

URINARY TRACT INFECTION BY ESHERICHIA COLI IN PATIENTS ATTENDING TERTIARY CARE HOSPITAL OF CENTRAL INDIA

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Abstract

Introduction: The most common infectious disease encountered in the community in all age group is Urinary tract infection (UTI) and usually empirical antibiotic therapy is given depending upon the common causative agent and their susceptibility to commonly used antibiotic. More than 70% of the UTIs are caused by the Enterobacteriaceae group, of which Escherichia coli (E. coli) accounts for around 80% of the cases. UTI is commonly seen in female patients, within all age group because of the short urethra and the incidence increases with the increase in the age. Changing pattern of UTI and its etiology has been studied in the various studies. Therefore constant monitoring of the antimicrobial resistance is necessary for specific micro-organisms in their specific environment. **Material And Methods:** This study was retrospective observational study which includes all the patients attending Out Patient Department (OPD) with UTI symptoms and confirmed by positive urine culture. Demographic and socioeconomic data was collected from the medical records of all the patients. Mid-stream urine sample was obtained from all the patients. Samples were tested by using microscopy, culture and isolation, and biochemical tests for the identification of isolates. Antibiotic sensitivity pattern was obtained by using Kirby- Bauer disc diffusion method. ESBL (extended Spectrum Beta lactamase) production was determined on MHA by Kirby Bauer disc diffusion method as per recommendation of CLSI. **Results:** Of the total 988 samples 355 (35.93%) samples showed significant growth of organisms and were included in the study. Of the 355 positive cultures 248 (69.86%) were female while 107 (30.14%) were male. Of the 355 isolates the most frequent isolate was E. coli 89 (25.07%) followed by Klebsiella pneumoniae 59 (16.62%). Proteus species was isolated from 47 (13.24%) cases, Enterococcus species from 46 (12.96%), CoNS(Coagulase Negative Staphylococci) from 44(12.39%), Staphylococcus aureus from 38 (10.70%), pseudomonas aeruginosa from 15 (4.23%), Candida albicans from 10 (2.28%) and Streptococcus species from 7 (1.97%) cases. E coli showed high resistance to ampicillin (94.38%), cefotaxime (66.29%), Cefuroxime (60.67%), imipenem (51.69%) and cotrimoxazole (52.81%). E coli isolates were least resistant to amikacin (5.62%) followed by gentamycin (6.74%) and nitrofurantoin (10.11%). Resistance to amoxicillin-clavulanate was 13.48%. ESBL production was observed in 9 (10.11%) of the E. coli isolates. **Conclusion:** E. coli (25.07%) is the most common uropathogens in urine culture. ESBL production by E. coli was 10.11%. Most of the isolates of E. coli were multidrug resistant showing high resistant to ampicillin and most were sensitive to amikacin (5.62%). Empirical and uncontrolled used of antibiotics should be checked and regular studies should be carried out to look for the pattern of antimicrobial resistance in particular area or community.

Keywords--- E.coli, UTI, ESBL, Antimicrobial Resistance

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INTRODUCTION

The most common infectious disease encountered in the community in all age group is Urinary tract infection (UTI) [1] and usually empirical antibiotic therapy is given depending upon the common causative agent and their susceptibility to commonly used antibiotic. But because of the increasing prevalence of bacterial resistance to a wide range of antibiotics, these micro-organisms pose a major public health issue [2]. More than 70% of the UTIs are caused by the Enterobacteriaceae group, of which Escherichia coli (E. coli) accounts for around 80% of the cases [3]. UTI is commonly seen in female patients, within all age group because of the short urethra and the incidence increases with the increase in the age [4]. In pediatric age group UTI may lead to renal problems, systemic illness, reinfections, hypertension and end stage renal disease [5]. Also the incidence of UTI is more in elderly and immune compromised patients [4].

Usually urinary tract is a sterile space with the exception of distal urethra which can be colonized by number of saprophytic organisms and bacteria in the vicinity of urethra, especially from the perineum and anus. A number of risk factors has been proposed for UTI, which includes sexual activity, physiological

and anatomical abnormalities, instrumentation and close proximity of vagina, anus and urethra in women [2].

Once the bacteria reach the bladder, they can proliferate in the urine as it serves as the good medium for the growth of bacteria. E. coli and other Enterobacteriaceae of intestinal origin are the bacteria which can find their way easily to the bladder, while UTI due to staphylococcus aureus, Candida sp., Salmonella and Mycobacteria may be due to hematogenous spread [6]. About 3-5% girls and 1% boys are affected by UTI by the age of 5 years [7]. UTI may be caused by various organisms like bacteria, viruses, fungi of which E. coli alone is responsible for the 70-90% of all UTI infections [8].

