

Isolation and Antimicrobial Susceptibility Pattern of Urinary Escherichia Coli in Dhaka Medical College Hospital, Bangladesh

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ABSTRACT

Background: Escherichia coli is the major bacterial pathogen being isolated and reported from urine, globally. For these uropathogens the therapeutic management becomes limited, so knowledge about the antimicrobial resistance pattern of these agents at a specific area may help the doctors to choose correct treatment regimen. The aim of the current study was to detect the common uropathogens from urine and the antimicrobial susceptibility pattern of Escherichia coli in Dhaka Medical College Hospital (DMCH).

Methods: Samples were collected over a period of 12 months from July 2011 to June 2012 from the patients of DMCH irrespective of age and sex. Samples were cultured in blood agar and MacConkey agar media and organisms were identified by different biochemical tests such as oxidase test, reaction in MIU and simmon's citrate media and different sugar fermentation tests. Data were analyzed using Microsoft Excel (2007).

Results: From total 300 urine samples, 177 (59%) Gram-positive and Gram-negative bacteria were isolated. Among them, Esch. coli was the most predominant 112 (63.28%) organism followed by Enterobacter spp. (11.87%). The prevalence of Esch. coli was significantly higher in females (63.39%) of younger age group than in males (36.61%). Esch. coli was highly sensitive to imipenem (100%) followed by ceftriaxone (62.50%), ceftazidime (55.36%) and azitromycin (35.72%) respectively. Low sensitivity patterns were found against doxycycline (13.39%), co-trimoxazole (16.07%), amoxiclav (21.43%) and ciprofloxacin (23.22%) respectively.

Conclusion: The result of this study provides insight into the high proportion of multidrug resistant Escherichia coli and creates a need to report them routinely in laboratories.

Key Words: Escherichia coli, urine

Introduction

Antimicrobial resistance among bacterial strains is an emerging problem, worldwide. Urinary tract infections (UTIs) are one of the most common bacterial infections in humans both in the community and the hospital settings¹⁻³. Escherichia coli are the pre-dominant pathogen commonly isolated in urine. These uropathogens have also developed resistance to commonly prescribed antimicrobial agents which severely limits the treatment options.

The prevalence of UTIs increases among patients from lower socio-economical group. UTIs including

catheter related bacteriuria constitute the most common nosocomial bacterial infection with an average rate of 13.1 cases per 1000 hospital discharges⁴. Due to this high prevalence UTIs warrant careful consideration by the clinicians. More than 90% of all uncomplicated UTIs are caused by Esch. coli infection⁵. Esch. coli causes a wide range of UTIs, including uncomplicated urethritis or cystitis, symptomatic cystitis, pyelonephritis, acute prostatitis, prostatic abscess, and urosepsis⁶.

An increasing antimicrobial resistance in Esch. coli

has been reported worldwide which is a crucial problem. The high consumption of often inappropriately prescribed broad spectrum antibiotics combined with overcrowding, multiple pathology and frequent use of invasive devices are the major factors contributing high level of resistance⁷. A continuous rise of resistance to different antimicrobial drugs complicates the treatment strategy of urinary tract infections. The prevalence and antimicrobial susceptibility profile of *Esch. coli* show considerable topographical differences as well as significant variations in different environments and populations⁸.

The present study has documented the distribution of urinary pathogens and multi drug resistance pattern of *Esch. coli* isolated from urinary tract infected patients in Dhaka Medical College Hospital.

Materials and Methods

Study design and population: It was a cross-sectional study. Urine samples were collected from the patients who were earlier admitted in inpatient department or visited the outpatient department of Dhaka Medical College Hospital. Clean catch mid stream urine samples were collected in sterile containers. The patients comprised both sexes and all the age groups.

