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Bacteriological Profile of Urinary Tract Infection at a Tertiary Care Hospital in Kalaburagi, India

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A B S T R A C T

Urinary tract infections (UTI) are the second most common infections encountered in clinical practice and is associated with a high rate of morbidity and economic burden. Knowledge of the local antibiotic resistance patterns will help in providing empirical therapy and helps in prevention of resistance. This was a retrospective study conducted from January 2017 to December 2018 at a medical college in South India. Samples received included mid-stream clean catch urine, Catheterized urine, suprapubic aspirate. Urine specimen was collected in a sterile, wide mouth, leak proof, labelled container. Urine was processed immediately within one hour without delay. Samples were processed and isolates were identified as per standard methods. Antibiotic sensitivity testing was done on Mueller Hinton agar by Kirby–Bauer disc diffusion method and CLSI guidelines. Most UTI cases were seen in females and in the age group of 31-40 years. The most common organism isolated was E. coli (64.4%), followed by Klebsiella species (9.9%) and Pseudomonas aeruginosa (7.4%). The most common Gram-positive organism was Staphylococcus aureus (5.9%). Highest resistance was seen with Ampicillin (98%) and Amoxicillin-clavulanic acid (74%) and least resistance was seen with Imipenem and Piperacillin-Tazobactam. The inappropriate and irrational empirical use of antibiotics (particularly wide spectrum antibiotics), immuno-suppression, prolonged stay (catherization) are some of the major reasons responsible for resistant urinary tract infections. The present study revealed that urinary tract infections caused by E. coli was resistant to commonly used antibiotics. On the basis of local antibiotic susceptibility pattern, Nitrofurantoin (oral) and Amikacin (parenteral) can be used as first line empiric therapy for treatment of UTI. A major intervention in preventing resistant UTI is the regular monitoring of antibiotic resistance pattern which helps in initiating empirical treatment of UTI and definitive therapy must be initiated only after culture sensitivity report. As the antibiotic resistance pattern changes over a period of time, regular antibiotic susceptibility pattern studies should be conducted region wise.

Keywords

Urinary tract infection, *Escherichia coli*, Antibiotic resistance, Uro-pathogens

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Introduction

Urinary tract infections (UTI) are the second most common infections encountered in clinical practice and is associated with a high rate of morbidity and economic burden (1,2). UTI is caused predominantly by Gram negative bacteria such as *Escherichia coli* (*E. coli*), *Enterobacter* species, *Klebsiella* species and Proteus species. The most common

organism causing community acquired acute UTI is *E. coli* (3) and often leading to secondary health issues which can be serious at times (4). UTI may involve only the lower urinary tract or may involve both the upper and lower tract. Malnutrition, low socio-economic status, poor hygiene is the most important factors associated with UTI (5).

Despite the availability of higher antibiotics, UTI continues to be the most common cause of infections in hospitalized patients, accounting for approximately 40% of the hospital acquired infections (6). UTIs in hospital and community setting are initially treated empirically based on local antibiotic resistance rates and severity of illness. Organisms causing UTI have shown an increase in resistance to commonly used antibiotics. Fluoroquinolones are extensively used for empirical therapy, because of high bactericidal and clinical cure rates as well as low rates of resistance (7). But recent studies have reported increased resistance to fluoroquinolones (8-10).

The antibiotic therapy relieves the symptoms of UTI and plays an important role in preventing the development of complications like renal scarring. Knowledge of the local antibiotic resistance patterns will help in providing empirical therapy and helps in prevention of resistance. There are few studies conducted on prevalence and antibiotic susceptibility pattern of pathogens causing UTI in this region, hence the present study was conducted.

Materials and Methods

Sample collection

This was a retrospective study conducted from January 2017 to December 2018 at a medical college in South India. Patients of either sex aged between 20-60 years who were suspected of having UTI were included in the study. A detailed history of patient including demographics, socioeconomic status, prior antibiotic use, previous history of UTI, hospitalization etc were recorded in the prescribed proforma. Samples received included mid-stream clean catch urine, Catheterized urine, suprapubic aspirate. Urine sample was collected in a sterile, wide mouth, leak proof, labelled container. Urine was processed immediately within one hour without delay. Samples were processed and isolates were identified as per standard methods (11).

Antibiotic sensitivity testing

Antibiotic sensitivity testing was done on Mueller Hinton agar by Kirby–Bauer disc diffusion method (12) The following antibiotics were tested as per CLSI guidelines (13), Ampicillin (10 mcg), Amoxicillin-clavulanic acid (30 mcg), Ceftriaxone (30 mcg), Cefuroxime (30 mcg), Ceftazidime (30 µg), Ciprofloxacin (5 mcg), Norfloxacin (10 mcg), Amikacin (30 mcg), Gentamicin (10 mcg), Co-trimoxazole(1.25/23.75µg) Imipenem (10 mcg), Nitrofurantoin (300 mcg), and Piperacillin-Tazobactam (100/10 mcg).

Statistical analysis

All data were tabulated and analyzed. Descriptive statistics were used for analysis. The data was analyzed using Microsoft excel (2016 version) and the results are explained in frequency and percentage.

