

## CLINICAL PROFILE AND OUTCOME OF URINARY TRACT INFECTIONS IN CHILDREN AGED 1-12 YEARS

B. Manohar<sup>1</sup>, T. Jayachandra Naidu<sup>2</sup>, M. N. J. Sushma<sup>3</sup>, B. Sasi Kumar<sup>4</sup>, K. Sivaramudu<sup>5</sup>, V. S. Anjan Kumar<sup>6</sup>, L. Srividya<sup>7</sup>

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**ABSTRACT: BACKGROUND:** Urinary tract is a common site of infection in the pediatric population. Unlike generally benign course of urinary tract infection (UTI) in the adult population, UTI in the pediatric population is well recognized as a cause of acute morbidity and chronic medical conditions like hypertension and renal insufficiency in adulthood. As a result, it is crucial to have a clear understanding of clinical profile of UTI in children. **AIMS AND OBJECTIVES:** 1. to study the clinical presentation of UTI in children. 2. To identify the common microorganisms causing UTI in children. 3. To evaluate the risk factors for UTI in children. **SETTINGS AND DESIGN:** Hospital based prospective study conducted from October 2010 to September 2011 in Department of Pediatrics at S.V.R.R Government General Hospital, a tertiary care hospital affiliated to S.V. Medical College, Tirupati, Andhra Pradesh. **METHODS AND MATERIAL: INCLUSION CRITERIA:** All children in the age group of 1 to 12 years admitted in hospital with a probable urinary tract infection and later confirmed by a positive urine culture. **EXCLUSION CRITERIA:** Those children who received partial treatment with antibiotics prior to admission and those with any neurological abnormality of urinary bladder. Informed written consent was taken from parents of children and data was collected in pre-designed pro-forma. **RESULTS:** Significant pyuria was present in all patients. Most common organisms isolated on urine culture were Escherichia coli and Klebsiella pneumoniae. Both were sensitive to third generation Cephalosporins, Piperacillin-Tazobactam and Amikacin. VUR was a significant risk factor for UTI ( $P < 0.0001$ ). **CONCLUSIONS:** In children aged  $>1$  year, UTI is much more common in girls than boys. Escherichia coli and Klebsiella pneumoniae are the most common organisms causing UTI in children. Ultrasound examination of abdomen is a sensitive test to detect. Vesicoureteral reflux is a common predisposing factor for UTI in both boys and girls.

**KEYWORDS:** Urinary Tract Infections, Children, Fever, Pyuria, Tirupati.

**MeSH TERMS:** Urinary Tract Infections, Child, Fever, Pyuria.

**INTRODUCTION:** Fever is one of the most common symptoms for which a child is brought to the Pediatrician. Unlike other severe bacterial infections, not much attention has been focused on the identification of urinary tract infections (UTI) in febrile children despite the fact that urinary tract infections account for a significant proportion of cases of unexplained febrile illnesses and are associated with significant morbidity. Fever, may be the only significant symptom in children with urinary tract infections and all children with otherwise unexplained fever merit evaluation for possible UTI.<sup>1</sup>

# ORIGINAL ARTICLE

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Urinary tract infection is one of the most common bacterial infections and its occurrence in childhood may carry special significance.<sup>2</sup> Making the diagnosis is difficult particularly in young children. This is because in this age group the clinical presentation of UTI is often with non-specific clinical signs such as fever, irritability and vomiting that are also commonly seen in many acute self-limiting childhood viral illnesses and localizing symptoms are minimal.<sup>3</sup> Seeking laboratory confirmation of the diagnosis requires the initial step of collecting an uncontaminated urine sample and this is a challenge in infants and children who are not toilet-trained. Failure to consider a diagnosis of UTI or delaying the antibiotic treatment of a urine infection can have the effect of producing an acute clinical deterioration and in addition it may result in long-term renal damage.<sup>4</sup>

The risk of having a UTI before the age of 14 years is approximately 1-3% in boys and 3-10% in girls.<sup>4</sup> Even a single confirmed UTI should be taken seriously, especially in young children, due to the potential for renal parenchymal damage. Recurrent UTI, defined as the recurrence of symptoms with significant bacteriuria in patients who have recovered clinically following treatment, is common in childhood, especially girls.<sup>5</sup>

## **AIMS & OBJECTIVES:**

1. To study the clinical presentation and outcome of UTI in children.
2. To identify the common microorganisms causing UTI in children.
3. To evaluate the risk factors for UTI in children.

**METHODOLOGY: DESIGN:** Hospital based prospective study done at Department of Pediatrics of Sri Venkateswara Ramnarayan Ruia Government General Hospital, a tertiary care hospital affiliated to Sri Venkateswara Medical College, Tirupati, Andhra Pradesh for a period of one year i.e. from October 2010 to September 2011.

