

Prevalence of Urinary Tract Infection in Infants with Unexplained Acute Fever: A cross sectional study

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Received: 11-09-2021 / Revised: 16-10-2021 / Accepted: 15-11-2021

Abstract

Background: Urinary tract infection (UTI) is one of the most common bacterial infections in infancy, with a high risk of recurrence, and maybe an indicator of underlying urinary tract abnormality. It is often misdiagnosed due to irregular and unrelated symptomatology in the absence of directed screening. Knowledge of baseline risk of urinary tract infection can help clinicians make informed diagnostic and therapeutic decisions. **Objectives:** The objectives of the study were to know the prevalence of UTI in infants with unexplained acute fever and to know other features of UTI besides fever. **Methods:** This was an observational, descriptive, cross sectional study. The study was conducted in private tertiary care hospital in Kolkata involving 110 infants attending the out-patient department of Paediatrics, KPC Medical College and Hospital from January 2020, to June 2020. Urine specimens were collected using midstream clean-catch urine (CCU) method and tested by urinalysis and culture. Template was generated in MS excel sheet and analysis was done on SPSS software. **Results:** Urine sample was successfully obtained from 110 infants, of which 66 (60%) were males, 44 (40%) were females. UTI was maximum present in age group 61-365 days (12.73%). In gender maximum UTI was present in males (11.82%). Majority of cases present with the temperature 38.30C to 38.90C (37.27%). Fever (100%) and Failure to thrive (70.91%) were the commonest presentation of cases selected for the study. Gastroenteritis was the most common illness observed in 33 (30%) infants. **Conclusions:** Prevalence rates of UTI varied by age, gender, race, and circumcision status. Prevalence estimates can help clinicians make informed decisions regarding diagnostic testing in children presenting with signs and symptoms of urinary tract infection.

Keywords: Prevalence, fever, infant, urinary tract infections

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Introduction

Urinary tract infection (UTI) is the most common type of severe bacterial infection (SBI) in infants presenting with fever without a source (FWS). Several management protocols have been developed to assess children with FWS and identify those with a UTI[1-3]. The overall prevalence of UTI in infants with FWS is around 5%[4-9]. However, this prevalence is not homogeneous and can vary with age, sex, race, body temperature or circumcision status. For example, a UTI is found in a large proportion of febrile girls aged less than 24 months and febrile boys aged less than 12 months. Infants that receive a diagnosis of UTI require special care. Most febrile infants with this diagnosis exhibit renal parenchymal involvement. This can lead to long-term health problems, including hypertension and diminished renal function. The risk of renal impairment is greater in infants, and the diagnosis may be challenging to clinicians. The signs and symptoms of a UTI are often nonspecific, and the definitive diagnosis requires testing of a non contaminated urine sample collected by catheterization or suprapubic aspiration[10,11]. An accurate diagnosis is

important to identify, evaluate and treat children at risk of UTI and renal scarring and to avoid over diagnosis and overtreatment in children who are not at risk[11,12]. Nevertheless, there are still differences between clinical guidelines on how to identify infants with FWS in whom UTI has to be ruled out in the paediatric emergency department (PED)[1,2,13-18]. Most clinical guidelines recommend performing urinalysis in infants with a rectal temperature of 39°C or higher

UTI may also be present when the source of fever, such as upper respiratory infection (URI) or gastroenteritis, is identified, additionally contributing to missed diagnoses in many cases[19,20]. Early diagnosis is crucial in infants to minimize pyelonephritis and prevent renal scarring, in addition to identifying risk factors such as vesicoureteric reflux (VUR) and congenital abnormalities to prevent recurrence[21]. If untreated, UTI will lead to hypertension, uremia, renal scars, and end-stage renal failure[19,22,23].

Hence, the present study was conducted to assess the prevalence of UTI in infants with unexplained acute fever and to know other features of UTI besides fever among infants of unexplained acute fever in private tertiary care hospital in Kolkata.

Method and Materials

A cross sectional study was conducted in the out-patient department of Paediatrics Dept of KPC Medical College and Hospital for six months' duration from January 2020, to June 2020. The infants attending Paediatric OPD were selected by suitable sampling techniques within the study period who fulfilled the inclusion criteria

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and whose parents gave consent for the study were taken as the sample size.

Inclusion Criteria

Any febrile infant with an axillary temperature of $>100^{\circ}\text{F}$ or 37.8°C irrespective of provisional diagnosis was included in the study.

Exclusion Criteria

Febrile infants who had received antibiotics before attending OPD and those requiring admission, intensive care therapy and/or immediate antibiotics in cases of pyogenic meningitis, severe pneumonia, shock, status epilepticus, etc., were excluded from the study.

