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Original Research Article

Prevalence of urinary tract infection among preschool febrile children attending the pediatric OPD

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ABSTRACT

Background: Urinary tract infection (UTI) is one of the most common bacterial illness among febrile infants and preschool children with a reported prevalence between 4.1% and 7.5%. The objective of this study was to know the prevalence of urinary tract infection in preschool febrile children.
Methods: Cross sectional study conducted in pediatric OPD of a Government teaching hospital with 500 febrile preschool children aged 3 to 6 years.
Results: Prevalence of UTI in febrile preschool children aged 3-6 years was 2.9% in males and 5.5% in females with overall prevalence of 4%. 15% had temperature > 39.3 ºC. 45% had dysuria, 35% had vomiting. 25% and 20% had increased frequency and burning micturition respectively. 70% patients with UTI and 30% cases without UTI had proteinuria. 95% patients had pus cells > 5 per HPF. 60% patients had bacteria in their urine where as in culture negative cases only 1.04% had bacteria. *E coli* was the common organism isolated (80%), followed by *Klebsiella*. Majority were resistant to Ampicillin (55%). 75% of microorganisms were sensitive to ceftriaxone. 70% were sensitive to gentamycin, norfloxacin and cephalexin. 5% UTI cases had RFT. KUB X-ray was normal in all the cases. 20% of cases showed features suggestive of acute pyelonephritis on Ultrasonography. 1 out of 4 Patients who underwent Intravenous pyelography showed hydronephrosis. 2 out of 4 cases showed VUR in MCU.
Conclusions: UTI is a potential cause of fever in children below 6 years of age. 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.

Keywords: Febrile children, Urine culture, Urinary tract Infection

INTRODUCTION

Urinary tract infection (UTI) is one of the most common bacterial illness among febrile infants and preschool children with a reported prevalence between 4.1% and 7.5%.[1-5] It accounts for 4 to 10% of febrile children admitted to the hospital and is the third most common infection in pediatric age group next to respiratory and gastrointestinal infections.[5]

Urinary complaints are rare below the age of 5 years. Symptoms are vague and often over looked. Most of these infections in the first 2 years of life are "occult" and most infection remains undiagnosed if tests are not routinely performed to detect them. The typical triad of abdominal pain, vomiting and fever with chills, rigors or suprapubic pain are the characteristic features of upper and lower UTI.[6] Presence of fever has long been considered significant because it has been accepted as a clinical marker of renal parenchymal involvement (pyelonephritis).[6]

Unexplained renal scarring has been cited as one of the established risk factor for subsequent hypertension.[7] Up to 50% of the long-term sequelae of UTI in infants and young children are preventable by urine testing.[8]

Although urine microscopic examination for leukocytes and bacteria is often used as a diagnostic test for UTI, the sensitivity, specificity and predictive values of these tests varies greatly according to the patient population studied, the definition of a positive culture result and the method of urinalysis.[2,9-11]

The difficulty of correctly diagnosing UTI in febrile children is evident from a study by Bauchner et al.[12] The episodes of illness ultimately diagnosed as UTI were initially assigned other diagnosis like acute otitis media, gastroenteritis, upper respiratory tract infection and bronchiolitis.[12] Many studies also have shown that routine culture in febrile children with clinical evidence of other illness give high positive yields.[1,13] Hence a high index of suspicion should be maintained by the practicing pediatricians when they come across febrile preschool children.

In view of the above concern, this study was under taken to determine the prevalence of urinary tract infection in preschool febrile children aged between 3-6 years who attended pediatric outpatient services. This study also assesses the validity of routine microscopic urinalysis as compared to urine culture in the diagnosis of UTI and the usefulness of routine urine culture in preschool febrile children aged 3 - 6 years.

METHODS

The study was carried out over a period of one year. Five hundred febrile children between the ages of 3 to 6 years who attended paediatric outpatient department of our Government Teaching Hospital were included in the study group. Purposive sampling technique was used to select the cases.

Children aged 3-6 years with fever of ≥37.4 ^{0}C with minor potential sources of fever such as gastro enteritis, otitis media, upper respiratory tract infections or nonspecific rash were included in the study. Immunosupressed children, children on antibiotics, those with definite source of fever on examination Eg: pneumonia, varicella were excluded from the study.

