CLINICO-MICROBIOLOGICAL PROFILE OF UTI IN CHILDREN LESS THAN 10 YEARS IN DEPARTMENT OF PEDIATRICS IN TERTIARY CARE CENTRE

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ABSTRACT: BACKGROUND: Urinary Tract Infection (UTI) is among the most common serious bacterial infections in infants and children, and is frequently missed, probably because of its non-specific presentation. The knowledge of etiology and antibiotic sensitivity and resistance pattern of the organisms causing urinary tract infection is essential. **OBJECTIVES:** To record the common clinical presentation and risk factors for UTI in children. The distribution of bacterial strains isolated from these patients and their sensitivity and resistance pattern were also studied. **MATERIALS AND METHODS:** An observational study was conducted in Department of Pediatrics, Raja Rajeswari Medical College, Bangalore, a tertiary care centre, from August to December, 2013. Patients who had UTI confirmed by positive urine culture reports were included in the study. Statistical analysis was done using the SPSS version 17. **RESULTS:** 82 children had UTI with positive urine culture reports. Maximum number of cases was seen in the age group 1-5 years (51.2%), where males were 31% and females were 69%. Fever was the commonest presenting single symptom and the commonest organisms isolated in urine were *Escherichia coli* (73.2%), *Enterococcus* (8.5%) and *Klebsiella* (4.8%). History of incomplete course of antibiotic (12.1%) and posterior urethral valve (3.7%) were the major risk factors for UTI. Imipenem (58.5%), Amikacin (57.3%) and Gentamicin (52.4%) were the drugs with highest sensitivity to the organisms cultured. Furazolidine, Tobramycin, Metronidazole, Pefloxacin and Cefuroxime were found the most resistant drugs as 97.5% patients were found resistant against each one of them. The other most resistant drug was Erythromycin (96.3%) followed by Amoxicillin (90.2%). **CONCLUSION:** Overall, females have a higher risk of UTI. Clinical presentation plays a minor role in establishing diagnosis in UTI in children. *E. coli* is the most widely prevalent organism causing UTI in children. Imipenem, Amikacin and Gentamicin were the drugs with highest sensitivity and Furazolidine, Tobramycin, Metronidazole, Pefloxacin, Cefuroxime, Erythromycin and Amoxicillin were found to be the most resistant drugs. A strong decision has to be established regarding the antibiotic policies for UTI and stringent measures have to be taken to ensure the effectiveness of the same.

KEYWORDS: Organism, Antibiotic sensitivity, Children, Urinary tract infection.

INTRODUCTION: Urinary Tract Infection (UTI) is among the most common serious bacterial infections in infants and children. It distresses the child and concerns the parents. It has a wide variety of clinical presentation, ranging from the asymptomatic presence of bacteria in the urine to potentially life-threatening infection of the kidney.¹

A UTI in infants and children is defined as the detection of significant bacteria in the urine (quantitative culture) with associated specific and nonspecific signs and symptoms. The established definition for a bacterial UTI is greater than 100,000 colony-forming units (CFU) of single bacteria when obtained from a midstream collection of urine or 50,000 CFU or greater of a single organism

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collected by transurethral catheterization from a child with fever². The American Academy of Pediatrics (AAP) guidelines suggest that any colony count with a single organism collected from a suprapubic bladder aspirate is indicative of infection.³

A UTI can occur in the bladder or lower tract (cystitis), kidneys or upper urinary tract (pyelonephritis), or both. Asymptomatic bacteruria is a transient colonization of the bladder, which if left untreated usually resolves without sequelae.⁴ The presence of specific symptoms for UTI, including dysuria, frequency, urgency, suprapubic discomfort, and flank pain, should lead to screening.

However, young children with UTI may present with non specific symptoms, such as poor feeding, vomiting, irritability, jaundice (in newborns), or fever alone, and a broader approach to screening may be appropriate.⁵ Risk factors for UTI include female gender especially at the onset of toilet training, uncircumcised males, voiding dysfunction, obstructive uropathy, constipation, pinworm infestation and anatomic abnormalities.

