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Antimicrobial Susceptibility Patterns of Uropathogenic Escherichia Coli and Urinary Tract Infection in Pregnancy and Their Prevalence in Female around Dhanbad, Jharkhand

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Abstract: Urinary tract infections are common during pregnancy and the most common causative organisms are *Escherichia coli*. Pregnant women are at increased risk for UTIs. Beginning in week 6 and peaking during weeks 22 to 24, approximately 90 percent of pregnant women developed ureteral dilation, which will remain until delivery increase bladder volume and decrease bladder tone, contribute to increased urinary stasis and ureterovesical reflux, the physiologic increase in plasma volume during pregnancy decreased urine concentration. Up to 70 percent of pregnant women develop glycosuria, which encourages bacterial growth in the urine. The increase in urine progesterone and estrogens may lead to a decreased ability of the lower urinary tract to resist invading bacteria allowing some strains of bacteria to selectively grow. These factors may all contribute to the development of *Escherichia coli* during pregnancy. The purpose of this study was to evaluate the prevalence and their antibiogram profile of uropathogenic *Escherichia coli* (UPEC) in and around Dhanbad.

Materials and Methods: A total of 641 urine samples were collected from the suspected patients of UTI. The samples were cultured on MacConkey agar for isolation and identification. Antibiotic susceptibility test was done by disc diffusion method. Female pregnant patients of different age groups were included in this study.

Result: 29.48% urinary isolates were identified as *Escherichia coli*. 51.32% UPEC isolates were sensitive to Nitrofurantoin and Piperacillin/Tazobactam. 25.38% isolates were susceptible to Levofloxacin and Amikacin followed by Cefotaxime (12.16%).

Conclusion: Prevalence of *Escherichia coli* among urinary isolates was high in our study. Antibiogram profile of these isolates varies to different antibiotics in terms of their susceptibility pattern. Continuous surveillance of Antibiogram profile of UPEC isolate is mandatory because it varies significantly.

Keywords: UPEC, UTI, *Escherichia Coli*, Antibiogram

INTRODUCTION

Urinary tract infection is one of the most common infections in a pregnant lady, which causes high morbidity and mortality among women's population [1, 2, 3]. It remains one of the most common community-acquired as well as nosocomial infections with over 150 million cases detected annually worldwide [4]. Serotypes of *Escherichia coli* consistently associated with UTI are designated as uropathogenic *E. coli* (UPEC) [5]. UPEC strains are responsible for about 90% of all community-acquired UTI and up to 50% of all nosocomial UTI [6]. *E. coli* may acquire another antibiotic resistance gene from surrounding bacteria and conversely, it can

spread to different potential pathogens [7]. These E. coli strains are often multi-drug resistant, i.e resistant to 3 or more different classes of antibiotic agents [8]. Data related to antibiotic susceptibility pattern is needed from a specified area if empirical antibiotics are to be administered to the patient suffering from UTI [9]. The present study aims at an insight in the changing scenario of the antibiotic susceptibility pattern of Escherichia coli. With the rampant use (or rather misuse) of antibiotics, there is a drastic change in the susceptibility pattern. In the current scenario, it varies according to the regional and geographical location. Therefore, knowing the etiological agent and the antibiotic susceptibility pattern in an area may help the clinicians in choosing appropriate empirical antimicrobial treatment.

METHODS

Sample collection

This study was done in the department of microbiology at Patliputra Medical College and Hospital, Dhanbad, Jharkhand. A total of 641 urine samples were collected from the clinically suspected patient of UTI. This study was done between April-2016 to March 2017. Patients were instructed to give clean catch midstream urine in a sterile wide mouth universal sample container. Both male and female of different age groups were included in this study.

Laboratory identification of uropathogenic E. coli

Urine samples were cultured on MacConkey agar with the help of a sterilized nichrome wire loop of 0.01 mm diameter. The culture plates were incubated aerobically for overnight at 37°C. The lactose-fermenting colonies were counted manually for significant bacteriuria. Suspected isolated colonies were diagnosed and characterized using microscopical (Gram stain and motility test by hanging drop method) and biochemical tests. Biochemical tests used were: Catalase test, Indole production in peptone water, Urease test on Christensen's Urea agar slant, Citrate utilization on Simmon's citrate agar slant and acid/gas/H₂S production in TSI (Triple Sugar Iron agar) slant.

Antibiotic Susceptibility testing.

Antibiotic susceptibility test was performed by disc diffusion method as per designed by Bauer et al [10]. All E. coli isolates were tested for their antibiotic susceptibility pattern against following antimicrobials (HiMedia, Mumbai, India): Ampicillin (10µg), Cefazidime (30µg), Levofloxacin (5µg), Nitrofurantoin (300 µg), Cefotaxime (30 µg), Piperacillin-Tazobactam (100/10 µg) and Trimethoprim/sulfamethoxazole (1.25/23.75µg) according to the CLSI guidelines and interpretative criteria [12]. Bacterial suspensions were prepared in 1.0 ml of sterile peptone water. The turbidity of this suspension was adjusted to 0.5 McFarland. Plating of the suspension was done on Mueller-Hinton agar plates by lawn method and then incubated at 37°C for 24 hours. The inhibition zones were measured in accordance with Clinical Laboratory Standards Institute (CLSI) [11]. Pseudomonas aeruginosa ATCC 27853 was used as a susceptible control strain while performing antimicrobial susceptibility testing [12]. ESBL (Extended spectrum beta lactamase) testing was not done for any of these isolates.