After taking institutional ethical clearance the study was conducted with taking informed consent from the parents of the study participants. A detailed history was obtained with special emphasis on urinary symptoms such as increased frequency, crying while voiding, and pyuria. Complete general and systemic examinations were also done with attention to urological findings such as phimosis, vulval synechia, suprapubic mass, renal mass, dysmorphic features, and other associated congenital anomalies. A provisional diagnosis was made mainly based on presenting signs and symptoms, intake output charts, wound site infections and other complications.

Mothers were trained through verbal instructions to collect urine using the CCU method in a sterile bottle. They were asked to clean the perineum with clean water, breastfeed the baby frequently, and apply mild pressure over the suprapubic area every 15 min.

In routine urine analysis, urine microscopy was done using uncentrifuged urine. An observation of more than 5 pus cells/high power field (HPF) was the threshold for pyuria, a positive diagnosis of UTI[24]. For urine culture, the urine specimen was inoculated for culture in MacConkey culture media using the standard loop technique. The average time from urine collection to inoculation was 30 min. UTI was diagnosed only when a single uropathogen with $\text{CFU} \geq 105/\text{mL}$ was present, designated as significant growth. Growth of uncommon organisms, such as staphylococcus, pseudomonas, and Citrobacter, and growth of multiple organisms were considered a sign of urine sample contamination. The culture-positive cases were tested for sensitivity by inoculating in nutrient agar and using combined Gram-negative microbial sensitivity disks for UTI.

In culture-proven infants, further investigations such as abdominal ultrasonogram (USG), micturating cystourethrogram (MCU), and isotope scan studies were advised to know the underlying anomalies of the renal tract. These infants were treated with appropriate antibiotics for 10 days and were asked to continue with prophylactic medications until all the imaging studies were over.

Differential Diagnosis of UTI

Inflammations of the external genitalia, vulvitis and vaginitis caused by yeast, pinworms and other agents may be accompanied by symptoms mimicking cystitis, on the basis of history and result of urine culture. Radiographically, the hypoplastic or dysplastic kidney or a small kidney secondary to a vascular accident, may appear similar to a kidney with chronic pyelonephritis, with the later, however, VUR is usually present.

Pyuria

Pyuria (>5 WBC/HPF in a centrifuged specimen) is a hall mark of pyelonephritis with sensitivity and specificity of 30 – 50%. However, pyuria alone is not satisfactory for making a diagnosis, as a number of conditions are associated with sterile pyuria including hydration, instrumentation, chemical inflammation, oral poliovaccine administration, non specific gastroenteritis and respiratory tract infections. Pyuria I strong supportive evidence of UTI in the presence of positive culture. Many (30 – 50%) patients with bacteriuria with UTI do not demonstrate significant pyuria. The most accurate method of measuring pyuria is to quantitate the urinary leukocyte excretion rate.

Data were entered into MS-Excel and later exported to SPSS Version 20. Results are presented in terms of frequencies and percentages. Chi-square test was used to test the association between variables. Informed written consent was obtained from the parents/guardian of the febrile infants at the time of recruitment.

Results

A cross sectional study was conducted taking 110 infants at the OPD of Paediatrics dept, KPC Medical College and Hospital. The results were analysed using MS Excel and SPSS v23.

Table-1: Age, gender wise distribution of study participants (n=110)

Age in Months	Male (n = 66)		Female (n = 44)		Total (n = 110)	
	No.	%	No.	%	No.	%
≤ 60 days	32	29.09	28	25.45	60	54.55
61 – 365 days	34	30.91	16	14.55	50	45.45
Total	66	60.00	44.00	40.00	110	100.00

In the present study, total 110 participants were included, 66 (60%) were males, 44 (40%) were females; Maximum cases for the study of urinary tract infection were in the age ≤ 60 days (54.55%) (Table 1).

Table-2: Gender wise socioeconomic status distribution among the study participants (n=110)

Socioeconomic Status	Male (n = 66)		Female (n = 44)		Total (n = 110)	
	No.	%	No.	%	No.	%
Upper middle	6	5.45	4	3.64	10	9.09
Lower middle	14	12.73	9	8.18	23	20.91
Upper lower	20	18.18	12	10.91	32	29.09
Lower	26	23.64	19	17.27	45	40.91
Total	66	60.00	44	40.00	110	100.00

According to Modified KuppuSwamy's scale, 10 (9.09%) were belong to upper middle, 23 (20.91%) lower middle, 32 (29.09%) upper lower class and 45 (40.91%) belong to lower class. However, none of the participants belong to upper class. Gender wise, majority of female children belong to lower class 19 (17.27%) and upper lower class 12 (10.91%) and in male category also, (Table 2).

