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Original Article

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Trend of Sensitivity Pattern of Uropathogenic *Escherichia coli*: Five Year Experience at a Tertiary Care Hospital in Dhaka

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Abstract

Background: Urinary tract infections are among the most common bacterial infections caused by pathogens with a decreasing susceptibility to several classes of antimicrobials. **Objective:** The purpose of the present study was to see the trend of sensitivity pattern of *Escherichia coli* (*E. coli*) isolated from the urinary tract patients. **Methodology:** This retrospective study was conducted at Uttara Adhunik Medical College Hospital, Dhaka from 2008 to 2012 for a period of 5(five) years. All patients were within ages 1 month to 80 years, comprising of both male and female, either out or in patients were included as study population. Urine sample was collected and *Escherichia coli* was isolated and identified as well as the antimicrobial susceptibility patterns was determined. **Results:** A total number of 16,666 urine samples were collected. No significant changes of susceptibility pattern of *Escherichia coli* was found to ciprofloxacin, cephradine, ceftriaxone, levofloxacin, nalidixic acid, imipenem and meropenem; however, significant change was detected to amoxicillin, amoxiclav, cefixime, trimethoprim-sulfamethoxazole, amikacin, ceftazidime and mecillinam between 2008 and 2012. **Conclusion:** Trend of sensitivity pattern of *Escherichia coli* is changing to few important antibiotics. [J Shaheed Suhrawardy Med Coll, 2013;5(2):103-105]

Keywords: Urinary tract infection, uropathogens, *Escherichia coli*, antimicrobial susceptibility

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Introduction

Increasing rates of resistance among bacterial uropathogens has become a major public health problem in both developed and developing countries[1]. Several factors are associated with the rise of resistance rate of bacterial uropathogens including misuse of antimicrobials[2], frequent oral use of wide-spectrum antimicrobials that may change the intestinal flora, which is usually common cause of urinary tract infection[2-4] and inappropriate dosages and duration of treatment[5]. Escherichia coli is the primary urinary tract pathogen, accounting for 75 to 90% of uncomplicated urinary tract infection isolates[4]. Surveillance studies provide information of the causative agents of UTIs and their antimicrobial resistance patterns which may aid clinicians in choosing the appropriate antimicrobial empirical treatment.

This study was conducted to determine the antimicrobial susceptibility patterns of *Escherichia coli* towards ciprofloxacin, trimethoprim-sulfamethoxazole, ceftriaxone, cephradine, ceftazidime, levofloxacin, imipenem, meropenem, amikacin, cefuroxime, amoxicillin, amoxiclav, cefixime, and mecillinam during a 5-year period from January 2008 to December 2012.

Methodology

This retrospective study was carried out at Uttara Adhunik Medical College Hospital, Dhaka, Bangladesh from January 2008 to December 2012 on patients who presented symptoms

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of urinary tract infections. All patients were within ages 1 month to 80 years, comprising of both male and female, either outpatient or inpatients department were included in this study. The diagnosis of urinary tract infection was based on microscopic findings of more than 5 White blood cells per high power field (1000x for high power) and a colony count of 105 CFU/ml of a single pathogen. The urine of all patients was sampled by clean catch of midstream urine. Urine samples were delivered to the laboratory within 1 hour of collection and processed within 2-4 hours.

Isolation and identification of *Escherichia coli*: A loopful 0.01ml of urine sample was cultured on blood agar (Oxoid N.Y., USA) and MacConkeys agar (Oxoid N.Y., USA) and was incubated for 24 hours at 37?C aerobically. Escherichia coli was selected for inclusion in further study when it was isolated as pure culture as well as the concentrations was greater than 105 CFU/ml. Isolations and identifications were performed by biochemical tests.

Antimicrobial susceptibility testing: Kirby Bauer disc diffusion technique[6] was used and 0.5 MacFarland's 108/mL employed in inoculums suspensions preparation according to the recommendations of the Clinical Laboratory Standard Institute (CLSI), former the National Committee for Clinical Laboratory Standards (NCCLS)[7-8]. The discs were ciprofloxacin, trimethoprim-sulfamethoxazole, ceftriaxone, cephradine, ceftazidime, levofloxacin, imipenem, meropenem, amikacin, cefuroxime, amoxicillin, amoxiclav, and cefixime (Table I) and were tested against the isolates. Sensitivity test was performed by disc diffusion technique using commercially available discs on Mueller Hinton agar (Oxoid N.Y., USA) plates[9].

Statistical analysis: Statistical analysis was done by Z test.

Table I: Antibiotics Disc (Oxoid N.Y., USA) Used for the Disc diffusion technique against *Escherichia coli*

Antibiotic	Conc. level	Antibiotic	Conc. level
Trimethoprim-sulfamethoxazole	25g	Mecillinam	25 g
Cefuroxime	30 g	Ceftazidime	30 g
Amoxiclav	30 g	Amikacin	30 g
Cephradine	30 g	Ceftriaxone	30g
Amoxicillin	1010 g	Cefixime	05g
Levofloxacin	05 g	Ciprofloxacin	05 g
Meropenem	10 g	Imipenem	10 g

*Commercial antibiotics discs (Oxoid N.Y., USA) were used.