**INCLUSION CRITERIA:** All children in the age group of 1 to 12 years admitted in hospital with a probable diagnosis of urinary tract infection that is later confirmed after admission by a positive urine culture.

**EXCLUSION CRITERIA:** Those children who received partial treatment with antibiotics prior to admission. Children with any neurological condition associated with bladder involvement.

All children admitted in the hospital who satisfied the inclusion and exclusion criteria were included in the study. Informed written consent was obtained from the parents. Data regarding name, age, sex, residence and socioeconomic status were collected in a pre-specified pro-forma.

Clean catch mid-stream urine specimen was collected from the patients. In very young urine specimen was obtained by catheterization. Urine sample was centrifuged and examined under microscope for significant pyuria (>5 leukocytes per high power field). Fresh urine specimen was plated on MacConkey and Nutrient agar culture media and incubated overnight at 37 degrees centigrade and observed for growth of any organisms. Colony count of  $>10^5$ /mL of a single species in a midstream clean catch sample or  $>5 \times 10^4$ /mL for specimen obtained by

# ORIGINAL ARTICLE

urethral catheterization was considered significant and taken as an evidence of presence of urinary tract infection.

All the patients were subjected to Ultrasound examination of the abdomen to look for anomalies and post void urine residue. Patients were treated as per protocols. After the patients have completely recovered, just prior to discharge from the hospital, all patients were subjected to micturating cystourethrography to look for the presence of any vesicoureteric reflux and posterior urethral valves. All patients who had abnormal findings on ultrasonography of the abdomen as well as all children between 1 and 5 years of age were asked to review after 3 months for radionuclide scan using Dimercaptosuccinic acid (DMSA). A renal scar was defined as a photopenic area in the renal parenchyma not caused by lobulation.

**Data Analysis:** Statistical analysis was done using SPSS version 15 for numerical data requiring estimation and evaluation of parameters such as age, mean and standard deviation were calculated. Proportion of individuals belonging to specific group or having particular attributes was expressed in absolute number and percentage. The difference between two or more proportions was tested using the Chi-square test.  $p$  value  $< 0.05$  was considered to be significant.

**OBSERVATIONS:** A total number of 70 patients with culture positive UTI were studied. The following observations were made in these patients.

**Age Distribution:** Mean age of patients was 6.8 years.

Age group	No. of cases	%
1-6 yrs.	33	47
7-12 yrs.	37	53
<b>Total</b>	<b>70</b>	<b>100</b>

Table 1: Age Distribution

Infants ( $< 1$ yr) were not included in the present study. It was observed that UTI occurred in children belonging to all age groups There was no significant difference in the incidence of UTI in 1-6 year age group as compared to 7-12 year age group ( $p=0.61, ns$ ).

Sex	No. of cases	%
Male	12	17
Female	58	83
<b>Total</b>	<b>70</b>	<b>100</b>

Table 2: Sex Distribution

In the present study, the incidence of UTI was significantly more common in girls than boys, the male: female ratio being 1:4.8 ( $p < 0.0001$ ).

# ORIGINAL ARTICLE

**Presenting Symptoms:** The major presenting symptoms observed in the patients were fever, dysuria, and urgency, increased frequency of micturition, abdominal pain and vomiting.

Symptom	No. of Cases	%
Fever	53	75
Dysuria	41	58
Frequency/urgency	38	54
Vomiting	27	38
Abdominal pain	24	34

Table 3: Prevalence of Symptoms at Presentation

**Urine Microscopy:** Significant pyuria (>5 leukocytes/ high power field in a centrifuged urine specimen) was present in all patients.

Urine Microscopy for Pus Cells	No. of Cases	%
5 to 10	21	30
10 to 15	23	33
Plenty	26	37

Table 4: Urine Microscopy

**Urine Culture:** The most common organisms isolated on urine culture were Escherichia coli and Klebsiella pneumoniae. Both organisms were sensitive to third generation Cephalosporins, Piperacillin- Tazobactam and Amikacin.

Organism Isolated	No. of Cases	%
Escherichia coli	39	56
Klebsiella pneumonia	13	18
Staphylococcus aureus	5	7
Pseudomonas aeruginosa	4	6
Enterobacter species	4	6
Acinetobacter species	3	4
Proteus mirabilis	1	1.5
Candida albicans	1	1.5
<b>Total</b>	<b>70</b>	<b>100</b>

Table 5: Organisms isolated on Urine Culture

**Antimicrobial Treatment:** All patients were treated with intravenous antimicrobial agents for a duration of 8-10 days, according to the sensitivity pattern of the microbial isolate. Cefotaxime, Amikacin and Piperacillin- Tazobactam, were the most common antibiotics used. Infections caused by Staphylococcus aureus were treated with intravenous vancomycin. One patient with candida infection was treated with Fluconazole.

