



## BACTERIOLOGICAL EVALUATION OF URINARY TRACT INFECTION (UTI) IN PEDIATRIC PATIENTS.

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### ABSTRACT

Urinary tract infection is one of the most common diseases in children. It is associated with high morbidity and long term complications. The current study was undertaken to determine the bacteriological profile and antibiogram of uropathogens causing UTI among the pediatric age group. The study population included 0 to 12 years old patients, who were clinically suspected to have a UTI. The urine samples were collected and processed by conventional microbiological methods and antimicrobial susceptibility testing was performed. Among 352 cases, 64 had their urine culture positive. In Infants, there was a male preponderance for culture proven UTI and in the age group 1-12 years there was female preponderance. Also, overall there was female preponderance. Predominant uropathogens isolated in our study were *E.coli* followed by *Klebsiella* species. Most of the isolates were resistant to commonly prescribed antibiotics. Accurate knowledge on local epidemiology and antibiogram of uropathogens among pediatric patients is necessary for treatment.

**KEY WORDS-** UTI, Pediatrics, *E.coli*, Antimicrobial resistance



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## INTRODUCTION

Urinary tract infections (UTIs) are one of the most common causes of hospital admissions and outpatient consultations in pediatric practice. It is one of the most common bacterial diseases in children and can be asymptomatic or symptomatic, characterized by a wide spectrum of symptoms ranging from mild irritative voiding to sepsis or even death.<sup>1</sup> Pediatric UTIs are associated with high morbidity and long term complications like renal scarring, hypertension and chronic renal failure. Gram negative enteric bacilli, especially *Escherichia coli* & *Klebsiella* species are the leading pathogens, though *Enterococcus* species, yeasts and *Staphylococcus aureus* have emerged as prominent agents in recent years, many of them resistant to multiple antibiotics.<sup>2</sup> In recent years, widespread use of antibiotics has been resulted in increasing incidence of antibiotic resistance among the urinary tract pathogens all over the world.<sup>3</sup> Frequent use of wide-spectrum antibiotics may change the intestinal flora, and as a consequence, induce bacterial resistance. Epidemiology of UTI during childhood varies by age, gender and other factors. UTI commonly affect boys during 1<sup>st</sup> year of life, but thereafter 3-5% of the girls are affected, increasing to 10% by teenage years.<sup>4</sup> Early recognition and prompt treatment can significantly decrease late serious complications of UTI. Appropriate treatment of UTI requires the knowledge about antibiotic resistance pattern of common uropathogens in specific geographical location.<sup>5</sup> Hence, the current study was undertaken to determine the bacteriological profile and antimicrobial susceptibility pattern of uropathogens causing UTI among pediatric age group.

### AIMS AND OBJECTIVES

- To study the bacteriological profile of UTI in pediatric age group.
- To determine the antimicrobial susceptibility pattern among isolated uropathogens.
- To study the association between age group and gender of patients with UTI.

## MATERIALS AND METHODS

The study was carried out in the Department of Microbiology, S .R. T. R. Govt. Medical College and Hospital, Ambajogai from August 2012 to January 2014. The study population included 352 cases, ranges from 0 to 12 years old patients, who were clinically suspected to have a UTI. The urine samples were collected using mid stream method in toilet-trained children and using transurethral bladder catheterisation in younger children and infants by taking all aseptic precautions. The samples were transported immediately to the Microbiology laboratory and were processed by conventional microbiological methods.<sup>6</sup> Urine specimens were subjected for direct microscopy and smear by Gram staining. Urine samples were cultured on MacConkey agar and blood agar (Hi Media, Mumbai) and then incubated for 24 hours at 37°C. The colony count cultures  $\geq 10^5$  cfu/ml were considered as significant. The isolated bacterial strains were further identified by standard microbiological techniques. Antimicrobial susceptibility testing was performed by Kirby-Bauer disc diffusion method by using different antibiotic discs (Hi Media, Mumbai) as per CLSI guidelines.<sup>1,7</sup>

### STATISTICAL METHODS

The data obtained was analyzed by applying appropriate statistics wherever needed.

## RESULTS

A total of 352 children (age <12 years) with suspected UTI were evaluated in the study, of whom 207 were from inpatient and 145 were from outpatient department. Out of 352 patients, 226 were female and 126 were male. Among 352 urine specimens, 64 (18.18%) were found to be culture positive. Out of 64 culture positive cases, 13 were infants (10 male, 3 female) and 51 were in the age group 1-12 years (6 male, 45 female). Thus in infants, there was male preponderance for culture proven UTI and in age group 1-12, years there was female

preponderance. Also, overall there was a female preponderance in age group of 0 to 12 years. All of these findings were found to be

statistically significant by Chi Square test ( P value <0.05). (Table-1).