Bacterial isolates: A total of 300 urine samples were collected during July 1, 2011 to June 30, 2012 in the Department of Microbiology, Dhaka Medical College, Bangladesh. Approval was obtained from research review committee (RRC) and ethical review committee (ERC) of Dhaka Medical College according to declaration of Helsinki and national and institutional standards. Written consent was obtained from all participants.

Isolation of gram-negative bacteria: All the samples were inoculated on blood agar and MacConkey agar media and incubated at 37°C aerobically for 24 hours. The incubated plates were examined for bacterial growth and the organisms were identified by colony morphology, hemolytic criteria, staining character, pigment production and biochemical tests such as oxidase test, reaction in MIU and simmon's citrate media and different sugar fermentation tests⁹.

Antimicrobial susceptibility testing: Samples which showed significant colony count were taken into consideration and antimicrobial susceptibility pattern was determined by Kirby Bauer disk-diffusion method on Mueller-Hinton agar using commercially available antibiotic discs (Oxoid, Hampshire, UK) according to CLSI guidelines¹⁰. The antibiotic disk used in antibiogram for all the *Esch. coli* were co-trimoxazole (1.25/23.75 µg), gentamycin (10 µg), ciprofloxacin (5 µg), doxycycline (30 µg), azithromycin (30 µg), amoxiclav (20+10 µg), ceftriaxone (30 µg), ceftazidime (30 µg) and imipenem (10 µg). *Escherichia coli* ATCC 25922 was used for quality control.

Data analysis

Data were analyzed using Microsoft Excel (2007).

Results

Out of 300 mid stream urine samples 177 (59%) showed significant growth of bacteria from in patient department & out patient department (Table I).

Table-I: Rate of isolation of bacteria from urine sample (n=300)

Isolated bacteria	Frequency	Percentage
Significant growth	177	59.00
No growth	123	41.00
Total	300	100.00

Esch. coli was the most predominant (63.28%) Gram negative urinary pathogens followed by *Enterobacter* spp. (11.87%), *Acinetobacter baumannii* (5.65%) and *Klebsiella pneumoniae* (3.96%). Of the Gram positive bacteria, *Enterococci* (8.47%) was the predominant. Other Gram positive isolates were *Staphylococcus aureus* (1.69%) and *Staphylococcus saprophyticus* (1.13%) (Table II).

Table-II: Frequencies of microbial isolates from urine (n=177)

Species of bacteria	Number	Percentage
Esch. coli	112	63.28
Enterobacterspp.	21	11.87
Enterobacter aerogenes-19		
Enterobacter cbacae- 2		
Enterococci spp.	15	8.47
Acinetobacter baumannii	10	5.65
Klebsiella pneumoniae	7	3.96
Staphylococcus aureus	3	1.69
Pseudomonas aeruginosa	3	1.69
Proteus vulgaris	2	1.13
Citrobacter freundii	2	1.13
Staphylococcus saprophyticus	2	1.13

This study found that most (63.39%) Esch. coli associated UTI cases were in the age group of 21-40 years followed by 41-60 years (24.11%) with male and female distribution were 36.61% and 63.39% respectively (Table III).

Table-III: Age and sex distribution of Esch. coli culture positive cases (n=112)

Age group in years	Male n (%)	Female n (%)	Total n (%)
≤20	2 (1.78)	8 (7.14)	10 (8.92)
21 - 40	20 (17.86)	51 (45.53)	71 (63.39)
41 - 60	16 (14.29)	11 (9.82)	27 (24.11)
≥60	3 (2.68)	1 (0.90)	4 (3.58)
Total	41 (36.61)	71 (63.39)	112 (100.00)

Esch. coli had been shown highly sensitive (100%) to imipenem followed by ceftriaxone (62.50%), ceftazidime (55.36%) and azitromycin (35.72%) respectively. Low sensitivity patterns were shown against doxycycline (13.39%), co-trimoxazole (16.07%), amoxiclav (21.43%) and ciprofloxacin (23.22%) respectively (Table IV).