Most UTIs are not complicated, but some infections can lead to pyelonephritis, especially acute cystitis. UTI in the pediatric population is well recognized as a cause of acute morbidity and chronic medical conditions, such as hypertension, renal scarring and chronic renal failure.⁶

Escherichia coli is the most frequent bacteria to cause UTI in infants and children. Other organisms causing UTI include *Klebsiella*, *Enterobacter*, *Enterococci*, *Staphylococcus*, *Proteus*, *Pseudomonas aeruginosa*; Group B streptococcus.⁷ Common nonbacterial causes of UTI include hemorrhagic cystitis from adenovirus and *Candida* infection in immunocompromised individuals.⁵ In neonates, group B streptococci urinary infection is more common than in older children and adults.⁸

The diagnosis of UTI remains complicated by nonspecific symptoms and the difficulty in obtaining an uncontaminated urine specimen. The most recent guidelines issued by the AAP (1999) suggest that a UTI should be considered in infants and children who present with symptoms and they should also be evaluated with a urinalysis and urine culture.⁹ Urine culture is considered the "gold standard" and the only absolute way to make the diagnosis of a UTI.¹⁰ A clinician's main goals are early diagnosis and appropriate antimicrobial therapy based on urine culture.

The choice of antibiotic may be affected by local resistance patterns and other considerations. Empirical antibiotic therapy is usually applied here and for this, knowledge of the common uropathogens and their susceptibility to commonly used antibiotics is needed. Many times, physicians resort to prescribing broad-spectrum antibiotics over specific antibiotics in the view of resistance of the causative organism to the antibiotic. Poor patient compliance and incomplete course of antibiotic therapy have resulted in the evolution of resistance to many of these antibiotics. However, studies on UTI and the pattern of antibiotic resistance in India are few. The present trends of the uropathogens and their susceptibility to various antibiotics are essential to formulate guidelines for the empirical treatment of UTI while awaiting the culture sensitivity.¹¹

The aim of the present study was to record the common clinical presentation and risk factors for UTI in children. The distribution of bacterial strains isolated from pediatric patients with UTI and their sensitivity and resistance pattern against commonly used antibiotics at our setting were also studied.

METHODOLOGY: An observational study was conducted in Department of Pediatrics, Raja Rajeswari Medical College, Bangalore, a tertiary care centre, from August to December, 2013. The study

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included all the patients who were admitted or visited the out-patient department in the hospital with symptoms of UTI during the study period and had UTI confirmed by positive urine culture reports. Subjects with clinical symptoms of UTI but samples not grown on any organism were excluded from final analysis. Patients who underwent treatment with another antimicrobial within 48 h or within 24 h with only a single dose were also excluded. Hence, out of the 180 patients suspected with UTI, 98 were excluded and the final sample size was 82 culture positive patients. Data was collected using a questionnaire for clinical data.

A clean-catch midstream specimen or catheter sampling/ suprapubic aspirate, in subjects who were unable to give the former, was collected under aseptic precautions. In the presence of any potential growth of organism, antibiotic sensitivity testing was done by Kirby-Bauer disc diffusion method according to Bauer et al.¹²

For statistical analysis, the Statistical Package for Social Sciences version 17 (SPSS) was used.

RESULTS:

Age (years)	Male	Female	Total
<1	12 (85.7%)	2 (14.3%)	14
1-5	13 (31%)	29 (69%)	42
6-10	1 (3.8%)	25(96.2%)	26
Total	26 (31.7%)	56 (68.3%)	82

Table 1: Age and gender-wise distribution of urinary tract infection

Overall, 180 patients suspected to have UTI were screened. Of these, 82 patients showed growth on the urine culture and were included in the study. The mean age was 4.46 ± 2.84 years. Maximum number of cases was seen in the age group 1-5 years (51.2%), where males were 31% and females were 69% and majority of female culture positive cases were also in this age group. Of the total, 56(68.3%) were female patients and 26(31.7%) were males. During the first year of life, the male to female ratio of UTI is 6:1. Beyond 1 year, there is female preponderance with male to female ratio of 1:3.85.