**Table-1**

**Association between age group and gender of patients with UTI by applying Chi-square test.**

Age group	Male		Female		Total		P value
	Total no. of male cases (a)	No. of culture positive cases (b)	Total no. of female cases (c)	No. of culture positive cases (d)	Total no. of cases (a+c)	Total no. of culture positive cases (b+d)	
0-≤1 year	35	10	33	3	68	13	<0.05
Greater than 1 year up to 12 years	91	6	193	45	284	51	<0.05
Total 0-12 years	126	16	226	48	352	64	<0.05

Predominant Gram negative uropathogen isolated in our study was *E.coli* (45.31%) followed by *Klebsiella* species (18.75%) and *Pseudomonas aeruginosa* (10.94%). Among Gram positive isolates *Staphylococcus aureus* (6.25%) was most common followed by coagulase-negative staphylococci (4.69%). (Table-2).

**Table-2**

**Number of isolated organisms and their percentages**

Organism	Number of isolates	Percentages (%)
<i>Escherichia coli</i>	29	45.31
<i>Klebsiella</i> spp.	12	18.75
<i>Pseudomonas aeruginosa</i>	7	10.94
<i>Proteus mirabilis</i>	5	7.81
<i>Proteus vulgaris</i>	4	6.25
<i>Staphylococcus aureus</i>	4	6.25
Coagulase-negative staphylococci	3	4.69
Total	64	100

Antibiotic susceptibility testing revealed that, *E.coli* isolates were 100% sensitive to imipenam and meropenem. They had shown high sensitivity towards nitrofurantoin (96.55%), amikacin (93.10%) and low sensitivity to cephalosporins (0 to 10%), amoxicilline-clavulanic acid (10.34%), and cotrimoxazole (10.34%). (Table - 3) Similarly all other Gram negative isolates were 100% sensitive to imipenem and meropenem. They had shown good sensitivity to nitrofurantoin and amikacin. But they were highly resistant to commonly prescribed antibiotics like amoxicillin-clavulanic acid, cotrimoxazole, ticarcillin-clavulanic acid, piperacillin-tazobactam, cephalosporins and various forms of fluoroquinolones. (Table - 3)

**Table-3**  
**Antibiotic susceptibility pattern of Gram negative isolates.**

Antibiotic	<i>E.coli</i> n=29 (%)	<i>Klebsiella</i> spp. n=12 (%)	<i>Pseudomona</i> <i>s aeruginosa</i> n=7 (%)	<i>Proteus</i> <i>mirabilis</i> n=5 (%)	<i>Proteus</i> <i>vulgaris</i> n=4 (%)
Amoxicillin/Clavulanic acid	3 (10.34)	3 (25)	2 (28.57)	1 (20)	1 (25)
Ticarcillin/Clavulanic acid	4 (13.79)	3 (25)	2 (28.57)	1 (20)	1 (25)
Piperacillin/Tazobactam	11 (37.93)	6 (50)	3 (42.86)	3 (60)	2 (50)
Cefazolin	2 (6.90)	2 (16.67)	1 (14.29)	0 (0)	0 (0)
Cefuroxime	0 (0)	1 (8.33)	0 (0)	0 (0)	0 (0)
Ceftazidime	3 (10.34)	1 (8.33)	1 (14.29)	0 (0)	0 (0)
Cefotaxime	3 (10.34)	2 (16.67)	1 (14.29)	0 (0)	0 (0)
Ceftizoxime	3 (10.34)	1 (8.33)	1 (14.29)	0 (0)	0 (0)
Imipenem	29 (100)	12 (100)	7 (100)	5 (100)	4 (100)
Meropenem	29 (100)	12 (100)	7 (100)	5 (100)	4 (100)
Amikacin	27 (93.10)	10 (83.33)	5 (71.43)	5 (100)	4 (100)
Gentamicin	21 (72.41)	5 (41.67)	4 (57.14)	3 (60)	3 (75)
Ciprofloxacin	11 (37.93)	4 (33.33)	3 (42.86)	2 (40)	1 (25)
Lomefloxacin	18 (62.07)	7 (58.33)	4 (57.14)	3 (60)	2 (50)
Norfloxacin	13 (44.83)	5 (41.67)	3 (42.86)	2 (40)	1 (25)
Ofloxacin	14 (48.28)	5 (41.67)	3 (42.86)	2 (40)	1 (25)
Cotrimoxazole	3 (10.34)	2 (16.67)	1 (14.29)	0 (0)	2 (50)
Nitrofurantoin	28 (96.55)	11 (91.67)	6 (85.71)	5 (100)	4 (100)

All gram positive isolates were 100% sensitive to vancomycin, linezolid, netilmicin, teicoplanin and nitrofurantoin . High sensitivity was shown against gentamicin, lomefloxacin, ofloxacin, and low sensitivity was observed for erythromycin, clindamycin, cotrimoxazole, amoxicillin-clavulanic acid, cefoxitin and penicillin G. Rate of MRSA was high (75%) in our set up. (Table – 4)

