

## Original Article

# Prevalence of Urinary Tract Infection in Febrile children

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### Abstract

**Background :** Urinary tract infection is one of the most common causes of fever in children which can result in significant morbidity and mortality if left unrecognised. **Context:** Fever is often the only symptom in children with urinary tract infections. It is essential to identify urinary tract infections in febrile children and begin prompt treatment to reduce the potential for lifelong morbidity. Progressive renal damage from unrecognised pyelonephritis in children may lead to hypertension and chronic renal failure in later life increasing the mortality and morbidity. **Aims:** 1. To determine the prevalence of urinary tract infection in febrile children, less than 5 years age. 2. To assess the validity of routine microscopic urine analysis Vs urine culture in the diagnosis of urinary tract infection. 3. To assess the usefulness of routine urine culture in febrile children. **Material and Methods:** The present study was conducted in Department of paediatrics in a medical college hospital over a period of 12 months. Febrile children of less than 5 years of age with fever more than 3 days and temperature  $>38.5^{\circ}\text{C}$  attending the outpatient department or admitted in the hospital were included in the study. Cases were selected randomly. Children with known anatomic abnormalities of the genitourinary tract and Children with unequivocal sources of fever such as Meningitis / Pneumonia were excluded from the study. **Settings and Design:** In all cases, data related to age, sex, nutritional status, socioeconomic status and predisposing risk factors like urethral instrumentation, bowel habits etc. were noted. A complete history related to the onset, duration of fever and associated symptoms such as nausea, vomiting, diarrhoea, dysuria, urge incontinence etc. were noted. **Results:** 100 cases were studied over a period of 1 year. Out of the hundred cases, only 4 cases showed positive urine culture with suprapubic aspiration with overall prevalence of 4%. The prevalence of urinary tract infection in febrile children less than 2 years of age was 6%. In the present study, urinary tract infection was more common in females. **Conclusions:** Clinicians should be alert to the possibility that febrile children may have urinary tract infection and should consider obtaining a urine culture specimen as part of their diagnostic evaluation. The presence of another potential source of fever such as upper respiratory tract infection or otitis media is not reliable in excluding urinary tract infection. Neither the presence of clinical signs and symptoms nor the presence of leucocytes on microscopic examination of urine was an accurate predictor of positive urine culture results. Parents should be educated about the importance of urinary tract infection, their long lasting damaging effects on urinary system, so that they bring their children voluntarily for further examination.

**Keywords :** Urinary tract infection, Urine microscopy and culture, Suprapubic aspiration

**Key Messages :** Urinary tract infection should be considered in all children with fever.

### Introduction

Fever is one of the most common reasons for children under the age of 3 years to visit a hospital. Unlike other serious bacterial illness (in infants), little attention has been focused to the identification of urinary tract infections in febrile children in the emergency department, despite recent information that suggests a high prevalence of urinary tract infections. Quite often, child receives antibiotics empirically, without adequate evaluation for urinary tract infection. Fever, however, is often the only symptom in children with urinary tract infections.

Recent studies using renal parenchyma-avid nuclear scans

to determine the presence of urinary tract infection revealed that more than 75% of children under 5 years of age with febrile urinary tract infections have pyelonephritis.<sup>1,2,3</sup>

Pyelonephritis leads to renal scarring in 27% to 64% of children with urinary tract infections, even in the absence of underlying urinary tract abnormalities.<sup>4</sup> Most urinary tract infections that lead to scarring or diminished kidney growth occur in children younger than age 4 years especially infants in the first year of life<sup>1,5</sup>, those with gross reflux or obstruction and those who have a delay in therapy for urinary tract infection.

It is essential to identify urinary tract infections in febrile children and begin prompt treatment to reduce the potential for lifelong morbidity. Progressive renal damage from

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unrecognised pyelonephritis in children may lead to hypertension<sup>6</sup> and chronic renal failure in later life.

The present study is undertaken to estimate the prevalence of UTI in febrile children less than 5 years age, to assess the validity of routine microscopic urine analysis vs urine culture in the diagnosis of UTI and also to assess the usefulness of routine urine culture in febrile children.

### Material and Methods

The present study was conducted in Department of paediatrics in a medical college hospital. Febrile children of less than 5 years of age attending the outpatient department or admitted in the hospital over a period of 12 months were included in the study. Cases were selected randomly.

#### Inclusion Criteria

- 1) Febrile children less than 5 years.
- 2) Fever  $>38.5^{\circ}\text{C}$
- 3) Duration of fever more than 3 days
- 4) Febrile children with equivocal source of fever satisfying the above criteria were included in the study eg. URTI, Otitis media.