Results and Discussion

During the study period a total of 1568 samples were processed from suspected UTI patients, out of which 525 (33%) of samples were culture positive with significant growth, 15% insignificant growth and about 8% of culture showed contamination. The demographic variables are shown in table 1.

Most UTI cases were seen in females and in the age group of 31-40 years. The organisms isolated from urine samples are shown in table 2.

The most common organism isolated was *E. coli* (64.1%), followed by *Klebsiella* species (9.9%) and *Pseudomonas aeruginosa* (7.4%). The most common Gram-positive organism was *Staphylococcus aureus* (5.9%). *E. coli* was commonly isolated from females and in the age group of 31-40 years.

The antibiotic susceptibility pattern of E. coli is shown in table 3. Highest resistance was seen with Ampicillin (98%) and Amoxicillin-clavulanic acid (74%) and least resistance was seen with Imipenem and Piperacillin-Tazobactam.

UTI are the one of the most common infections encountered in clinical practice. UTI caused by E. coli has increased over the years, one of the major reasons being irrational use of antibiotics. The distribution of species causing UTI and their anti-microbial pattern varies with time and place (14). In the present study, culture positive rate was 33%, most UTI cases were seen in females and in the age group of 31-40 years. The most common organism isolated was E. coli (64.4%), followed by *Klebsiella* species (9.9%) and Pseudomonas aeruginosa (7.4%). The most common Gram-positive organism was *Staphylococcus aureus* (5.9%). *E. coli* was commonly isolated from females and in the age group of 31-40 years. Other studies have also reported similar findings (8, 15, 16).

Table.1 Demographic characteristics of the participants

Variable	Number	Percentage
Gender		
Male	169	32.2
Female	356	67.8
Age group		
20-30 years	119	22.6
31-40 years	176	33.5
41-50 years	104	19.8
51-60 years	126	24

Table.2 Organisms isolated from urine samples

Organism	Number	Percentage
E. coli	337	64.1
Klebsiella species	52	9.9
Pseudomonas aeruginosa	39	7.4
Proteus species	29	5.5
Enterococcus species	29	5.5
Staphylococcus aureus	31	5.9
Others	08	1.5

Table.3 Antibiotic susceptibility pattern of *E. coli* (n=525)

Antibiotic	Sensitive (%)	Resistant (%)
Ampicillin	6 (1.2)	519 (98)
Amoxicillin-clavulanic acid	133 (25.4)	392 (74.6)
Ceftriaxone	228 (43.4)	297 (56.6)
Cefuroxime	216 (41.2)	309 (58.8)
Ceftazidime	240 (45.7)	285 (54.3)
Ciprofloxacin	247 (47.1)	278 (52.9)
Norfloxacin	286 (54.5)	239 (45.5)
Amikacin	433 (82.5)	92 (17.5)
Gentamicin	216 (41.2)	309 (58.8)
Co-trimoxazole	188 (35.9)	337 (64.1)
Imipenem	499 (95.1)	26 (4.9)
Nitrofurantoin	391 (74.4)	134 (25.6)
Piperacillin-Tazobactam	480 (91.4)	45 (8.6)

The antibiotic susceptibility pattern of *E. coli* is shown in table 3. Highest resistance was seen with Ampicillin (98%) and Amoxicillin-clavulanic acid (74%) and least resistance was seen with Imipenem (4.9%) and Piperacillin-Tazobactam (8.6%). Significant resistance was also seen with fluoroquinolone and cephalosporin group of antibiotics (2, 5, 17). The reason for the development of resistance to commonly used antibiotics might be irrational therapeutic and undue prophylactic use, easy availability (over the counter sale) of the antibiotics and inappropriate dosing schedule. Resistance to aminoglycoside group of antibiotics was low with amikacin. Resistance to cotrimoxazole was high (64.1%), and to nitrofurantoin was 25.6%. Other studies have reported low resistance to nitrofurantoin ranging from 1% to 13% (18-19). This variation might be due to different geographical, patient and hospital characteristics. Least resistance was seen with Imipenem and Piperacillin-Tazobactam. Other studies have also reported similar findings (17-20). The inappropriate and irrational empirical use of antibiotics (particularly wide spectrum antibiotics), immuno-suppression, prolonged stay (catheterization) and lack of appropriated laboratory services are some of the major reasons responsible for resistant urinary tract infection.

Limitations of the study

The present study was conducted at a single center and the samples size was small, so results cannot be generalized. Future studies should include regional hospitals with large sample size.

In conclusion, the present study revealed that urinary tract infections caused by E. coli was resistant to commonly used antibiotics. On the basis of local antibiotic susceptibility pattern, Nitrofurantoin (oral) and Amikacin (parenteral) can be used as first line empiric therapy for treatment of UTI. A major intervention in preventing resistant UTI is the regular monitoring of antibiotic resistance pattern which helps in initiating empirical treatment of UTI and definitive therapy must be initiated only after culture sensitivity report. As the antibiotic resistance pattern changes over a period of time, regular antibiotic susceptibility pattern studies should be conducted region wise.

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