**Table – 4**  
**Antibiotic susceptibility of gram positive isolates.**

Antibiotic	<i>Staphylococcus aureus</i> n=4 (%)	Coagulase- negative staphylococci n=3 (%)
Penicillin G	0 (0)	0 (0)
Amoxicillin/Clavulanic acid	2 (50)	1 (33.33)
Cefoxitin	1 (25)	1 (33.33)
Gentamicin	3 (75)	2 (66.67)
Netilmicin	4 (100)	3 (100)
Ciprofloxacin	2 (50)	2 (66.67)
Lomefloxacin	3 (75)	2 (66.67)
Norfloxacin	2 (50)	1 (33.33)
Ofloxacin	3 (75)	2 (66.67)
Cotrimoxazole	1 (25)	1 (33.33)
Clindamycin	1 (25)	1 (33.33)
Erythromycin	2 (50)	1 (33.33)
Nitrofurantoin	4 (100)	3 (100)
Linezolid	4 (100)	3 (100)
Vancomycin	4 (100)	3 (100)
Teicoplanin	4 (100)	3 (100)
Tetracycline	2 (50)	1 (33.33)

## DISCUSSION

UTI is one of the most common bacterial infection refers to, presence of microbial pathogens within the urinary tract. It is common bacterial illness in children and is an important cause of morbidity & mortality in the pediatric population.<sup>1</sup> In the present study, of the 352 clinically suspected UTI cases, 18.18% were culture positive. This rate matches with studies done at other places.<sup>1,2,4</sup> When we consider the association of culture positivity with age and sex of the patients, we have observed that the overall culture positivity was higher in females, while below one year of age it was more common in males and after one year of age, it was higher in females. These findings were statistically significant by applying Chi-Square test. The reason behind the increased rate in females may be that, females are said to be more susceptible to UTI after age of 6 months due to their shorter urethra which provide easy access of the bacteria to the bladder. Similar findings were also shown in other studies.<sup>2,8-10</sup> The members of *Enterobacteriaceae* particularly *E.coli* & *Klebsiella* species are frequently reported as the most common cause of UTI worldwide.<sup>1,2,4-14</sup> These findings were matched with our study in which *E.coli* (45.31%) was the most common bacteria isolated followed by *Klebsiella* (18.75%) species (Table - 2). In this study, all *E.coli* strains were found to be susceptible to imipenem and meropenem. They have shown good sensitivity to nitrofurantoin, amikacin. But most of them are available in parenteral and are highly expensive. Also many of *E.coli* strains were highly resistant to commonly prescribed antimicrobial agents like cephalosporins, fluoroquinolones, amoxicillin-clavulanic acid and cotrimoxazole. Similar pattern of antibiogram was also mirrored in other gram negative bacteria isolated. Most of them were found to be multidrug resistant. Similar observation has also been made in the studies done at other places.<sup>1,2,4,5,8,13</sup> All gram positive bacteria isolated were 100% sensitive to vancomycin, linezolid, netilmicin,

teicoplanin, and nitrofurantoin. They were highly resistant to erythromycin, clindamycin, cotrimoxazole, amoxicillin-clavulanic acid, cephoxitin and penicillin G. Rate of MRSA in this study was 75%. Ranjbar R *et al* (2009) has also found that Gram positive bacteria isolated in his study were highly resistant to most of the commonly prescribed antibiotics.<sup>1,15</sup> Miller & Tang (2004) stated that, in the empirical treatment of uncomplicated UTI, cotrimoxazole is recommended unless resistance exceeds 10-20%. If such antibiotic is used, then there will be suboptimal clinical outcome.<sup>16</sup> Since in our study cotrimoxazole resistance is greater than 20%, its use in UTI in our region needs further review.

## CONCLUSION

So, in the end, important observations made in our study includes, (i) Male gender is a risk factor for developing a UTI below one year of age. (ii) *E.coli* was the commonest etiologic agent responsible for UTI in pediatric age group population. (iii) Most of the urinary isolates had a high level of resistance to commonly prescribed antibiotics. (iv) Various forms of cephalosporins, cotrimoxazole, fluoroquinolones, once were the mainstay in treating in UTIs in pediatric patients were less responsive at our center. (v) The rate of multi-drug resistant organisms was high and most appropriate first line antibiotic for empirical treatment of UTI in pediatric patients in our hospital was nitrofurantoin. Therefore accurate knowledge of local epidemiology and antibiotic susceptibility pattern of uropathogens among pediatric patients is necessary for designing effective patient management. Infection control policies, continuous monitoring of changes in bacterial pathogens and their antibiogram in each region to improve the knowledge of clinicians for effective treatment of UTI is recommended.

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