Table-IV: Antimicrobial susceptibility pattern of *Esch. coli* (n=112)

Antimicrobial Agents	Sensitive n (%)	Resistant n (%)
Imipenem	112 (100.00)	0 (0.00)
Azithromycin	40 (35.72)	72 (64.28)
Ciprofloxacin	26 (23.22)	86 (76.78)
Ceftriaxone	70 (62.50)	42 (37.50)
Gentamycin	33 (29.47)	79 (70.53)
Amoxiclav	24 (21.43)	88 (78.57)
Co - trimoxazole	18 (16.07)	94 (83.93)
Doxycycline	15 (13.39)	97 (86.61)
Ceftazidime	62 (55.36)	50 (44.64)

Discussion

Urinary tract infection is one of the most common infectious diseases encountered in the medical practices and only second to respiratory tract infections as a cause of hospital visit¹¹. *Esch. coli* is the leading cause of both community-acquired and nosocomial UTIs. The commonly prevailing factors like promiscuity, peer group influence, pregnancy, low socio-economic status]which are common among young men and women living in urban centers play a vital role in causing UTI^{12,13}. It has been usually observed that UTI most commonly occurs in females and up to one-third of all women experience UTI at some point during their lifetimes¹⁴.

In this study, urine samples from 300 subjects were cultured of which 177 (59%) showed significant growth. This correlates with the findings of other studies^{15,16}. Among the total 177 isolates, *Esch. coli* was the most predominant pathogen (63.28%) followed by *Enterobacter* spp. (11.87%), *Acinetobacter baumannii* (5.65%) and *Klebsiella pneumoniae* (3.96%). Of the Gram positive bacteria, *Enterococci* (8.47%) was the predominant followed by *Staphylococcus aureus* (1.69%) and *Staphylococcus saprophyticus* (1.13%) The predominance of *Esch. coli* associated UTI correlates with the findings of other studies¹⁶⁻¹⁸. The reason of the highest rate of isolation of *Esch. coli* is that they are the normal fecal flora and uropathogenic strains of *Esch. coli* have an adherence factor called fimbriae, or pili, which mediate the attachment to uroepithelial cells¹⁹.

In this study, UTI was found more in females (63.39%) than in males (36.61%). Maximum numbers of patients were found in age group 21-40 years. The findings are in agreement with the reports of other authors who found that 66%-71.1% cases were females and 28.9%-34% were males^{20,21}. The high prevalence of infection in females is usually related to anatomical and pathogenic factors, eg, the short length of the urethra and hence lesser distance for bacteria to ascend up the tract, hormonal changes and short distance of urethra to anus²².

The antibiogram of isolated Esch. coli of the present study reveals that maximum resistance was found against doxycycline (86.61%) followed by cotrimoxazole (83.93%), amoxiclav (78.57%), ciprofloxacin (76.78%) respectively. 62.50% Esch. coli were sensitive to ceftriaxone. Imipenem was found to be 100% sensitive towards Esch. coli which correlates with the studies done by other authors^{16,23}.

These increasing resistance patterns against commonly used antibiotics may be due to the fact that the antibiotic is being overprescribed, handed out to patients who have no bacterial infections²⁴. The inappropriate usage of wide spectrum antibiotics, insufficient hygiene, immunosuppression, and a prolonged stay in the hospital are some other major etiological factors that elevate the chances of MDR infections²⁵. The rapid emergence of antibiotic resistant strains such as ESBL, MBL producing strains alert us that we should be cautious with indiscriminate use of antibiotics as well as antibiotics should be prescribed with proper dose and duration after culture and sensitivity reports.

Conclusion

The data presented in this study may help the clinicians in the rational choice of antibiotic therapy and to prevent misuse, or over use of antibiotics. The disc diffusion method which was used to assess sensitivity and resistance may also be correlated clinically but further investigations for assessing the minimum inhibitory concentrations method will be needed to obtain more reliable and better results.

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Conflict Of Interest : Nothing to declare.

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