# **Research Article**

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# Clinical and laboratory profile of urinary tract infection in febrile children aged 1 to 5 years

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#### **ABSTRACT**

**Background:** Urinary tract infection (UTI) is a common problem in the pediatric age group and is a significant risk factor for long term sequelae. The clinical signs and symptoms of UTI are nonspecific and vague in the first 6 years of age. The aim was to study the prevalence of urinary tract infection in 500 febrile children.

**Methods:** This is a cross-sectional study in which 500 febrile children aged 1 to 5 years who attended pediatric outpatient department were selected, detailed history was taken and clinical examination was done in all the cases to find out the cause of fever. Necessary investigations were carried out to find the cause of fever and all the data were recorded in a specially designed proforma for this study.

**Results:** Prevalence of UTI in febrile children in the age group of 1-5 years was 2.9% in males and 5.5% in females with overall estimated prevalence of 4%. The most common organism isolated from patients with UTI was *E. coli*. Ultrasonographic features suggestive of acute pyelonephritis were found in 20% of cases with UTI. Micturating cysto-urethrogram (MCU) showed vesicoureteral reflux (VUR) in 2 cases.

**Conclusions:** UTI should be considered as a potential cause of fever in children below 5 years of age. As the febrile children with UTI usually present with nonspecific signs and symptoms, urine culture should be considered as a part of diagnostic evaluation. Urine culture is the gold standard for diagnosis of UTI in children. Parents should be educated about the importance of UTI and its long term complications so that they bring the children voluntarily for regular follow up.

Keywords: Urinary tract infection, Febrile children, Urine culture

# INTRODUCTION

Urinary tract infection (UTI) is the most common bacterial illness among febrile infants and young children, with a reported prevalence between 4.1% and 7.5%. <sup>1,2</sup> It is the third most common infection in pediatric age group, rank next to respiratory and gastrointestinal infections and account for four to ten percent of febrile children admitted to hospital. <sup>3</sup>

Urinary complaints are rare and only after 5 years of age, the typical triad of abdominal pain, vomiting and fever with chills, rigors or supra-pubic pain are common presentations of upper and lower UTI. It is often over looked especially in infants and young children in whom the symptoms are vague and do not focus the attention on urinary system. The presence of fever has long been considered a finding of special importance in infants and young children with UTI, because it has been accepted as a clinical marker of renal parenchymal involvement (pyelonephritis).<sup>4</sup>

UTI in children needs more attention because of the acute and chronic complications of it in children which is not seen routinely in adults. The majority of these infections in the first 2 years of life are "occult" and that most infection remains undiagnosed if tests are not routinely performed to detect them. Otherwise unexplained renal scarring has been cited as one of most common cause of end-stage renal disease (ESRD) and is an established risk factor for subsequent hypertension.<sup>5</sup>

Although microscopic urinalysis for leukocytes and bacteria is often used as a diagnostic tests for UTI, the sensitivity, specificity and predictive values of these tests have varied greatly according to the patient population studied, the definition of a positive culture result and the method of urinalysis.<sup>2,6</sup>

The difficulty of correctly diagnosing UTI in febrile children was evident in a study by Bauchner et al in which all episodes of illness ultimately diagnosed as UTI initially been assigned other diagnosis, including acute otitis media, gastroenteritis, upper respiratory tract infection and bronchiolitis.<sup>7</sup>

Various studies also have shown that routine culture in febrile children with clinical evidence of other illness give high positive yields. Hence a high index of suspicion should be maintained by practicing pediatricians during the first 5 years and urine culture ordered whenever required. In view of above concern, this study was under taken.

### **METHODS**

The present study was carried out in SVS medical college and hospital at Mahabubnagar, Telangana, India over a period of one year from January 2012 to December 2012.

Five hundred febrile children between the age of 1 to 5 years who attended pediatric out-patient department formed the study group. Purposive sampling technique was used to select the cases for the purpose of study.

# Inclusion criteria

- Children aged 1-5 years.
- Fever of >37.40 C.
- Minor potential source of fever such as gastro enteritis, otitis media, URTI or nonspecific rash.

# Exclusion criteria

- Children on antibiotics.
- Children with immunosuppression.
- Definite source of fever on examination.
  Eg: penuneonia, varicella.

Detailed history was taken and clinical examination was done in all the cases to find out the cause of fever with special emphasis given to symptoms of UTI. Necessary investigations were carried out to find the cause of fever and all the data were recorded in a specially designed proforma for this study.

Perineum and genitalia were washed with soap and water. A freshly voided clean catch mid-stream urine sample was collected in an autoclaved glass bottles for urinalysis and urine culture.

Urinalysis was done within half an hour after obtaining urine sample and the same specimen was immediately transported to the department of microbiology for urine culture. Urine albumin was qualitatively estimated by sulphosalicylicacid method and recorded as nil, haze +, cloud ++, granular precipitate +++.