History was taken and clinical examination was done in all the cases to evaluate the causes of fever with special emphasis given to the symptoms of UTI. Necessary investigations were done to find out 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 sterile containers 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 routine and culture. Urine albumin was qualitatively estimated by sulphosalicylic acid method and recorded as nil, haze +, cloudy ++, granular precipitate +++.

1 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. Gram stain was also done on the centrifuged specimen.

Urine culture was done on blood agar and Mac Conkey agar by using a 0.001 ml calibrated wire loop and observed for 48 hours. A colony counts more than 105/ml of single organism was considered diagnostic of urinary tract infection. Samples with multiple growth were considered as contaminated and those with a colony count less than 105/ml were taken as negative for infection.

Pyuria was defined as > 5 WBCs per HPF and bacteriuria as the presence of any number of bacteria per HPF or per oil immersion field. Urinalysis was considered positive when both pyuria and bacteriuria were present. These two parameters of routine microscopic urinalysis were correlated with standard quantitative urine culture reports.

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 tests'' test and 'z' test wherever necessary.

In all the culture, positive cases, renal function tests (blood urea and serum creatinine) were done. In culture, proven UTI cases, to know the involvement of upper urinary tract, vesicoureteral reflux, obstructive lesions and other congenital anomalies of the urinary tract, following investigations were done:

- Plain X-ray abdomen/KUB region and abdominal ultrasound were 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) were done after the urine became sterile, usually between 3 to 4 weeks after treatment with antibiotics.

Culture proven UTI cases were started on appropriate antibiotics and patients were put on prophylactic antibiotic therapy till radiological investigations were over. After complete diagnosis, each case was managed medically and surgical interventions were done whenever required.

The patients were advised for the follow-up. During follow up, urine culture was done whenever recurrence of UTI was suspected.

RESULTS

Out of 500 febrile children, 20 of them had UTI giving an overall prevalence of 4%. Seventy-five (15%) cases had temperature more than 39.3ºC. Dysuria (45%) and vomiting (35%) were the most common symptoms.

Urinary tract infection was the cause of fever in 20 cases, with an overall estimated prevalence of 4%. There was a slight female preponderance, 2.9% in males and 5.5% in females, with a male to female ratio of 1:1.50 which was not statistically significant Z = 1.41 P > 0.05. High frequency of UTI (23%) was documented common among severely malnourished children. Out of 20 patients with UTI, 15 (75%) cases had a provisional diagnosis other than UTI.

Table 1: The correlation between number of culture positive UTI cases with their initial clinical presentation.

Symptoms	Culture positive cases (C)
Fever	20 (100)
Dysuria	9 (45)
Vomiting	8 (40)
Chills and rigors	5 (25)
Loss of appetite	5 (25)
Increased frequency	5 (25)
Irritability	5 (25)
Decreased urine output	5 (25)
Passing high coloured urine	4 (20)
Burning Micturition	4 (20)
Puffiness of face	4 (20)
Loose stool	4 (20)
Abdominal distension	4 (20)
Abdominal pain	4 (20)
Refusal of seeds	3 (15)
Dribbling of urine	3 (15)
Cough and cold	3 (15)
Convulsion	3 (15)
Foul smelling urine	1 (5)

8% of patients had temperature more than 39.3 ^{0}C. 25% of children had no other signs other than fever. Dysuria was seen in 45%, increased frequency in 5 (25%) and burning micturition in 20% of cases. Six (30%) cases had ill and toxic appearance on clinical examination. Fever was the only presenting feature in 25% of cases. Other nonspecific symptoms like decreased appetite (25%) irritability (30%) and refusal of feeds (15%) were also noted (Table 1). One or the other symptoms referable to the urinary tract were present only in 45% of patients with UTI, indicating the absence of symptoms in the remainder. Out of 40 patients with febrile convulsions, 3 (7.5%) cases had UTI. Of 219 patients provisionally diagnosed to have respiratory infection, only 3 (1.4%) cases had UTI. Of 80 cases with gastroenteritis, 6 (7.5%) patients had UTI. 5 (11%) cases who presented with fever with no apparent source had UTI representing a high yield. In the present study, 14 (70%) patients with UTI (statistically significant χ^2 = 18.24 P < 0.05) and 150 (30%) cases without UTI had proteinuria which was statistically significant (P < 0.05). Nineteen (95%) patients had pus cells > 5 per HPF (statistically significant χ^2 = 179.09 P < 0.05).