Symptoms	N	%
Fever	20	24.4
Dysuria	10	12.2
Irritability	6	7.3
Vomiting	2	2.4
Offensive smell	1	1.2
Combination symptoms	43	52.4

Table 2: Frequency of symptoms seen in patients with urinary tract infection

Most of the patients had combination of symptoms (52.4%), of which predominant was fever with vomiting. Next common presentation was fever (24.4%) followed by dysuria (12.2%), irritability (7.3%), vomiting (2.4%) and offensive smell (1.2%).

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Associated condition	N	%
PUV	3	3.7
TB	2	2.4
Nephrotic syndrome	2	2.4
Glomerulonephritis	1	1.2
Immunosuppression	1	1.2
None	73	89
Risk factors		
History of incomplete course of antibiotic	10	12.1
Recurrent UTI	8	9.7
Indwelling catheter	7	8.5
Recent history of hospital admission	7	8.5
None	50	60.9

Table 3: Frequency of associated conditions and risk factors seen in patients with urinary tract infection

Of the associated factors which could lead to UTI, commonest underlying illness was posterior urethral valve (3, 3.7%) followed by tuberculosis and nephrotic syndrome (2, 2.4%), glomerulonephritis and immunosuppression (1, 1.2%). The remaining 73 (89%) children had no associated conditions known to cause UTI. History of incomplete course of antibiotic (12.1%) was the most common risk factor associated with UTI in our study. While recurrent UTI, indwelling catheter and recent history of hospital admission were noted in 9.7%, 8.5% and 8.5% of the study subjects respectively.

Organism	N	%
Escherichia coli	60	73.2
Enterococcus	7	8.5
Klebsiella	4	4.8
Pseudomonas	3	3.6
Non enterococcus	2	2.4
Candida	1	1.2
Staphylococcus aureus	1	1.2
Micrococcus	1	1.2
Coagulase negative Staphylococcus	1	1.2
E coli + Pseudomonas	1	1.2
Non enterococcus + Non candida	1	1.2

Table 4: Frequency distribution of uropathogens

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Escherichia coli (60, 73.2%) were the most commonly isolated organism followed by *Enterococcus* (8.5%), *Klebsiella* (4.8%), *Pseudomonas* (3.6%), and Non-enterococcus (2.4%). The presence of *Pseudomonas* (3.6%) was striking since it is considered to be a nosocomial pathogen.

Antibiotics	Sensitivity (N)	%
Imipinem	48	58.5
Amikacin	47	57.3
Gentamicin	43	52.4
Nitrofurantoin	39	47.6
Ciprofloxacin	29	35.4
Ampicillin	23	28
Cotrimoxazole	21	25.6
Doxycycline	20	24.4
Linezolid	20	24.4
Cefaclor	20	24.4
Vancomycin	17	20.7
Norfloxacin	16	19.5
Ceftriaxone	15	18.3
Cloxacillin	13	15.9
Ofloxacin	13	15.9
Cefotaxim	13	15.9
Ceftazidime	12	14.6
Cefazolin	9	10.9
Netilmycin	9	10.9
Meropenem	9	10.9
Amoxicillin	8	9.7
Piperacillin-Tazobactam	4	4.8
Erythromycin	3	3.6
Cefuroxime	2	2.4
Pefloxacin	2	2.4
Metronidazole	2	2.4
Tobramycin	2	2.4
Furazolidine	2	2.4

Table 5: Antibiotic sensitivity pattern of the uropathogens

Imipenem (48, 58.5%), Amikacin (47, 57.3%), Gentamicin (43, 52.4%), Nitrofurantoin (39, 47.6%), Ciprofloxacin (29, 35.4%) and Ampicillin (23, 28%) were the drugs with highest sensitivity to the organisms cultured. Furazolidine, Tobramycin, Metronidazole, Pefloxacin and Cefuroxime were found the most resistant drugs as 80 (97.5%) patients were found resistant against each one of them. The other most resistant drug was Erythromycin (79, 96.3%) followed by Amoxicillin (74, 90.2%).