## ORIGINAL ARTICLE

Antibiotic used	No. of Cases	%
Piperacillin-Tazobactam	29	41.5
Cefotaxime	25	36
Amikacin	10	14
Vancomycin	5	7
Fluconazole	1	1.5

Table 6: Antimicrobials used for treatment

**Abdominal Ultrasound Examination:** Ultrasound examination of abdomen and pelvis was performed for all patients immediately after the diagnosis. The most common abnormal ultrasound findings included hydronephrosis, hydroureter, altered echogenicity and small sized kidneys. No sonological abnormalities of urinary bladder could be identified.

Ultrasound Findings	No. of Cases	%
Abnormal	12	17
Normal	58	83
<b>Total</b>	<b>70</b>	<b>100</b>

Table 7: Abdominal Ultrasound findings

**Micturating Cystourethrography (MCU):** MCU was performed on all patients with abnormal ultrasound findings and in all children less than 5 years old even if there was no abnormality on abdominal ultrasound. 29 out of 70 patients underwent the test. Vesicoureteric reflux (VUR) and posterior urethral valves were the most commonly identified abnormalities. In our study, VUR was a significant risk factor for UTI ( $P < 0.0001$ ).

MCU findings	No. of Cases	%
Vesicoureteric reflux	10	14
Posterior urethral valves	2	3
Normal	17	25
Test not indicated	41	58
<b>Total</b>	<b>70</b>	<b>100</b>

Table 8: MCU findings

**Dimercaptosuccinic Acid (DMSA) Scan:** Twenty nine out of 70 patients in whom DMSA scan was indicated were asked to come for the investigation 3 months after discharge. However, many patients were lost to follow up and did not come back for the test. Ultimately, DMSA scan could be performed on only 5 patients all of whom had evidence of shrunken kidneys and multiple scars on the scan.

# ORIGINAL ARTICLE

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DMSA findings	No. of Cases	%
Multiple scars	5	7
Test could not be done	24	34
Test not indicated	41	59
<b>Total</b>	<b>70</b>	<b>100</b>

Table 9: DMSA Scan findings

## DISCUSSION:

**Age and Sex Distribution:** We found that in the age group of 1-12, UTI was common at all ages and occurred with similar incidence in all age groups without any specific predilection for certain age group. Our findings are similar to those of Taneja et al.<sup>6</sup> and A Sharma et al.<sup>7</sup> After 1 year of age, UTI is far more common in girls than boys at all ages the female to male ratio being 4.8:1. Our results are similar to those of other studies such as those by Anis Ur Rehman et al.<sup>8</sup> In contrast to, Taneja et al.<sup>6</sup> showed male dominance.

**Clinical Presentation:** In our study, we found that fever was the most common presenting symptom across all age groups and was present overall in 75% of the patients. Our finding is similar to many other studies such as those by Shaw et al,<sup>9</sup> apart from fever, abdominal pain and vomiting were the most common presenting features in children aged 1-5 years while dysuria, frequency of micturition and urgency were the most common symptoms in children older than 5 years of age. These findings correlate similarly with other studies such as those by Qureshi et al, Messi G et al.<sup>10</sup> and Anis Ur Rehman et al.<sup>8</sup>

Four out of seventy patients in our study had a past history of UTI giving an incidence of 6% for recurrent UTI. However, our prevalence of 6% for recurrent UTI is much lower than that of other studies that have reported an incidence between 40 and 70% for recurrent UTI in children such as the study by Clarke SE et al.<sup>11</sup> Several factors seem to be responsible for this.

**Microbiological Profile:** Our study included only culture positive cases of UTI. E. coli was the most common organism isolated (56%) in our study. This was in accordance with other studies such as those by Taneja et al,<sup>6</sup> A Sharma et al,<sup>7</sup> Akram et al,<sup>12</sup> in which E. coli was isolated from 51.0% to 72.8%.reported a very high percentage (87%) and (92%) of E. coli in their study.<sup>13</sup>

Klebsiella was isolated in 18% cases in our study. A study done by Chakupurakalet al.<sup>14</sup> and Akram et al showed similar data (22.0%) where Klebsiella was isolated in 15 to 23% of the cases. In contrast with the studies done by Chang SL<sup>15</sup> et al and Taneja et al.<sup>6</sup>

Proteus was the third most common isolate in most of the studies such as those by Chakupurakalet al.<sup>14</sup> Bouskraoui M et al,<sup>16</sup> in which it was isolated from 5-12% of cases. Staphylococcus aureus, Pseudomonas aeruginosa and Enterobacter species were the next common isolates in our study. The prevalence of infection by these organisms in our study is comparable to those of other studies from India as well as other countries.