Table 2: Sensitivity, specificity, positive predictive value and negative predictive value of urine routine examination.

Component	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
> 5 WBC/HPI	85	88	25	99.8
> 10 WBC/HPF	95	98.5	57.9	98.1
> 20 WBC/HPF	25	99.6	71.4	97.0
Any bacteria	60	99	70.6	98.3
Combined pyuria and bacteriuria	60	99	70.6	98.3

Table 3: Drug sensitivity pattern of organisms grown in urine culture.

Drugs	E. Coli (n = 13)		Klebsiella (n = 6)		Proteus (n = 1)		Total (n = 20)		Overall percentage of sensitivity
	S	R	S	R	S	R	S	R	
Ampicillin	8	8	-	3	1	-	9	11	45
Cotrimoxazole	8	8	2	1	-	1	10	10	50
Gentamycin	11	5	2	1	1	-	14	6	70
Cephalexin	11	5	3	-	-	1	14	6	70
Norfloxacin	12	4	2	1	-	1	14	6	70
Ceftriaxone	12	4	2	1	1	-	15	5	75
Cephotaxime	10	6	3	-	1	-	14	6	70
Ciprofloxacin	10	6	2	1	1	-	13	7	65

Twelve (60%) patients had bacteria in their urine whereas in culture negative cases only 5 (1.04%) patients had bacteriuria which was statistically significant (P < 0.05). Bacteriuria occurring along with pyuria had a specificity of 98.3% in predicting infection. In the present study, 58 (12.08%) cases without UTI also had pus cells >5/HPF which was statistically significant (<0.05), and would have been considered as infected if only pyuria was taken as a diagnostic method for UTI. Pyuria defined as >5 WBC per HPF had a sensitivity of 85% and specificity of 88%. However positive predictive value was low (25%) (Table 2).

The most common organism isolated was *E. coli* (80%) followed by klebsiella. Majority of the organisms were resistant to Ampicillin (55%). 75% of microorganisms were sensitive to ceftriaxone. 70% were sensitive to gentamycin, norfloxacin and cephalexin (Table 3). Only one patient (5%) with UTI had raised blood urea and serum creatinine levels. All the 20 cases with UTI had normal plain X-ray abdomen. Ultrasonography revealed features suggestive of acute pyelonephritis in 20% of cases along with associated abnormalities. Intravenous pyelography was done in 4 cases of which one patient had hydronephrosis which was detected by USG. MCU was done in 4 cases, 2 of which showed VUR.

DISCUSSION

Urinary tract infection is a common problem in the paediatric age group and has significant risk for long term sequelae. The clinical signs and symptoms of UTI are nonspecific and vague in the first 6 years of age. It may be present in febrile children with other illnesses, without clinical evidence of UTI. Such infection, if untreated can lead to subsequent renal scarring and is an established risk factor for end stage renal disease. Recent studies from abroad as well as from India have shown that, the routine urine culture in such patients give high positive yields, particularly in infants and young children.[14,15,19,24,25]

Out of the 500 febrile children who attended pediatric OPD, 20 patients had UTI giving an overall prevalence of 4%. This prevalence is comparable to many studies conducted all over the world.[14,15,19,24,25]

Seventy-five (15%) cases had temperature more than 39.3C. Next to fever, dysuria (45%) and vomiting (35%) were the most common symptoms. Clinically the provisional diagnosis was made mainly based on the presenting symptoms and signs. Among the 500 cases studied, the most common cause of fever was respiratory infection followed by gastroenteritis.

Urinary tract infection was the cause of fever in 20 cases, with an overall estimated prevalence of 4%. There was a slight female preponderance, 2.9% in males and 5.5% in females, with a male to female ratio of 1:1.50. Which was not statistically significant Z = 1.41 P > 0.05 but statistically significant increase in UTI up to 4.3% in febrile female children has been reported. By Dharnidarka et al.[16] High prevalence (5.5%) of UTI in the Grade V socioeconomic class may be due to poor perineal hygiene, poor toilet training and associated malnutrition which is prevalent among this population. High frequency of UTI (23%) is common among severely malnourished children. Out of 20 patients with UTI, 15 (75%) cases had a provisional diagnosis other than UTI. This suggests that 15 children with UTI would have been missed if urine culture was not done as a routine diagnostic method of evaluation.