Changing pattern of UTI and its etiology has been studied in the various studies [9]. Antibiotic resistance of the organisms responsible for the UTI has also been studied [10]. Therefore constant monitoring of the antimicrobial resistance is necessary for specific micro-organisms in their specific environment. Drug resistance to bacteria has been observed from 1% to more than 50% in different countries. In US at least 2.8 million people get an antibiotic-resistant infection each year, and more than 35,000 die [11]. In developing countries about 80% of the isolates from

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the UTI have shown resistance to trimethoprim or trimethoprim and sulphmethoxazole[12].

MATERIAL AND METHODS

Present study was conducted in the Dept. of Microbiology at Datta Meghe Medical College, Shalinitai Meghe Hospital and Research Centre Wanadongri, Nagpur in collaboration with Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Wardha, from October 2019 to March 2020.

This study was retrospective observational study which includes all the patients attending Out Patient Department (OPD) of Shalinitai Meghe Hospital and Research Centre with UTI symptoms and confirmed by positive urine culture. Demographic and socioeconomic data was collected from the medical records of all the patients.

Patients with clinical UTI but organisms not grown in the urine culture, who has taken antibiotic before urine sample collection were excluded from the study.

Mid-stream urine sample was obtained from all the patients, which was immediately transported to the Microbiology department. Skin and mucosal surface near the meatal opening was cleaned with soap and water before collection of sample to minimize the contamination from the distal urethra. Samples were tested by using microscopy, culture and isolation, and biochemical tests for the identification of isolates. Antibiotic sensitivity pattern was obtained by using Kirby- Bauer disc diffusion method[13] on Muller Hinton agar (Himedia) as per CLSI (Clinical and Laboratory Standard Institute) guidelines [14].

ESBL (extended Spectrum Beta lactamase) production was determined on MHA by Kirby Bauer disc diffusion method as per recommendation of CLSI. An increase in area diameter of more than 5 mm for ceftazidime (30 µg) measured in combination with clavulanate versus its area diameter when measured alone indicated an extended-spectrum beta-lactamase (ESBL) producing organism [15].

All results were entered in Microsoft Windows Excel Sheet version 2013 and were further analyzed by SPSS (Statistical Package for Social Sciences) version 21. Results were presented in number, mean and SD (Standard Deviation), Percentage (%). Pvalue of <0.05 was considered as statistically significant.

RESULTS

A total of 988 samples were collected from the patients having complaint of UTI and attending the OPD. Of the total 988 samples 355 (35.93%) samples showed significant growth of organisms and were included in the study. Of the 355 positive cultures 248 (69.86%) were female while 107 (30.14%) were male. Out of 633 culture negative samples 426(67.29%) were female and 207 (32.70%) were male. Statistically significant difference was noted in culture positive and culture negative cases in favor of female (P<0.0001).

Table 1. Culture report

	Female	Male	Chi-square, P value
Culture positive, n=355 (%)	248 (69.86%)	107 (30.14%)	111.857, P < 0.0001
Culture Negative, n=633 (%)	426(67.29%)	207 (32.70%)	151.353, P < 0.0001

Of the 355 isolates the most frequent isolate was E. coli 89 (25.07%) followed by Klebsiella pneumoniae 59 (16.62%). Proteus species was isolated from 47 (13.24%) cases, Enterococcus species from 46 (12.96%), CoNS (Coagulase Negative Staphylococci) from 44(12.39%), Staphylococcus aureus from 38(10.70%), pseudomonas aeruginosa from 15 (4.23%), Candida albicans from 10 (2.28%) and Streptococcus species from 7 (1.97%) cases.

Table 2. Distribution of Organisms isolated

Organism	N= 355	%
Esherichia coli	89	25.07%
Klebsiella pneumoniae	59	16.62%
Proteus species	47	13.24%
Enterococcus species	46	12.96%
CoNS(Coagulase Negative Staphylococci)	44	12.39%
Staphylococcus aureus	38	10.70%
Pseudomonas aeruginosa	15	4.23%
Candida albicans	10	2.82%
Streptococcus species	7	1.97%
Total	355	100.00%

Of the 89 isolates of E. coli 66 (74.16%) were from female patients and 23(25.84%) were from male patients. This E coli isolation in women was statistically significant (P<0.05).

Table 3. Antimicrobial resistance pattern of Escherichia coli

Antibiotic	Resistant (n=89)	%	Intermediate (n=89)	%	Sensitive (n=89)	%
Ampicillin (10µgm)	84	94.38%	4	4.49%	1	1.12%
Gentamycin (10µgm)	6	6.74%	7	7.87%	76	85.39%
Amikacin(30µgm)	5	5.62%	4	4.49%	80	89.89%
Amoxicillin Clavulanate (20/10µgm)	12	13.48%	7	7.87%	70	78.65%

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Piperacillin- tazobactam (100/10µgm)	19	21.35%	14	15.73%	56	62.92%
Cefuroxime (30µgm)	54	60.67%	13	14.61%	22	24.72%
Cefotaxime (30µgm)	59	66.29%	14	15.73%	16	17.98%
Imipenam (10µgm)	46	51.69%	8	8.99%	35	39.33%
Cotrimoxazole(1.25/23.75 µgm)	47	52.81%	9	10.11%	33	37.08%
Nitrofurantoin(300µgm)	9	10.11%	4	4.49%	76	85.39%

E. coli showed high resistance to ampicillin (94.38%), cefotaxime (66.29%), Cefuroxime (60.67%), imipenem (51.69%) and cotrimoxazole (52.81%). *E. coli* isolates were least resistant to amikacin (5.62%) followed by gentamycin (6.74%) and nitrofurantoin (10.11%). Resistance to amoxicillin-clavulanate was 13.48%. ESBL production was observed in 9 (10.11%) of the *E. coli* isolates.

