Original Article

Antimicrobial Sensitivity Pattern of Bacterial Pathogens Associated with Urinary Tract Infection

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Abstract

Background: *Urinary tract infection (UTI) is one of the common bacterial infections in mankind. The changing antimicrobial sensitivity in UTI demands use of appropriate antibiotics.* ***Objective:*** *This study was conducted to determine the distribution and antimicrobial susceptibility of uropathogens.* ***Materials and method:*** *This was a prospective study conducted in Bangladesh Medical College & Hospital, Dhaka, Bangladesh between May 2016 to June 2017 to identify the organisms causing UTI and their antibiotic susceptibility. Clean catch midstream urine samples were collected from 95 patients presenting with symptoms of UTI. Antimicrobial susceptibility was performed by disc diffusion method.* ***Results:*** *Out of 95 urine samples, 56 (58.9%) were found positive. The prevalence was significantly higher in females than in males (females: 58.9%; males: 41%). Age group of >48 years showed higher prevalence of UTI. The most common organisms isolated were Escherichia coli, Klebsiella, Pseudomonas, Proteus and Staphylococcus aureus. These represented 44.6%, 21.4%, 14.3%, 12.5%, and 7.14% of isolates respectively. Imipenem and Meropenem were found the most susceptible drug against isolated uropathogens.* ***Conclusion:*** *Most powerful antibiotics in our study were imipenem and meropenem. In conclusion, one can truly affirm that the choice of drugs in the treatment of UTI is becoming quite narrow today due to the wide scale resistance that the common UTI pathogens show to drugs which have been used previously.*

Keywords: *Urinary tract infection; antimicrobial resistance.*

Delta Med Col J. Jul 2017;5(2):57 – 62

Introduction

Among the most common infectious diseases, urinary tract infections (UTIs) are commonly encountered by clinicians in developing countries.[1,2] Urinary tract infections (UTI) affect any part of the urinary tract and include mainly cystitis (bladder infection), pyelonephritis (kidney infection) and urethritis (urethra infection) showing tissue damage, burning, painful urination, urgency and increased urinary frequency, suprapubic pain, pain in renal angle, fever and other systemic manifestations but asymptomatic cases may also occur.[3,4] Presence of 105 cfu/mL

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in midstream urine is considered as significant number of bacteria for UTI.[5]

Effective management of patients suffering from bacterial UTIs commonly relies on the identification of the type of organisms that caused the disease and the selection of an effective antibiotic agent to the organism in question.[6] UTI is more common in females than in males as female urethra is structurally found to be less effective for preventing the bacterial entry.[7] It may be due to the proximity of the genital tract and urethra[8] and adherence of urothelial mucosa to the mucopolysaccharide lining.[9] The vast majority of uncomplicated UTIs are caused by the Gram-negative bacillus Escherichia coli, with other pathogens including Staphylococcus, Klebsiella spp. and Proteus mirabilis.[10] 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.[11] The distribution of antimicrobial susceptibility data of UTI-causing microorganisms changes from time to time and from place to place.[12] Increasing drug resistance in UTI needs regular monitoring of the antibiotic susceptibility of uropathogens in a particular area.

Materials and method

A total of 95 urine specimens were examined from patients who were suspected to have urinary tract infection, from May 2016 to June 2017. The study was performed at Bangladesh Medical College & Hospital, Dhaka, Bangladesh. Clean catch midstream urine was collected from each patient. All patients were well instructed on how to collect sample aseptically prior to sample collection to avoid contaminations from urethra. Qualitative microbiological analysis was performed with all the samples. The diagnosis of urinary tract infection was based on microscopic findings of more than 5 white blood cells (WBC) per high power field. Identification of organisms was done by conventional methods through culturing of samples followed by biochemical tests including their distinct colony characteristics. The inoculation at 37ºC for 48 hours and CFU count of 105/mL of urine were considered positive for UTI. The antibiotic sensitivity test was done on disc diffusion test. Interpretation as 'Sensitive' or 'Resistant' was done on the basis of the diameters of zones of inhibition of bacterial growth as recommended by the disc manufacturer.

Results

A total of 95 clinical urine samples were collected. Out of the collected 95 urine samples, 56 samples (58.9%) were found positive with one organism for each after culturing. Out of 56 urine samples which showed the significant bacterial growth, 23 (41.07%) samples were from males and 33 (58.9%) from females (Table I). The highest prevalence of UTI was found in the age group of >48 years (44.6%). (Table II)

Of the 95 tested samples, total 56 urine samples showed significant bacterial growth. The pie chart (Fig 1) shows prevalence of UTI in patients was found to be 59%.