There were no consistent symptoms common to all patients with UTI other than fever. In the present study, there was no significant difference among the three groups of temperature. However, high yield (8%) was obtained in patients with temperature more than 39.30C. Significant prevalence of UTI in febrile children with temperature > 39 ^{0}C is high.[1] In young children with UTI, no other signs or symptoms accurately predict the presence of UTI except fever. In fact, 25% of children had no other signs other than fever indicating the importance of recognition of UTI in such patients. Dysuria and vomiting were the predominant symptoms. Other nonspecific symptoms like decreased appetite, irritability and refusal of feeds were also noted. Similar to present study, nonspecific symptoms were also seen in a study by Hoberman et al.[9] One or the other symptoms referable to the urinary tract were present only about half of the patients with UTI, indicating the absence of symptoms in the remainder. Out of 40 patients with febrile convulsion, 3 (7.5%) cases had UTI. In a study of 100 children with febrile seizure had shown no UTI in any of the patients.[26] In a retrospective study involving 228 children with febrile convulsion, 19 (8.33%) cases were found to have UTI and recommended practice guidelines in such patients.[27]

Of 219 patients provisionally diagnosed to have respiratory infection, only 3 (1.4%) cases had UTI. This low yield is similar to studies by Bauchner et al and Dharnidarka of 1.27% and 1.25% respectively.[12,15]

Of 80 cases with gastroenteritis, 6(7.5%) patients had UTI. Female patients with gastroenteritis are particularly at increased risk of UTI (10.7%), which is statistically significant (P < 0.05). This observation is in accordance with studies by Dharnidarka et al and Srivaths et al who reported high prevalence of 25% and 40% respectively and recommended routine urine culture in such patients. Heavy periurethral colonization often associated with perineal contamination following gastroenteritis explains the high degree of prevalence in these patients.[15,25]

5 (11%) cases who presented with fever with no apparent source had UTI representing a high yield. In a retrospective study of 503 children with fever of uncertain cause, Buys et al reported significant bacteriuria in 44 (8.66%) children.[20] Similarly Roberts et

al and Shaw et al had reported high prevalence of UTI in children with no definite source of fever and recommended urine culture in such patients.[19,26]

In the present study, one patient each with provisional diagnosis of neuroinfection and enteric fever had UTI. Both Bauchner et al and Dharnidarka et al had shown no UTI in any of the patient with neuroinfection.[12,15] In another study involving 28 children with enteric fever, Dharnidharka et al had found 2 cases with positive urine culture.[16] In this study, no patients with malaria and viral hepatitis had UTI, which is similar to the observation make by Dharnidarka et al.[24] Hypertension was noted in 1 (5%) case with UTI which is similar to the observation made by Jaya et al.[28] Out of 29 patients with provisional diagnosis of UTI, 6 (20.7%) cases had culture proven UTI which is similar to a study by Matthai J et al who found it in 30% of patients with suspected UTI.[10] Hence routine urine culture in these patients is not useful. Fourteen (70%) patients had proteinuria. In the present study, 14 (70%) patients with UTI (statistically significant $\chi^2 = 18.24$ $P < 0.05$) and 150 (30%) 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 Matthai et al who found that 78% and 20% of cases had proteinuria in culture positive and culture negative groups respectively.[10]

Nineteen (95%) patients had pus cells > 5 per HPF (statistically significant $\chi^2 = 179.09$ $P < 0.05$) (ref table) $P < 0.05$ (S). An attempt was made to know the value of routine microscopic analysis in the diagnosis of UTI by examining the urine for pus cells and bacteria using centrifuged urine.