Antimicrobial	Number (%) of isolates sensitive for <i>Escherichia coli</i> (N = 60)
Imipinem	40 (66.7)
Amikacin	38 (63.3)
Gentamicin	33 (55)
Nitrofurantoin	30 (50)
Ciprofloxacin	17 (28.3)
Ampicillin	16 (26.7)
Cotrimoxazole	16 (26.7)
Cefaclor	15 (25)
Doxycycline	14 (23.3)
Norfloxacin	13 (21.7)
Linezolid	12 (20)
Vancomycin	10 (16.7)
Cloxacillin	10 (16.7)
Ofloxacin	9 (15)
Ceftriaxone	8 (13.3)
Meropenem	8 (13.3)
Ceftazidime	8 (13.3)
Cefotaxim	7 (11.7)
Amoxicillin	6 (10)
Cefazolin	6 (10)
Netilmycin	5 (8.3)
Piperacillin+Tazobactam	1 (1.7)
Erythromycin	1 (1.7)
Cefuroxime	1 (1.7)
Metronidazole	1 (1.7)
Tobramycin	1 (1.7)
Furazolidone	1 (1.7)
Pefloxacin	1 (1.7)

Table 6: Antibiotic sensitivity pattern of *Escherichia coli*

E. coli isolates were most sensitive to Imipenem (40, 66.7%), Amikacin (38, 63.3%), Gentamicin (33, 55%) followed by Nitrofurantoin (30, 50%) and Ciprofloxacin (17, 28.3%). Importantly for *E. coli*, the antimicrobials Pefloxacin, Furazolidone, Tobramycin, Metronidazole, Cefuroxime and Erythromycin showed high resistant rates (98.7% respectively). The safest oral drug (with minimal side effects) that can be used in children with UTI seems to be Cotrimoxazole, Cefotaxime with a moderate sensitivity of 26.7% and 11.7% respectively. Having the highest sensitivity, Amikacin or Gentamicin can be given parenterally.

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DISCUSSION: Overall, 180 patients suspected to have UTI were screened. Of these, 82 patients showed growth on the urine culture and were included in the study. Maximum number of cases was seen in age group 1-5 years (51.2%). The study by Muoneke et al¹³ reported predominance of UTI among children (67%) younger than 5 years. Aljumaili et al¹⁴ noted a majority of female culture positive cases in age group 2-5 years, as was seen in our study. Of the total, male to female ratio was 1:2.1. During the first year of life, the male to female ratio of UTI is 6:1. Beyond 1 year, there is female preponderance with male to female ratio of 1:3.85. Muoneke et al¹³ in their study also showed a slight female preponderance with a male: female ratio of 1:1.3 and the male: female ratio in UTI varies with age, observed as 2.8-5.4:1.0 in the first year of life and changing to 1:10 after the second year of life. It was also supported by study of Dulczak et al⁶ which showed in preschool and school age children the prevalence of UTI is about 1% to 5% for females and rare in males. According to Chang et al¹⁵, during the first year of life, boys have a higher incidence of UTI; in all other age groups, girls are more prone to developing UTI. Valavi E et al¹⁶ showed that the female: male ratio was 2:1 in infants aged < 1 year and 8:1 in those aged > 1 year.

Most of the patients had combination of symptoms (52.4%), of which predominant was fever with vomiting. Next common presentation was fever (24.4%) followed by dysuria (12.2%), irritability (7.3%), vomiting (2.4%) and offensive smell (1.2%). According to Muoneke et al,¹³ fever was the presenting symptom in 76.4% children and was most common. Vomiting was found in 17.3% patients while most patients presented with more than one symptom. The prevalence of non-specific symptoms like fever, irritability and vomiting and the relative rarity of disease-defining symptoms in this study apparently support the need for screening all febrile children for UTI. Clinical presentation plays a minor role in establishing diagnosis in UTI.