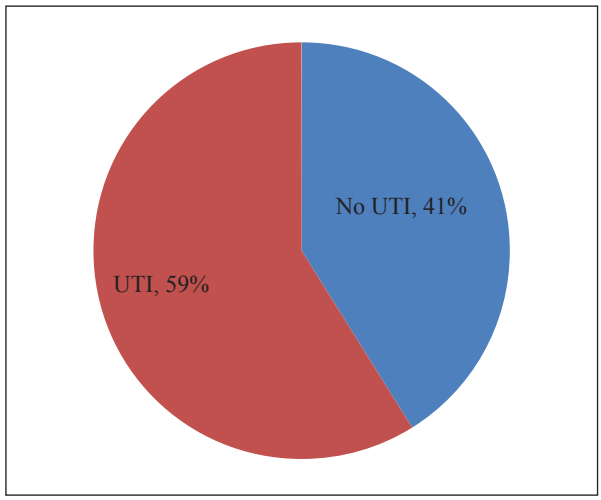

Fig 1: Prevalence of UTI

Table I: Prevalence of UTI in different genders (n=56)

Gender	Significant growth (n=56)	
	Frequency	Percentage
Male	23	41.1%
Female	33	58.9%

Table II: Prevalence of UTI in different age groups (n=56)

Age (years)	UTI group (n=56)	
	Frequency	Percentage
≤ 25	15	26.8
26 -36	27	12.5
37- 47	29	16.1
≥ 48	25	44.6

Escherichia coli was found to be the dominant bacteria among all isolated uropathogens with the prevalence rate of 44.6%. The second most prevalent isolate was Klebsiella pneumoniae (21.4%) followed by Pseudomonas aeruginosa (14.3%), Proteus spp. (12.5%), and Staphylococcus aureus (7.14%). (Table III)

Table III: Distribution of isolated uropathogens (n=56)

Bacterial pathogens	Frequency (%)
Escherichia coli	25 (44.6%)
Klebsiella pneumoniae	12 (21.4%)
Pseudomonas aeruginosa	8 (14.3%)
Proteus spp.	7 (12.5%)
Staphylococcus aureus	4 (7.14%)

Imipenem, meropenem, nitrofurantoin and amikacin showed the highest sensitivity against 92%, 92%, 88% and 84% E. coli. Imipenem and meropenem were found to be the most susceptible drug for K. pneumoniae with the rate of 91.6%. and 83%. In case of P. aeruginosa, the highest susceptible antibiotics were imipenem (87.5%), meropenem (87.5%) and amikacin (87.5%). Sensitivity of the Proteus was 85.7% against both Imipenem and meropenem. Imipenem and meropenem were found to be 100% sensitive for S. aureus. (Table IV)

Table IV: Antibiotic sensitivity pattern of isolated organism in UTI

Antibiotics	E.coli (25)	Klebsiella (12)	Pseudomonas (8)	Proteus (7)	S. aureus (4)
Imipenem	92	91.6	87.5	85.7	100
Meropenem	92	83	87.5	85.7	100
Nitrofurantoin	88	58.3	*NT	42.9	75
Amikacin	84	75	87.5	71.4	*NT
Levofloxacin	72	75	75	71.4	75
Ceftriaxone	64	75	37.5	28.6	75
Gentamycin	52	58.3	75	71.4	75
Ciprofloxacin	32	41.6	50	57.1	50
Amoxycillin	16	25	*NT	28.6	50
Nalidixic acid	12	50	25	28.6	25
Cotrimoxazole	4	50	25	57.1	50

* Not tested

Discussion

Out of the collected 95 urine samples, 56 samples (58.9%) were found positive. Our study also shows similarity to the study of Rahman et al. in non-diabetic patients.[14] The prevalence rate of UTI in our study also correlates with other studies done in South Trinidad[15], which showed highly significant uropathogens. In other studies prevalence rate of UTI accounted for 38.6%[16], 35.5%[17], 34.5%[18], and 36.68%[19] in India.

Our study showed a high prevalence of UTI in females (58.9%) than in males (41.07%) which correlates with others' findings which revealed that the frequency of UTI is greater in females as compared to males.[15,20-25] The reason behind this high prevalence of UTI in females is due to close proximity of the urethral meatus to the anus and shorter urethra.[26-28]

The occurrence of UTI recorded among the elderly was highest in the age group of ≥48 years (45%). Our results agree with the study done in Japan with a 20-year period in which a trend of increasing complicated UTI was reported in elderly patients.[29]

The predominant isolates in our study were Escherichia coli (44.6%). These findings are in conformity with reports by other researchers.[30-32] Our results correlate with others in which

Klebsiella spp. was reported as the second most frequently isolated organism in UTI.[33-37]

The sensitivity rate of carbepenems (meropenem vs. imipenem) among uropathogens was as follows: E. coli (92% vs. 92%), Klebsiella (83% vs. 91.6%), Proteus (85.7% vs. 85.7%), P. aeruginosa (87.5% vs. 87.5%), and S. aureus (100% vs. 100%). A study conducted in India showed that meropenem was highly sensitive against Gram negative bacilli whereas cephalosporin showed highest resistance against Gram negative rods.[38] In other study, meropenem and imipenem were found to be 98% and 100% sensitive, respectively, against highly resistant gram negative bacilli.[39] A study done in King Fahd Hospital, Saudi Arabia showed that meropenem was 95.8% sensitive followed by amikacin (93.7%) and imipenem (91.71%) against extended spectrum β lactamase producing E. coli.[40] The high rate of resistance against fluoroquninolones was suggested by studies done in Spain, Europe, and Iran[41,42] and also by other studies done in India.[25,43,44] Another study done in Spain also showed the reduced susceptibility of E. coli isolates from patients with UTI to Fluoroquinolones. This reduced susceptibility might be due to using antibiotics without restriction. In several studies it has been shown that the high prescribing habits of the physicians are the driving factor for the antibiotic resistance for this group of antibiotic.[45-47]

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