#### Exclusion Criteria

- 1) Children with known anatomic abnormality of the genitourinary tract were excluded from the study.
- 2) Children with unequivocal sources of fever such as Meningitis / Pneumonia were excluded from the study.

#### Methods of study

In all cases, data related to age, sex, nutritional status, socioeconomic status and predisposing risk factors like urethral instrumentation, bowel habits etc were noted. A complete history related to the onset, duration of fever and associated symptoms such as nausea, vomiting, diarrhoea, dysuria, urgency etc. was obtained.

All the 100 febrile children were subsequently classified into two categories:

- 1) No definite source for fever
- 2) Possible source for fever. Ex: Upper respiratory tract infection, Otitis media etc.

A thorough physical examination with relevant investigations was carried out in all patients. Routine blood counts, urine analysis and urine cultures were performed in all patients and the data collected was recorded in a proforma enclosed for subsequent analysis.

Collection of Urine Sample & analysis:

From all the 100 cases, the two samples of urine, i.e. mid-stream sample and suprapubic aspirate were collected

within 1 to 6 hrs of each other, on the same day. The collection of "Clean Catch" mid-stream sample could be ensured only in toilet trained children. Suprapubic aspiration of urine was done under aseptic precautions. The fresh urine specimens obtained from both the techniques were subjected to urinalysis for detection of pyuria, hematuria and proteinuria. The sterile urine was inoculated onto blood and MacConkey agar plates with a 0.01 ml calibrated loop. All plates were incubated at  $35^{\circ}\text{C}$ - $37^{\circ}\text{C}$  for 24 hours to obtain an accurate colony count, and an additional 24 hours was required for organism identification and antibiotic susceptibility testing.

The following definitions were employed in the present study:

- ◆ Significant pyuria: Presence of more than 5 pus cells/high power field in a centrifuged urine sample.
- ◆ Hematuria: Presence of more than 5 red cells/high power field in a centrifuged urine sample.
- ◆ Positive Urine Culture: A positive urine culture was defined as growth of  $> 10^5$  colonies of a single urinary tract pathogen/ml of specimen in a mid-stream sample of urine and growth of any number of organisms from suprapubic urine aspirate.
- ◆ Samples showing insignificant growth, mixed growth of two or more pathogens or growth of non-pathogens such as *Lactobacillus* sp., *Corynae* bacterium sp., Coagulase staphylococci were considered negative.
- ◆ Urinary Tract Infection: Urinary Tract Infection was defined as the growth of any number of organisms from the suprapubic urine aspirate.
- ◆ In the present study, sensitivity, specificity and predictive values of pyuria in mid-stream sample and suprapubic aspirate, were calculated with positive suprapubic urine culture as the standard.

### Results

Study population: 100 cases

The study included 100 patients with fever, among which 42 were males and 58 were females and majority of them i.e., 50% were below 2 years of age. In the present study, 32 patients (32%) were below the expected weight for their age. Of these, 28 patients (28%) had grade I to grade II malnutrition. Majority of the patients belonged to Lower Middle and Upper Lower (79%) socioeconomic status. No obvious source for fever was found in 57% of patients. In the remaining 43 patients, upper respiratory tract infection (48.8%) was the most common associated illness followed by diarrhoea (30.2%).

**Table XI : Association of Variables with urinary tract infection:**

Variables		Total No. of cases	Cases found to have UTI	
			No. of cases	%
Age (in months)	0 – 12	28	2	7.1
	13 – 24	22	1	4.5
	25 – 36	25	1	4
	37 – 48	13	-	-
	49 - 60	12	-	-
Sex	Males	42	1	2.3
	Females	58	3	5.1
Associated illness	URTI	21	-	-
	Diarrhoea	13	1	7.6
	Otitis media	3	-	-
	Others	6	-	-
Nutritional status	With malnutrition	32	3	9.3
	Without malnutrition	68	1	1.47
Socio-economic status	Upper	-	-	-
	Upper middle	12	-	-
	Lower middle	43	2	4.6
	Upper lower	36	2	5.5
	Lower	9	-	-

### Urinalysis & culture

The centrifuged urine samples obtained by mid-stream collection and suprapubic aspiration were examined under the microscope for hematuria, proteinuria and leukocyturia. None of the samples showed significant hematuria, i.e. more than 5 red cells/high power field. Mild proteinuria, ranging from traces to 1 + was seen in 16 mid-stream samples of urine and 11 suprapubic samples. In the present study, 11 cases showed significant pyuria in mid-stream sample of urine while it was found in only 2 samples of urine obtained by supra pubic aspiration. The culture of midstream sample of urine showed growth in 36 samples, out of which pure growth was seen in 7 samples. Rest of the samples showed either mixed growth/ insignificant growth/ growth of contaminant. In the present study, culture was positive in 4 cases of suprapubic aspirate of urine, all of which showed pure growth.