One ml. of the urine was centrifuged at 3000 rpm for one minute. Unstained specimen of the sediment was examined microscopically for pus cells and bacteria and result reported per high power field. Gram stain was also done on the centrifuged specimen and result reported per oil immersion field. Urine was cultured on blood agar and Mac Conkey agar by using a 0.001 ml calibrated wire loop and observed for 48 hours.

Colony count more than 105/ml of single organisms was considered diagnostic of urinary tract infection. Samples with multiple growth were considered as contaminated and those with a colony count <105/ml were not taken as positive for infection.

Sensitivity, specificity and positive and negative predictive values were calculated for pyuria and bacteriuria in relation to urine culture results as the validating standard.

Relationships between variables were analysed by using the chi- square test, t-test and z-test wherever necessary.

Renal function tests (blood urea and serum creatinine) were done in all the culture positive cases. Further, following investigations in culture proved UTI cases were carried out to know the involvement of upper urinary tract, vesicoureteral reflux, obstructive lesions and other congenital anomalies of the urinary tract.

- Plain X-ray abdomen/KUB region and abdominal ultrasound was done in all the culture positive cases if one of these investigations showed any underlying anomaly, they were further evaluated by IVP and MCU.
- Intravenous pyelogram (IVP) and micturating cystourethrogram (MCU) was done after the urine became sterile, usually between 3 to 4 weeks.

All the culture proved cases were treated with appropriate antibiotics and patients were put on prophylactic antibiotic therapy till radiological investigation were over. After complete diagnosis, each case was managed both medically and surgically whenever required and advised for follow-up. During follow up urine culture was done whenever recurrence of UTI was suspected.

#### **RESULTS**

Fourteen (70%) patients with UTI and 140 (29.1%) cases without UTI had proteinuria which was statistically significant.

Table 1: Distribution of cases as per urine analysis (N=500).

Grade	With UTI	Without UTI	Total
Nil	6	340	346
1+	8	100	108
2+	4	30	34
3+	2	10	12
Total	20	480	500

 $X^2=18.24$ , P < 0.05(S).

19 (95%) patients with UTI and 58 (12%) cases without UTI had pus cells >5 per HPF which was statistically significant.

Table 2: Distribution of cases as per microscopic urine analysis-pyuria (n = 500).

Number of pus cells /HPF	With UTI	Without UTI	Total
0-5	01	422	423
6-10	08	50	58
11-20	06	06	12
> 20	05	02	07
Total	20	480	500

 $\overline{X^2}$ =179.09, P <0.05(S)

Table 3: Distribution of cases as per microscopic urine analysis-bacteriuria (n = 500).

Bacteriuria	With UTI	Without UTI	Total
Present	12	05	17
Absent	08	475	483
Total	20	480	500

Table 4: Sensitivity, specificity and predictive values of microscopic urinalysis in identifying positive culture results.

Component/WBC/HPF	Sensitivity	Specificity	Positive predictive value (%)	Negative predictive value (%)
>5	85	88	25	99.8
>10	95	98.5	57.9	98.1
>20	25	99.6	71.4	97
Any bacteria	60	99	70.6	98.3
Combined pyuria and bacteriuria	60	99	70.6	98.3

In culture positive cases, 12 (60%) patients had bacteria in their urine where as in culture negative cases only 5 (1.05%) patients had bacteriuria which was statistically significant.

In diagnosing UTI, pyuria >10 WBC/HPF was more specific with higher positive predictive value than the conventional > 5 WBC/HPF. Bacteriuria occurring along with pyuria had a specificity of 98.3% in predicting infection. The most common organism isolated from patients with UTI was *E. coli* followed by *Klebsiella*. Only one patient with UTI had raised blood urea and serum creatinine levels. All the 20 cases with UTI had normal plain X-ray abdomen. In 80% of cases with UTI, ultrasonography was normal. Ultrasonographic features suggestive of acute pyelonephritis were found in 20% of cases with UTI.

Table 5: Organisms grown in culture positive cases (n=20).

Organisms isolated	Total number of cases	Percentage
E. coli	16	80
Klebsiella	03	15
Proteus	01	05
Total	20	100

Table 6: Renal function tests (n = 20).

Component	Normal	Raised	Percentage
Blood urea	19	01	05
Serum creatinine	19	01	05

Table 7: Abdominal ultrasound findings in UTI cases (n = 20).

Findings	Number of cases	Percentage
Normal	16	80
Abnormal	04	20
Total	20	100

All the 4 cases with abnormalities on ultrasound had acute pyelonephritis. In addition to this they had associated abnormalities as shown in the Table. Intravenous pyelography was done in 4 cases of which one patient had hydronephrosisandone had hydroureteronephrosis all of which were detected by USG. MCU was done in 4 cases, 2 of which showed VUR.

Table 8: Abdominal ultrasound findings in UTI cases (n=4).