Results

A total number of 16, 666 reports of urine samples were collected from the microbiology laboratory data base of which 3,000(18%) reports showed presence of *E. coli. E. coli* were mostly susceptible to Meropenem from the year 2008 to 2012 (100%) except 2010 (98.58%) followed by amikacin (81.20%-100%) and imipenem (78.66%-100%). Gradual decrease of susceptibility pattern of mecillinam was found from 2008-9 (3.27%) to 2012 (75.65%) except 2010 where slight increases of sensitivity occur than 2009. Amoxicillin is highly resistant (0.0-7.7%) to *E. coli.* Resistant pattern was gradually increased in case of cephradine and amoxiclav which was 32.48% in 2008, 0.57% in 2012 and 80.28% in 2008, 35.56% in 2012. Study showed no significant changes of susceptibility pattern of this pathogen to ciprofloxacin, cephradine, ceftriaxone, levofloxacin, cefuroxime and nalidixic acid; however, significant change of p value ($p < 0.05$) to amoxicillin, amoxiclav, cefixime, amikacin, ceftazidime and mecillinam between 2008 and 2012. Increase susceptibility of *E. coli* to trimethoprim-sulfamethoxazole occur from 2008 (41.76%) to 2012 (58.89%) ($p < 0.05$).

Table 2: Antimicrobial Sensitivity patterns of E. coli in urine isolated from the years 2008 to 2012

Antibiotics	2008 n=431	2009 n=472	2010 n=564	2011 n=670	2012 n=883
Ciprofloxacin	192(44.55)	258(54.66)	288(51.06)	305(45.52)	435(49.26)
Cephradine	140(32.48)	162(34.32)	96(17.02)	43(06.42)	05(00.57)
Ceftriaxone	236(54.76)	275(58.26)	344(60.99)	368(54.92)	484(54.81)
Levofloxacin	257(59.63)	263(55.72)	288(51.06)	326(48.66)	442(50.06)
TMX	180(41.76)	231(48.94)	293(51.95)	279(41.64)	520(58.89)
Imipenem	419(97.21)	472(100)	559(99.11)	527(78.66)	881(99.77)
Meropenem	431(100)	472(100)	556(98.58)	670(100)	883(100)
Amikacin	379(87.93)	454(96.19)	458(81.20)	590(88.06)	883(100)
Ceftazidime	289(67.05)	379(80.30)	415(73.58)	449(67.01)	503(56.96)
Amoxicillin	33(07.66)	25(05.30)	24(04.25)	20(02.98)	00(00)
Nalidixic acid	87(20.18)	95(20.13)	192(34.04)	132(19.70)	107(12.12)
Amoxiclav	346(80.28)	324(68.64)	338(59.93)	361(53.88)	314(35.56)
Cefixime	216(50.12)	261(55.30)	324(57.45)	316(47.16)	330(37.37)
Cefuroxime	217(50.35)	215(45.55)	324(57.45)	242(36.12)	444(50.28)
Mecillinam	402(93.27)	425(90.04)	514(91.13)	563(84.03)	668(75.65)

* Figure within the parenthesis indicates percentage.

* TMX= trimethoprim - Sulfamethoxazole

Discussion

More than 95% of UTIs are caused by a single bacterial species[10]. Pathogens causing UTIs are almost always predictable, with *E. coli* the primary etiologic agent among both outpatients and inpatients. Infectious Diseases Society of America (IDSA)[11] recently recommended that each hospital should establish routine mechanisms to determine the local resistance rates among uropathogens and that the standard antimicrobial regimens for empirical treatment of UTIs should be reassessed periodically in light of changing susceptibility patterns. Physicians should be aware of current antimicrobial susceptibility patterns for *E. coli* and other uropathogens in their local communities as antimicrobial susceptibility changes over time[12].

As regards antimicrobial susceptibility pattern, *E. coli* are poorly susceptible to Amoxicillin (07.56% - 0%) and Cephradine (32.48% to 00.57%) Trimethoprim-sulfamethoxazole (41.76-58.89%) throughout this period (2008-2012). Similar observation was reported in other authors from Pakistan[13,14,15,16]. Susceptibility pattern of Trimethoprim-sulfamethoxazole is increasing due to less use of this drug in clinical practice in UTI.

Fluoroquinolones are a logical choice for the empirical treatment of uncomplicated UTIs; however, their

widespread use has raised concern for increasing fluoroquinolone resistance[17] which is similar in case of Levofloxacin but in Ciprofloxacin susceptibility rate was increasing over the years. Pattern of susceptibility to Ceftriaxone were almost homogenous in this study over last five years. The activity Nalidixic acid against *E. coli* has decreased significantly over six years (2006-2011)[18] similar to this study.

E. coli showed highest sensitivity towards imipenem (97.21% to 99.77%), meropenem (100%) and amikacin (87.93-100%) which correlates with the study of Tanvir et al[19].

Gradual improvement in susceptibility of *E. coli* was to Cefixime during a study period of 2005 to 2009 differs from this study where resistant pattern is increased but similar to study on Amoxicillin-clavulanic acid where gradual decline of susceptibility[20].

Conclusion

Higher resistance rates to all antibiotics tested in our study may be explained by high and uncontrolled consumption of these antibiotics during the past decade in our institute. All antimicrobials are available as over-the-counter drugs without requiring the doctor prescriptions in our country. A good infection control and antibiotic policy will certainly help in delaying the era of unabated microorganisms for which no antibiotic is going to be effective.

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