In diagnosing UTI, pyuria> 10 WBC/HPF was more specific with higher positive than the conventional > 5 WBC/HPF. Twelve (60%) patients had bacteria in their urine where as in culture negative cases only 5 (1.04%) patients had bacteriuria which was statistically significant($P<0.05$).Bacteriuria occurring along with pyuria had a specificity of 98.3% in predicting infection.In the present study, 58 (12.08%) cases without UTI also had pus cells >5/HPF which was statistically significant (<0.05), and would have been considered as infected if only pyuria was taken as a diagnostic method for UTI. Pyuria defined as >5 WBC per HPF had a sensitivity of 85% and specificity of 88%. However positive predictive value was low (25%). Hoberman et al obtained figures of 54% sensitivity and 96% specificity.[9]

Matthai J et al correlated pyuria of varying levels with culture positive cases and recommended using > 10 WBC/HPF to define pyuria in centrifuged urine.[10] 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.[9] When >20 WBC/HPF was considered, we found a sensitivity of 25% and specificity of 99.6%, while John Matthai et al recorded figures of 65% and 94% respectively.[10]

Twelve (60%) patients with UTI and 5 (1.04%) patients without UTI had bacteria in their urine which was statistically significant. However, 7 (35%) 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.

The most common organism isolated was *E. coli* (80%) followed by klebsiella. Majority of the organisms were resistant to Ampicillin (55%). 75% of microorganisms were sensitive to ceftriaxone. 70% were sensitive to gentamycin, norfloxacin and cephalexin.

Urine microscopy for bacteria significantly increases the reliability of urinalysis for detection of UTI, with a sensitivity of 60% and specificity of 99%. This is similar to observations made by Matthai J et al who noted sensitivity of 78% and specificity of 96% using centrifuged urine sediments.[10]

Bacteriuria occurring along with pyruia had a specificity of 98.0% in predicting infection which is similar to the observation made by Hoberman et al.[9] Although microscopic urine analysis may not replace urine culture to prove UTI, but it may be valuable in selecting patients for prompt initiation of antibiotic therapy while awaiting the results of urine culture.

The most common organism isolated from patients with UTI was *E. coli*, (80%) followed by Klebsiella (15%). This is in accordance with most of the previous studies.[12,14,15,17-19] Proteus was isolated in one patient.

Majority of the organisms (55%) were resistant to ampicillin with a slightly better sensitivity to cotrimoxazole (50%). 75% of microorganisms were sensitive to ceftriaxone. This suggests a need to do repeat urine culture to confirm bacteriological cure as most of the organisms are resistant to commonly used antibiotics. Dharnidarka et al also noted that all microorganisms were uniformly resistant to ampicillin with a variable sensitivity to gentamycin and were sensitive to ciprofloxacin.[16] However, they have not studied the sensitivity pattern to co-trimoxazole.

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.[28]

All the 20 cases with UTI had normal plain x-ray abdomen. Ultrasonography revealed features suggestive of acute pyelonephritis in 20% of cases along with associated abnormalities. Intravenous pyelography was done in 4 cases of which one patient had hydronephrosis and one had hydroureteronephrosis all of which were detected by USG. MCU was done in 4 cases, 2 of which showed VUR.

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. 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.[28,30] He concluded routine plain x-ray abdomen alone may not be sufficient as an initial investigation of UTI.

Out of 20 patients who underwent abdominal ultrasonography, 16 (80%) cases had normal study which is similar to study by Alon and Ganapally S who reported normal renal ultrasound in 84.7% of patients with UTI.[31] Ultrosonogrpahic features suggestive of acute pyelonephritis were 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.[30] Various studies have shown that ultrasonography is not a reliable method for the detection of VUR.[22,23]

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 in normal.[32]

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.[22,28,33] In the present study with very small number of patients studied, we cannot conclude that VUR is not a predisposing condition for UTI. So, we still consider MCU as the initial radiological evaluation in children with UTI.

Fifteen patients were followed for variable periods of 6 months to one year. Remaining five children were lost to follow-up. During follow up 2 patients had recurrent UTI. One patient with recurrent UTI had growth of same organism (*E. coli*) on urine culture. Her abdominal ultrasound was suggestive of acute pyelonephritis with normal MCU and IVP studies. The other patient had bilateral hydroureteronephrosis with gross hydronephrosis of left kidney. This patient had recurrent UTI with Klebsiella (earlier *E. coli*) and was sensitive to ceftriaxone. This patient was advised DMSA and DTPA scan and was lost to follow up. Two patients with phimosis who had undergone circumcision were doing well on follow up. One child with hydronephrosis was asymptomatic on follow up.

CONCLUSION

UTI is a potential cause of fever in children below 6 years of age. 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 their children for regular follow up.

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