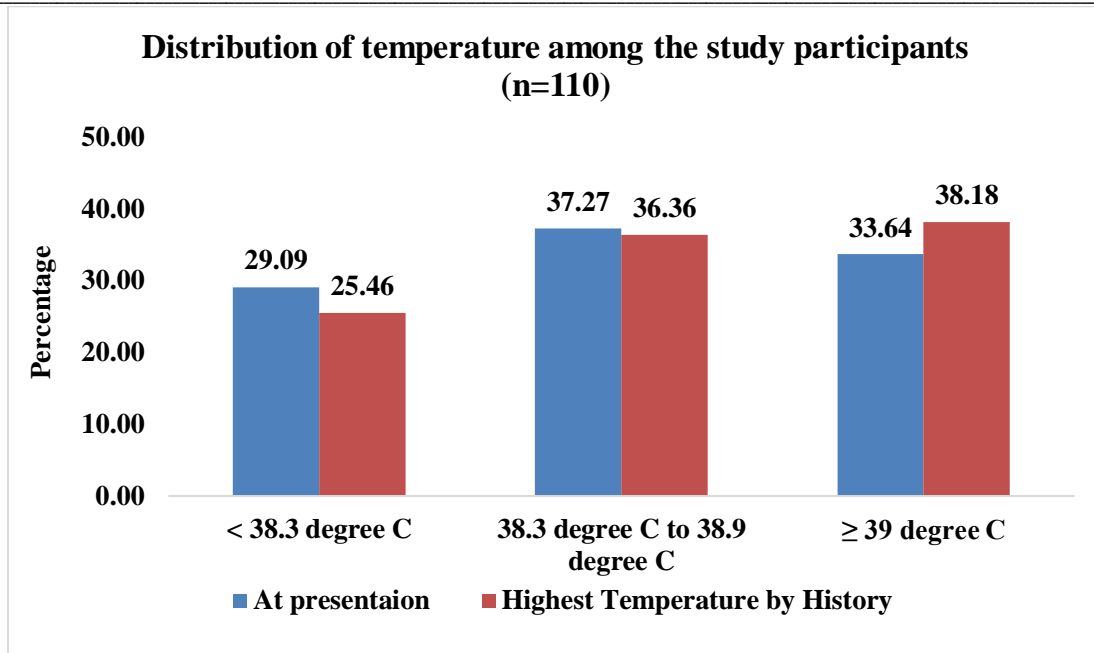


Fig 1:- Distribution of temperature among the study participants (n=110)

Figure 1 shows that majority of cases present with the temperature 38.3°C to 38.9°C (37.27%). On the other hand, majority of the cases gave history of temperature ≥ 39°C (38.18%).

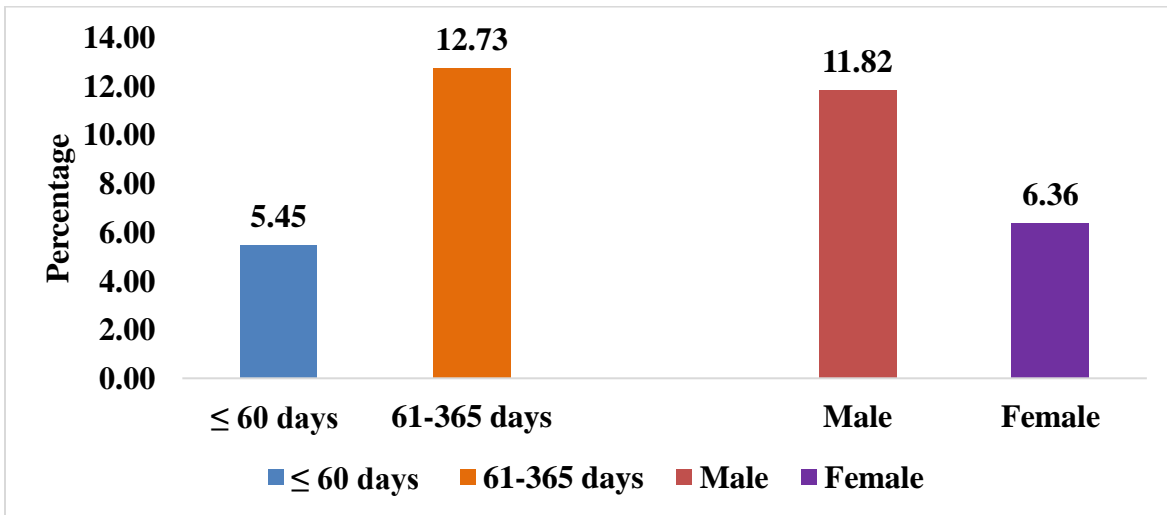


Fig 2: Prevalence of UTI According to Age Group and Gender

Figure 2 shows that prevalence of UTI was maximum present in age group 61-365 days (12.73%). In gender maximum UTI was present in males (11.82%).