Of the associated factors which could lead to UTI, commonest underlying illness was posterior urethral valve (3, 3.7%). The remaining 73 (89%) children had no associated conditions known to cause UTI. Recurrent UTI, indwelling catheter and recent history of hospital admission were noted in 9.7%, 8.5% and 8.5% of the study subjects respectively. Taneja et al⁷ found in their study that the commonest underlying illnesses was PUV (118, 27.6%), while recurrent UTI was seen in 1.6%. 118 (27.6%) children had no predisposing conditions known to cause UTI. In their study, long term indwelling catheters were recognized as a risk factor towards UTI acquisition in these patients. In the study conducted by Kanishka Das,¹⁷ the role of PUV in UTI is doubtful. No empiric evidence has been obtained from the available Randomized Control Trials to suggest PUV as a modifiable risk factor of UTI in children of age group 1-10 yrs. Muoneke et al¹³ found that 54 (49.1%) children received antibiotics prior to presenting to hospital.

Escherichia coli (60, 73.2%) was the most commonly isolated organism followed by *Enterococcus* (8.5%), *Klebsiella* (4.8%), *Pseudomonas* (3.6%), *Non enterococcus* (2.4%). The presence of *Pseudomonas* (3.6%) was striking since it is considered to be a nosocomial pathogen. Jantunen et al¹⁸ stated that *E coli* accounts for about 85% to 90% of all UTIs in children. Muoneke et al¹³ also supported this by stating that the incriminating organism is usually *Escherichia coli* followed by *Klebsiella* and *Proteus*. Valavi E et al¹⁶ showed that the most common pathogens were *Escherichia coli* (84%), *Klebsiella* spp. (10.1%), *Enterococcus* spp. (2.4%), *Proteus* spp. (1.7%), and *Pseudomonas* spp. (1.7%). As per the study about managing urinary tract infection in children, *E.coli* accounts for approximately 75% of UTIs in children while *Enterococcus*, *Proteus*, *Staphylococcus*, *Klebsiella*, and *Pseudomonas* account for most other cases of UTI in children.⁸

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Imipenam (48, 58.5%), Amikacin (47, 57.3%), Gentamicin (43, 52.4%), Nitrofurantoin (39, 47.6%), Ciprofloxacin (29, 35.4%) and Ampicillin (23, 28%) were the drugs with highest sensitivity to the organisms cultured. Furazolidine, Tobramycin, Metronidazole, Pefloxacin and Cefuroxime were found the most resistant drugs as 80 (97.5%) patients were found resistant against each one of them. The other most resistant drug was Erythromycin (79, 96.3%) followed by Amoxicillin (74, 90.2%). Muoneke et al¹³ in his study showed that Gentamicin (50, 45.5%), Ceftriaxone (49, 44.5%), and Ciprofloxacin (36, 32.7%) were the drugs with highest sensitivity to the organisms cultured. The increased sensitivity of urinary tract isolates to gentamicin, the quinolones has been previously documented in other studies.¹⁹

Though they can be used for empiric therapy in UTI, the urine of all suspected cases of UTI should be cultured and sensitivity pattern determined for appropriate treatment. Aljumaili et al¹⁴ in their study stated that *E. coli* was the principal isolate showing high susceptibility to Amikacin and Gentamicin (69.2%) followed by Norfloxacin, Nalidixic acid and Ofloxacin. Kumari et al²⁰ reported Amikacin as the most sensitive followed by Gentamicin, in agreement to the present study. Others, Malla et al²¹ showed Amikacin was the most sensitive drug. Increased rates of *Escherichia coli* resistance have made amoxicillin a less acceptable choice, and studies have found higher cure rates for trimethoprim-sulfamethoxazole³. This approves to the finding of our study.

CONCLUSION: Overall, females have a higher risk of UTI. Clinical presentation plays a minor role in establishing diagnosis in UTI in children and most of the patients had no risk factors. *E. coli* is the most widely prevalent organism causing UTI in children. Imipenam, Amikacin, Gentamicin, Nitrofurantoin, Ciprofloxacin and Ampicillin were the drugs with highest sensitivity to the organisms cultured. Furazolidine, Tobramycin, Metronidazole, Pefloxacin, Cefuroxime, Erythromycin and Amoxicillin were found to be the most resistant drugs. The resistance pattern is ever increasing due to uncontrolled abuse of the available antibiotics. A strong decision has to be established regarding the antibiotic policies for UTI and stringent measures have to be taken to ensure the effectiveness of the same.

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