In the present study, the over-all prevalence of urinary tract infection was 4% and the maximum prevalence was found in children less than 1 year with a prevalence of 7.1%. Females outnumbered males, with a prevalence of 5.1%. The prevalence in males was 2.3%. Cases with

associated malnutrition had a greater prevalence of urinary tract infection (9.3%). The male to female ratio in children less than one year of age was 1:1 in the present study. The almost equal prevalence rates observed in infants in this study, could be due to exclusion of children with congenital genitourinary abnormalities. The two cases of urinary tract infection reported in above one year age group were females. In the present study, all the 4 cases with urinary tract infection belong to lower middle and upper lower socio-economic status. Out of the 100 patients in this study, 32% of patients were below the expected weight for their age, among which 28% had grade II to grade III malnutrition. The prevalence of urinary tract infection in malnourished febrile children was 9.3%, i.e., three out of four confirmed cases of urinary tract infection were malnourished. The prevalence of urinary tract infection in children without malnutrition was 1.47%. In the present study, significant pyuria in centrifuged mid-stream sample of urine had a sensitivity of 75%, specificity of 92.7%, positive predictive value of 30% and negative predictive value of 98.8%. The results of pyuria in suprapubic sample of urine had a sensitivity of 50%, specificity of 100%,

positive predictive value of 100% and negative predictive value of 97.95%.

Gram negative enteric bacilli were the predominant organisms isolated in the present study. Out of the 4 cases with urinary tract infection, *Escherichia coli* was isolated from 3 cases and *Klebsiella* from the remaining 1 case. Among the organisms isolated most were sensitive to Norfloxacin and Gatifloxacin and were resistant to Ampicillin and Co-trimoxazole.

### Discussion

Urinary tract infection is a common, potentially serious and often occult bacterial infection of childhood. Urinary tract infection causes acute morbidity as well as long term sequelae including hypertension and impaired renal function. Accurate diagnosis of urinary tract infection is important both to facilitate appropriate management of the acute illness, and to ensure appropriate evaluation and follow-up. Equally important is accurately ruling out a urinary tract infection to avoid unnecessary, costly and potentially harmful treatment and evaluation.

The present study was conducted in the Department of Pediatrics, of a medical college hospital, to determine the prevalence of urinary tract infection in febrile children and also to assess the validity of routine microscopic urine analysis Vs urine culture in the diagnosis of urinary tract infection.

Out of 100 patients in this study, 42 were males and 58 were females and majority of them, i.e., 50% were less than 2 years of age. Out of the hundred cases, only 4 cases showed positive urine culture with suprapubic aspiration with overall prevalence of 4%. According to Bauchner H et al.<sup>7</sup>, the overall prevalence of urinary tract infection in febrile children younger than 5 years of age was 1.7%.

In the present study, the prevalence of urinary tract infection in febrile children less than 2 years of age was 6%. Roberts K.B. et al.<sup>8</sup>, reported overall prevalence of urinary tract infection as 4.1% in febrile children less than two years of age. Shaw K.N. et al.,<sup>9</sup> from U.S.A. reported 3.3% prevalence of urinary tract infection in febrile young children. The present study contrasts with the prevalence rates reported by Srivaths et al.,<sup>10</sup> who reported the prevalence rate of urinary tract infection as 2.48% which was the lowest reported from a developing country.

The prevalence of urinary tract infection in febrile children between 3 to 5 years of age in the present study was 2%

which was in near correlation with prevalence rates reported by North A.F. et al.<sup>11</sup> In contrast M.H. Fallahzadeh, et al.,<sup>12</sup> reported the prevalence of urinary tract infection in pre-school children as 4.4%.

In the present study, urinary tract infection was more common in females. Out of hundred patients in the study, four cases showed growth on culture of suprapubic sample of urine, among which three were females and one was male, giving an overall prevalence of 5.1% in females and 2.3% in males.

The male to female ratio in children less than one year of age was 1:1 in the present study. The almost equal prevalence rates observed in infants in this study, could be due to exclusion of children with congenital genitourinary abnormalities. The two cases of urinary tract infection reported in above one year age group were females. The higher prevalence of urinary tract infection in females in this study is in correlation with other studies. Hoberman et al.,<sup>13</sup> reported a prevalence of urinary tract infection in females as 8.8% and in males as 2.5% in febrile infants. In the present study, all the 4 cases with urinary tract infection belong to lower middle and upper lower socio-economic status.

