceptibility to Ciprofloxacin (88.23%). But ESBL E. coli showed highest sensitivity to Imipenem (100%) with Nitrofurantoin (90%) and Amikacin (83.3%). Enterococci is highly sensitive to Imipenem, Meropenem (100%), Nitrofurantoin (86.6%) and Gentamicin (53.33%). Pseudomonas showed highest sensitivity to Meropenem (90%) followed by Amikacin, Cefepime (60%) and Ciprofloxacin (50%). Imipenem, Gentamicin, cephalosporin group and Cotrimoxazole showed highest percent susceptibility (100%) against Proteus. Staphylococcus aureus showed highest sensitivity to Nitrofurantoin, Imipenem, Meropenem, Amikacin (100%) followed by Cotrimoxazole (80%). Gentamicin and Imipenem are 100% sensitive against Klebsiella followed by Amikacin (75%) and Cotrimoxazole(50%). The isolates show low degree of susceptibility to Amoxycillin (11.81%), Cefixime (34.54%), Cefepime (44.54%), Ceftriaxone (36.37%) and cotrimoxazole (31.81%).

Table 3: Antibiotic sensitivity and Resistance pattern of isolated organisms in UTI

S	E.coli (n=34)		ESBL E.coli (n=30)		Enterococci (n=15)		Pseudomonas (n=10)		Proteus (n=9)		Staph.aureus (n=5)		Klebsilla (n=4)	
	R	S	R	S	R	S	R	S	R	S	R	S	R	
Amoxycillin	8.33%	91.67%	0%	100%	53.33%	46.67%	0%	100%	0%	100%	20%	80%	0%	100%
Cefixime	82.35%	17.65%	0%	100%	0%	100%	0%	100%	88.9%	11.1%	20%	80%	25%	75%
Ceftriaxone	82.35%	17.65%	0%	100%	0%	100%	0%	100%	100%	0%	20%	80%	25%	75%
Cefepime	82.35%	17.65%	0%	100%	0%	100%	60%	40%	100%	0%	80%	20%	25%	75%
Ciprofxacin	88.23%	11.77%	3.33%	96.67%	15.38%	84.62%	50%	50%	70%	30%	20%	80%	25%	75%
Gentamicin	94.11%	5.99%	73.33%	26.67%	53.33%	46.67%	60%	40%	100%	0%	20%	80%	100%	0%
Amikacin	100%	0%	83.33%	16.67%	33.3%	66.7%	60%	40%	80%	20%	100%	0%	75%	25%
Imipenem	100%	0%	100%	0%	93.3%	6.7%	90%	10%	100%	0%	100%	0%	100%	0%
Meropenem	100%	0%	100%	0%	93.3%	6.7%	90%	10%	100%	0%	100%	0%	100%	0%
Nitrofurantoin	100%	0%	90%	10%	86.66%	13.34%	ND		0%	100%	100%	0%	0%	100%
Cotrimoxazole	23.52%	76.48%	16.67%	83.33%	0%	100%	10%	90%	100%	0%	80%	20%	50%	50%

S= Sensitive, R= Resistant, ND= Not done

Table 4 depicts the overall percentage of uropathogens sensitivity to antibiotics. More than 98% of the isolates are sensitive to Imipenem, Meropenem , while 86.36% are sensitive to Amikacin , 73.63% to Nitrofurantoin and 74.54% to Gentamicin.

Table 4: Overall percentage of uropathogens sensitivity to Antibiotics

Antibiotic	Sensitivity (%)	Resistance (%)
Amoxycillin	11.81%	88.19%
Cefixime	34.54%	65.46%
Ceftriaxone	36.37%	63.63%
Cefepime	44.54%	55.46%
Ciprofloxacin	40%	60%
Gentamicin	74.54%	25.46%
Amikacin	86.36%	13.64%
Imipenem	98.18%	1.82%
Meropenem	98.18%	1.82%
Nitrofurantoin	73.63%	26.37%
Cotrimoxazole	31.81%	68.19%

Discussion:

The study observes that the prevalence of UTI is high among females (68.18%) than males (31.82%). Females of the reproductive age group (18-49years) constituted 56.37% of the total patients with UTI. It has been reported that adult women have a higher prevalence of UTI than men, principally due to anatomical and physical factors.[12] Among males an increased prevalence of UTI was recorded in elderly age group 50-90 (23.64%) than young (8.18%). This is probably because with advancing age, the incidence of UTI increases in men due to prostate enlargement and neurogenic bladder.[13]

The study demonstrates that E.coli remain the leading uropathogen being responsible for 58.18% of UTI. This is in consistence with findings of other studies in which E. coli was the most frequently reported isolate from patients with UTIs.[14] Following E.coli , our study shows Enterococcus species (13.6%) and Pseudomonas (9.09%) as the other common uropathogens. Our findings are in accordance with a study by Dias Neto et al.[15] Enterobacteriaceae have several factors responsible for their attachment to the urothelium. These gram negative aerobic bacteria colonize the urogenital mucosa with adhesion, pilli, fimbriae and P1-blood group phenotype receptor.[13]

Our study reveals that 46.87% of E.coli isolates and 25% of Klebsialla species to be ESBL producers. Aggarwal et al.reported 40% of E.coli and 54.54% of Klebsialla species to be ESBL producers from Rohtak, Haryana.[16] In another study in Nagpur, 18.5% of E.coli isolates and 25.6% Klebsiella isolates were found to be ESBL producers.[17] This geographical difference may be due to different patterns of antibiotic usage. Our study confirms the global trend towards increased resistance to beta lactum antibiotics. ESBL producing bacteria may not be detectable by routine disk diffusion susceptibility test, leading to inappropriate use of antibiotics and treatment failure. It is emphasized that institutions should employ appropriate tests for their detection and avoid indiscriminate use of third generation cephalosporins.

From this study, it can be seen that cotrimoxazole and amoxicillin are virtually useless against uropathogens as they were effective against 31.81%and 11.81%of all isolated organisms respectively. Nitrofurantoin showed strong activity against 73.63% of all isolated organisms and was very active E.coli and Staph aureus particularly. However it has a very weak activity against Proteus spp and Pseudomonas spp. It has also been shown to be very safe in pregnancy[18] and also a recent study in India showed that Nitrofurantoin had the best in-vitro susceptibility profile against E.coli.[19] The consistent and high level susceptibility of E.coli to Nitrofurantoin may be influencd by nitrofurantoin's narrow spectrum of activity, limited indication, narrow tissue distribution and limited contact with bacteria outside the urinary tract.[20] The isolates shows low degree of susceptibility (40%) to Fluoroquinolone which indicates that they can no more be opted for treating UTI. From our study, it can be seen that more than 98% of the isolates are sensitive to Imipenem, Meropenem, while 86.36% are sensitive to Amikacin, 73.63% to Nitrofurantoin and 74.54% to Amikacin.

Conclusion

In our study , culture positive rate for uropathogens was high, with the majority coming from adult female patients. E.coli was the most common etiological agent and remains susceptible to nitrofurantoin. This drug should be the ideal antibiotic to use for uncomplicated UTI. Our findings suggest the presence of ESBL-producing strains; therefore, monitoring of antibiotic susceptibility of bacterial isolates should be mandatory.To tackle the upcoming problems of ESBL producing E.coli, Imipenem and Amikacin are good choice along with nitrofurantin.

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