Abnormal findings	Number of cases
Acute pyelonephritis with ascites	02
Acute pyelonephritis with bilateral hydronephrosis	01
Acute pyelonephritis with bilateral hydroureteronephrosis with bladder wall thickening	01

#### DISCUSSION

In the present study, 14 (70%) patients with UTI and 140 (29.1%) cases without UTI had proteinuria which was statistically significant (P<0.05). The presence of false positive results in 140 (29.1%) patients may be due to febrile proteinuria. These findings correlate well with the study by John M et al who found that 78% and 20% of cases had proteinuria in culture positive and culture negative group respectively.

In the present study, it was found that pyuria had a sensitivity of 85% and specificity of 88% however positive predictive value was low (25%). Goldsmith et al recorded a sensitivity of 82% and specificity of 81% while Hoberman et al obtained figures of 54% and 96% respectively. <sup>10,6</sup>

John M et al correlated pyuria of varying levels (5, 10, 20) with culture positive cases and recommended using >10 WBC/HPF to define pyuria in centrifuged urine. They noted that >5 WBC/HPF had sensitivity and specificity of 84% and 66.6% respectively, compared to 80% and 82% with >10 WBC/HPF. Using this definition of > 10 WBC/HPF, we found a sensitivity of 55% and specificity of 98.3% with higher positive predictive value (57.9%). Hoberman et al also noted high specificity of 99% with pyuria >10 WBC/HPF as compared to 96% with >5 WBC/HPF. When >20 WBC/HPF was considered, a sensitivity of 25% was found and specificity of 99.6%, while John Matthai et al recorded figures of 65% and 94% respectively.

In the present study, 12 (60%) patients with UTI and 5 (1.04%) patients without UTI had bacteria in their urine which was statistically significant. However, 8 (40%) cases with UTI would have been missed if presence of bacteria alone on microscopy was taken as a method of diagnosis for UTI. Thus, absence of bacteria on microscopy does not rule out the UTI.

Urine microscopy for bacteria significantly improves the reliability of urinalysis for detection of UTI, with a sensitivity of 60% and specificity of 99%. This is similar to observations made by John M et al who noted sensitivity of 78% and specificity of 96% using centrifuged urine sediments.

Bacteriuria occurring along with pyuria had a specificity of 98.3% in predicting infection which is similar to the observation made by Hoberman et al.<sup>9</sup>

Although microscopic urinalysis cannot substitute for a urine culture to document the presence of UTI, but it may be valuable in selecting patients for prompt initiation of antibiotic therapy while awaiting the results of urine culture.

Only one patient (5%) with UTI had raised blood urea and serum creatinine levels which is similar to study by Jaya et al in which 3 (9.37%) cases out of 32 patients with UTI had raised blood urea and serum creatinine.<sup>11</sup>

In the present study, plain X-ray abdomen was normal in all the 20 cases with UTI. This is similar to the study by Jaya et al who noted X-ray KUB was essentially normal in all except vertebral anomalies in 2 children. 11,12 Kenney et al studied 683 children and noted renal calculi in 5 children, all of which are detected on ultrasound and spinal abnormalities in 4 children. He concluded routine plain X-ray abdomen was not useful as initial investigation of UTI.

Out of 20 patients who underwent abdominal ultrasonography, 16 (80%) cases had normal study which is similar to study by Alonand S et al who reported normal renal ultrasound in 84.7% of patients with UTI. 13

Ultrosonogrpahic features suggestive of acute pyelonephritis was found in 4 (20%) cases and hydronephrosis in 2 of them. Though it is said that 30-50% of children and 40-50% of infants with UTI have VUR, none of our patients had VUR on ultrasonography. 30Various studies have shown that ultrasonography is not a reliable method for the detection of VUR. <sup>14,15</sup>

Intravenous pyelography was done in 4 cases. One patient had hydronephrosis and one had hydroureteronephrosis, all of which were detected by USG. This observation is similar to Kangarloo et al who considered IVP is not necessary where USG is normal.<sup>16</sup>

Micturating cytourethrogram was done in 4 cases which showed VUR in 2 (10%) cases. However, most of the studies have shown VUR in 30-50% of patients with UTI. <sup>14</sup> In the present study with very small number of patients studied, it cannot be concluded that VUR is not a predisposing condition for UTI. So, we still consider MCU as the initial radiological evaluation in children with UTI.

#### **CONCLUSION**

UTI should be considered as a potential cause of fever in children below six years of age. As the febrile children with UTI usually present with nonspecific signs and symptoms, urine culture should be considered as a part of diagnostic evaluation. High yield was obtained whenever UTI was suspected or in patients with fever with no apparent source and in female children with gastroenteritis. Hence urine culture should be done routinely in such patients.

Routine plain X-ray abdomen is not useful in evaluating the patients with UTI. It should be reserved whenever spinal abnormalities or calculi associated with UTI, are suspected. Even though ultrasound abnormalities were seen in few cases of UTI, routine ultrasound examination has to be done in all cases of proved UTI. Parents should be educated about the importance of UTI and its long term complications so that they bring the children, voluntarily for regular follow up.

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Institutional Ethics Committee

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