Out of the 100 patients in this study, 32% of patients were below the expected weight for their age, among which 28% had grade II to grade III malnutrition. The prevalence of urinary tract infection in malnourished febrile children was 9.3%, i.e., three out of four confirmed cases of urinary tract infection were malnourished. The prevalence of urinary tract infection in children without malnutrition was 1.47%.

Thakar et al.,<sup>14</sup> reported significant association between urinary tract infection and the degree of malnutrition. According to Svanborg et al.,<sup>15</sup> lower secretory levels of IgA at the mucosal surface or a subclinical vitamin-‘A’ deficiency present in malnourished children may have predisposed them to urinary tract infection.

In the present study, 57 febrile patients were without a focus of infection and 43 were with focus of infection. The prevalence of urinary tract infection was 5.26% and 2.3% respectively in these two groups. Shaw K.N., Gorelick M.H. et al.,<sup>9</sup> reported a prevalence of urinary tract infection in those who did not have a potential source for fever as 5.9% and prevalence for those with an equivocal source for fever as 2.7 to 3.5%. The present study is in correlation with this but contrasts with the

reports of Hoberman et al.,<sup>11</sup> who reported an almost equal prevalence in both the groups, i.e., 5.9% and 5.1% respectively.

In the present study, significant pyuria in centrifuged mid-stream sample of urine had a sensitivity of 75%, specificity of 92.7%, positive predictive value of 30% and negative predictive value of 98.8%. The results of pyuria in suprapubic sample of urine had a sensitivity of 50%, specificity of 100%, positive predictive value of 100% and negative predictive value of 97.95%.

Although the sensitivity of pyuria for detection of urinary tract infection was high in mid-stream sample of urine, the positive predictive value was low indicating a high frequency of false positive results and increased chances of misdiagnosis. In contrast, the results of pyuria as an indicator of urinary tract infection from suprapubic aspirate showed low sensitivity but high positive predictive value with no false positivity. The false negative rate was 50% in this study, indicating that if only pyuria was taken as an indicator, there was 50% chance of missing urinary tract infection.

According to Hoberman et al.,<sup>13</sup> more than 5 pus cells/high power field had a sensitivity of 54%, specificity of 96%, positive predictive value of 45% and negative predictive value of 97%. Significant pyuria had a sensitivity and specificity of 30-50% according to Sanjeev Gulati and Vijay Kher<sup>16</sup>. Hence pyuria alone is not satisfactory for making a diagnosis but it constitutes a strong supportive evidence of urinary tract infection.

In the present study 36% of urine cultures, collected by mid-stream method yielded growth among which 80.5% were either contaminants, insignificant growth or mixed growth of uncommon organisms. In contrast, only 4% of urine cultures collected by suprapubic aspiration technique revealed growth with no contaminants.

Gram negative enteric bacilli were isolated in all 4 cases with urinary tract infection, with *Escherichia coli* constituting 75% and *Klebsiella* constituting the remaining 25%.

Bryan C.S. et al.,<sup>17</sup> reported *Escherichia coli* as the most common urinary pathogen accounting for 85% of community acquired urinary tract infection. According to Arvind Bagga et al.,<sup>18</sup> about 90% of first symptomatic urinary tract infection and 70% recurrent infections were due to *Escherichia coli*. Hoberman et al.,<sup>11</sup> reported

*Escherichia coli* as the most common bacterium isolated in this study. Sanjeev Gulati and Vijay Kher<sup>16</sup> reported Gram negative bacteria as the most common etiologic agents among which *Escherichia coli* was the most common. According to Srivaths P.R. et al.,<sup>13</sup> *Escherichia coli* was the most common bacteriological agent isolated from urinary tract infection cases.

In the present study it was evident that urine culture of sample obtained by Suprapubic aspiration had less chances of contamination and was more accurate than the results of urine culture of mid-stream samples.

Neither the presence of pertinent clinical signs/symptoms nor the presence of leukocytes on microscopic examination of urine, both commonly used as potential indicators of urinary tract infection, was an accurate predictor of positive urine culture. The presence of pyuria defined as  $\geq 5$  leukocytes/high power field in a centrifuged sample was a relatively insensitive indicator of urinary tract infection. Had the urine cultures been omitted, nearly half of the urinary tract infections would not have been diagnosed.

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