Statistical Analysis

Categorical variables were summarized by percentages. χ^2 tests performed for the trend of an ordinal variable.

Results: Out of 849 urine samples received during this period, only 321 samples were found positive for the bacterial growth in the culture. Among these isolates, 189 were identified as Escherichia coli (58.87%). Other isolates were Pseudomonas aeruginosa 34(10.59%), Klebsiella pneumonia 26(8.09%), Klebsiella oxytocolin 19(5.91%), Proteus Vulgaris 16(4.98%), Proteus mirabilis 5(1.55%), Candida spp 22(6.85%), Staphylococcus saprophytic 10 (3.11%).

Age and sex predilection of UPEC

The incidence of UPEC was made according to gender and age group of the patients. Among the 189 positive growth, 69 (36.50%) were non-pregnant females and 120 (63.50%) pregnant females. The prevalence of E. coli among people was significantly higher in pregnant females than non-pregnant females ($p < 0.05$). People were divided into 3 groups according to their age (Table 1). Our study showed that the prevalence of UPEC was different across all age groups. It was found that the percentage of E. coli isolates was high in people of age groups of 16- 30 years and more than 31 years of age. Statistical analysis showed that the incidence of infection with uropathogenic E. coli was significant ($p < 0.05$) in 16-30 years age group and more than 31 years of age group.

Table 1 Incidence of UPEC among Non-Pregnant Female and Pregnant female according to age groups

Gender	No of infected Patient (%)	Age (years)		
		18-26	27-35	> 35
Non pregnant Female	69 (36.50)	32(46.37)	28 (40.57)	09 (13.04)
Pregnant female	120 (63.50)	60 (50.00)	38 (31.66)	22 (18.33)

Antibiogram

All E. coli (189) isolates were tested for 7 antibiotics. Their susceptibility pattern is shown in table 2. It was found that the most effective antibiotics for E. coli isolates from UTI were Nitrofurantoin (43.56%) and Piperacillin/ Tazobactam (43.56%). Levofloxacin and Amikacin were exhibited equal susceptibility pattern of 22.77% followed with cefotaxime (21.78%). UPEC isolates were mostly resistant to Ampicillin and Trimethoprim/sulfamethoxazole, their susceptibility pattern was found to be 11.88% and 5.94% respectively.

Table 2 Antimicrobial susceptibility pattern of UPEC

Antibiotics	No of sensitive isolates (%)
Ampicillin	15 (7.93)
Nitrofurantoin	46 (24.33)
Levofloxacin	24 (12.69)
Amikacin	24 (12.69)
Trimethoprim/sulfamethoxazole	6 (3.17)
Cefotaxime	23 (12.16)
Piperacillin/Tazobactam	51 (26.99)

DISCUSSION

E. coli is frequently associated with urinary tract infection and it contributes about 70- 95% of all the isolates from the upper and lower UTIs [16]. The incidence of Escherichia coli in our study was found to be 45.70 %. In other two studies on Uropathogens by Hasan et al [13] and Agrawal et al [14] were observed the prevalence of E. coli of 50.7% & 50% respectively among gram-negative isolates from urinary tract infection.

It is stated that UTI is predominantly a disease of the females due to a short urethra and proximity to anal opening, it makes easy for bacteria to ascend in the urinary tract [15]. In the present study, the higher rate of E. coli was found in Pregnant females (63.50%) compared to Non-Pregnant females (36.50%).

Antibiotics resistance in uropathogenic E. coli is of major concern globally due to its increasing resistance to several commonly prescribed antimicrobial agents [17]. In our study, UPEC isolates were various in their susceptibility to different antibiotics belonging to different groups. Ampicillin and Trimethoprim/sulfamethoxazole were relatively more resistant for UPEC, their susceptibility pattern were 11.88% and 5.94% respectively. This high resistance may be due to the spontaneous and uncontrollable use of these antibiotics [18]. Okesola in his study found UPEC isolates were 100% resistant to Cotrimoxazole and amoxicillin [19]. Piperacillin/Tazobactam and Nitrofurantoin were found more effective as their susceptibility pattern were higher than the other drug. Bhattacharyya et al have also found similar observations [9]. 22.77% UPEC isolates were found susceptible to Levofloxacin and Amikacin in our study. Mandal et al during his study on UTI found 73% urinary E.coli isolates were resistant to Ciprofloxacin [20]. 21.78 % of UPEC were found susceptible to 3rd generation cephalosporin (Cephalosporin).

CONCLUSION

Prevalence of Escherichia coli among urinary isolates was high in our study. Pregnant Females were more susceptible to UTI than non-pregnant Female. Piperacillin/Tazobactam and Nitrofurantoin were the most effective antibiotics for E. coli isolates from UTI in our study. Other commonly used antibiotics like levofloxacin, Cotrimoxazole, Amikacin and cefotaxime were found resistant relatively. Continuous surveillance of Antibiogram profile of UPEC isolate is mandatory because it varies significantly in the different geographical area. Thus the empirical selection of antimicrobials should be based on the knowledge of the local prevalence and individual sensitivity rather than on universal guideline.

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