DISCUSSION

UTI is a major health problem worldwide and about 150 million cases are reported worldwide per year [16]. In this study out of the 988 samples collected from the UTI patients, 355 samples showed significant growth of organisms (35.93%). Of the 355 samples *E. coli* was isolated in 89 (25.07%) cases.

The most frequent isolate in this study was *E. coli* 89 (25.07%) followed by *Klebsiella pneumoniae* 59 (16.62%). *Proteus* species was isolated from 47 (13.24%) cases, *Enterococcus* species from 46 (12.96%), CoNS (Coagulase Negative Staphylococci) from 44(12.39%), *Staphylococcus aureus* from 38(10.70%), *Pseudomonas aeruginosa* from 15 (4.23%), *Candida albicans* from 10 (2.28%) and *Streptococcus* species from 7 (1.97%) cases. Similar uropathogens were isolated from other studies [10,17,18]. In this study we have not identified the comorbid conditions but Stapleton et al [19] in his study observed that uropathogens in diabetic persons is different than non-diabetic cases. While Bonadio et al did not find any difference in uropathogens causing UTI in diabetic and non-diabetic persons.

ESBLs are enzymes that mediate resistance to the beta-lactam antibiotics, which includes extended-spectrum cephalosporins and monobactams. In this study ESBL production was observed in 9 (10.11%) of the *E. coli* isolates. Similar results were observed by Kedar et al [20] (8.9% ESBL isolates in Gram negative) while Bean et al reported 5.7% ESBL producing *E. coli* isolates from UTI patients [21].

In the present study females were affected more as compared to males while culture positivity in female with UTI was also significantly higher than males. The ARES study states that in primary health care setting about 50-80% women have typical symptoms of UTI [22]. In a study by Vranic SM et al [2] percentage of female suffering from UTI was significantly higher as compared to male.

Of the total isolates *E. coli* was isolated in 89 (25.07%) of the total cases. Studies have reported the isolation of *E. coli* as a primary pathogen up to 75-90% of the isolates which was quite higher than our study [23]. According to ARES study, *E. coli* was the most common isolate (76.7%), followed by *Enterococcus faecalis* (4%), *Staphylococcus saprophyticus* (3.6%), *Klebsiella pneumoniae* (3.5%), and *Proteus mirabilis* (3, 5%) [24]. Similar results were observed in our study as *E. coli* most common isolate followed by *Klebsiella pneumoniae* 59 (16.62%). *Proteus* species was isolated from 47 (13.24%) cases, *Enterococcus* species from 46 (12.96%), CoNS (Coagulase Negative Staphylococci) from

44(12.39%), *Staphylococcus aureus* from 38(10.70%), *Pseudomonas aeruginosa* from 15 (4.23%), *Candida albicans* from 10 (2.28%) and *Streptococcus* species from 7 (1.97%) cases. In a study by Bhayani P et al [24] the most common organism causing UTI was *E. coli* and they observed that risk factors associated with UTI was diabetes, prolong use of catheter and chronic kidney disease.

In this study 94.38% isolates of *E. coli* were resistant to ampicillin. Resistance to cefotaxime (66.29%), Cefuroxime (60.67%), imipenem (51.69%) and cotrimoxazole (52.81%). *E. coli* isolates were least resistant to amikacin (5.62%) followed by gentamycin (6.74%) and nitrofurantoin (10.11%). Resistance to amoxicillin-clavulanate was observed as 13.48%. more or less similar antibiotic resistance pattern was seen in other studies also [10,26,27]. In a study by Dash et al high level of antimicrobial resistance was observed to commonly used empirical antibiotics β-lactams (ampicillin, augmentin, cefaclor, and cefpodoxime), fluoroquinolones (ciprofloxacin and ofloxacin) and cotrimoxazole [28].

CONCLUSION

E. coli (25.07%) is the most common uropathogen in urine culture. ESBL production by *E. coli* was 10.11%. Most of the isolates of *E. coli* were multidrug resistant showing high resistance to ampicillin and most were sensitive to amikacin (5.62%). Looking at the resistance pattern of *E. coli* isolates strong antibiotic policies should be established in the hospital setting, to reduce the menace of multi-resistant isolates. Empirical and uncontrolled use of antibiotics should be checked and regular studies should be carried out to look for the pattern of antimicrobial resistance in particular area or community.

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