# ORIGINAL ARTICLE

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**Treatment:** All our patients received intravenous antibiotics for 8-10 days. Initially, patients were started on empirical broad spectrum antibiotics later changed according to the sensitivity pattern. All the E.coli isolates were sensitive to Cefotaxime and Piperacillin-tazobactam. Pseudomonas isolates were sensitive to Piperacillin-tazobactam. Infections caused by Staphylococcus aureus were treated with intravenous Vancomycin. One patient with Candida infection was treated with Fluconazole. All patients in our study responded well to antimicrobial therapy.

**Abdominal Ultrasound:** Ultrasound examination of the abdomen was done in all our patients according to current Indian guidelines immediately after the diagnosis. In our study, out of 70 patients, 12 (17%) had abnormalities detected similar to G Zamir et al.<sup>17</sup> However, Wing Hang Luk et al.<sup>18</sup> in their study, which included 550 children with UTI, found abnormal Ultrasound findings in only 7% of the cases.

**Risk Factors:** Two of the twelve (16%) boys in our study had phimosis which is a risk factor for UTI in boys. None of the 12 boys in our study were circumcised. Similar to Griebing TL et al.<sup>19</sup> and Foxman B et al.<sup>20</sup> the risk of UTI was higher in uncircumcised boys and circumcision was deemed to be protective.

In the present study, Micturating cystourethrography (MCU) was performed on all patients with abnormal ultrasound findings and in all children less than 5 years old even if there was no abnormality on abdominal ultrasound. A total of 29 out of 70 patients underwent the test. Ten patients (14%) had vesicoureteric reflux (VUR) and 2(3%) had posterior urethral valves. Similar to Wing Hang Luk et al.<sup>18</sup> in their study, Taneja et al.<sup>6</sup> found that 19% of their patients, who were children below 12 years of age, most of them with first episode of UTI, had VUR which is almost similar to the prevalence rate in our study.

However, other studies demonstrated much higher prevalence of VUR Hoberman.<sup>21</sup> study on 309 children with UTI, revealed VUR in 39%, Honkinen.<sup>22</sup> study on 76 children with UTI, demonstrated reflux in 28 patients.<sup>8</sup> In a study by MitraNaseriet al,<sup>23</sup> the major predisposing factor in both genders was VUR with similar frequency (46.9% in females and 48.9% in males).

**Limitations of the study:** The sample size is small and hence may not be representative of the entire population. Children less than 1 year of age were not included in the study. Many of the patients in the study could not get DMSA scan performed due to various reasons. We did not follow up our patients prospectively to see if they develop recurrent UTI.

**CONCLUSIONS:** In children aged more than 1year, UTI is much more common in girls than boys. Fever is a common symptom of UTI in children and all children with unexplained fever. The typical symptoms of UTI such as dysuria. All boys presenting with UTI should be examined for phimosis. Escherichia coli and Klebsiella pneumoniae are the most common organisms causing UTI in children in the community setting. Ultrasound examination of abdomen is a sensitive test to detect renal parenchymal involvement and underlying abnormalities of urinary tract. Vesicoureteral reflux is a common predisposing factor for UTI in both boys and girls.

# ORIGINAL ARTICLE

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### **AUTHORS:**

1. B. Manohar
2. T. Jayachandra Naidu
3. M. N. J. Sushma
4. B. Sasi Kumar
5. K. Sivaramudu
6. V. S. Anjan Kumar
7. L. Srividya

### **PARTICULARS OF CONTRIBUTORS:**

1. Professor, Department of Pediatrics, S. V. Medical College & S. V. R. R. Government General Hospital, Tirupati.
2. Professor, Department of Pediatrics, S. V. Medical College & S. V. R. R. Government General Hospital, Tirupati.
3. Post Graduate, Department of Pediatrics, S. V. Medical College & S. V. R. R. Government General Hospital, Tirupati.
4. Assistant Professor, Department of Pediatrics, S. V. Medical College & S. V. R. R. Government General Hospital, Tirupati.

5. Assistant Professor, Department of Pediatrics, S. V. Medical College & S. V. R. R. Government General Hospital, Tirupati.
6. Assistant Professor, Department of Pediatrics, S. V. Medical College & S. V. R. R. Government General Hospital, Tirupati.
7. Resident Specialist, Department of Pediatrics, S. V. Medical College & S. V. R. R. Government General Hospital, Tirupati.

### **NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:**

Dr. B. Manohar,  
Professor, Department of Pediatrics,  
S. V. Medical College & S. V. R. R. Government  
General Hospital, Tirupati-517507.  
E-mail: [punya\\_manohar2002@yahoo.com](mailto:punya_manohar2002@yahoo.com)

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