Table 3: Distribution of clinical presentation of the study subjects.

Signs / Symptoms	Number	Percentage (%)
Fever	110	100.00
Vomiting	42	38.18
Irritability	64	58.18
Failure to thrive	78	70.91
Jaundice	16	14.55
Convulsion	24	21.82

Table 3 shows that fever (100%) and Failure to thrive (70.91%) were the commonest presentation of cases selected for the study. Rest presentation were irritability (58.18%), vomiting (38.18%), convulsion (21.82%) and jaundice (14.55%).

Table-4: Various diagnosis in urine culture-positive febrile infants.

Provisional diagnosis	Number	Percentage (%)
Gastroenteritis	33	30.00
Fever without focus	28	25.45
Upper respiratory infection	17	15.45
Urinary tract infections	20	18.18
Septicemia	11	10.00
Bronchiolitis	6	5.45

Table 4 shows various diagnoses in urine culture-positive febrile infants. Gastroenteritis was the most common illness observed in 33 (30%) infants. Other diagnoses were Fever without focus (25.45%), Upper respiratory infection (15.45%), Urinary tract infections (18.18%), Septicemia (10%) and Bronchiolitis (5.45%) infants.

Table-5: Antibiotic sensitivity of organisms growing urine culture samples.

Antibiotic	Number	Percentage (%)
Amikacin	98	89.09
Ofloxacin	82	74.55
Norfloxacin	64	58.18
Gentamycin	46	41.82
Nitrofurantoin	18	16.36
Nalidixic acid	16	14.55
Ceftriaxone	12	10.91
Cefixime	14	12.73
Cefotaxime	0	0.00
Co-trimoxazole	0	0.00

Table 5 shows that maximum, 98 (89.09%) of the organisms were sensitive to Amikacin and majority to Ofloxacin (74.55%) and Norfloxacin 58.18%). Only 12.73% sensitivity to Cefixime and 10.91% to Ceftriaxone and 100% resistance to Cotrimoxazole and Cefotaxime were observed. This could be a result of widespread antibiotic usage, leading to recent surge in extended-spectrum beta-lactamase microorganisms.

Discussion

UTIs are common, potentially serious infections of infants. UTI may lead to renal scarring, hypertension, and end stage renal disease. The diagnosis of UTI in infants is important as it may be the marker of urinary tract abnormalities. UTI is one of the most important risk factor in development of renal insufficiency or end stage renal disease. Early diagnosis is important to preserve renal function of the growing kidney.

In the present study, the prevalence of UTI was 18.18%, based on urine culture. These results compare favorably to the wide prevalence range, 2.48%–10.78%, observed in the other studies[25,26,27,28].

In the present study 66 (60%) were males, 44 (40%) were females; UTI was maximum present in age group 61-365 days (12.73%). In gender maximum UTI was present in males (11.82%). As per Almfarreh M et al. study, gender is the commonest influencing factor of UTI[29] In the study conducted by Gonzalez M prevalence of UTI was 32.9% in febrile infants and 19.3% in febrile girls[30]. Our findings are consistent with a series of studies performed by Bachur,[31] Zorc[32] and colleagues, which found the highest point prevalence in febrile male infants.

In the present study 10 (9.09%) were belong to upper middle, 23 (20.91%) lower middle, 32 (29.09%) upper lower class and 45 (40.91%) belong to lower class. Majority of cases in our study present with the temperature 38.3°C to 38.9°C (37.27%). On the other hand, majority of the cases gave history of temperature $\geq 39^\circ\text{C}$ (38.18%). Other studies confirmed that high fever with temperature of 39.5°C or more is the single best predictive parameter[33,34].

Present study shows that fever (100%) and Failure to thrive (70.91%) were the commonest presentation of cases selected for the study. Rest presentation were irritability (58.18%), vomiting (38.18%), convulsion (21.82%) and jaundice (14.55%). In a study done by Hoberman et al, vomiting, diarrhea, irritability and poor feeding were present in 40%, 30%, 80% and 65% respectively of 20 infants with UTI. Jeena PM et al also showed the presenting symptoms were similar tin in children with UTI[10,35].

In the present study diagnoses in urine culture-positive febrile infants, gastroenteritis was the most common illness observed in 33 (30%) infants. Other diagnoses were Fever without focus (25.45%), Upper respiratory infection (15.45%), Urinary tract infections (18.18%),

Septicemia (10%) and Bronchiolitis (5.45%) infants. These results were in accordance with the study by Indian Society of Pediatric Nephrology et al. (ISPN)[36]. Similarly, diarrhea has been shown to be a significant risk factor for UTI, even though the infections may be unrelated, as reported by Fallahzadeh and Ghane[37].

In the present study maximum, 98 (89.09%) of the organisms were sensitive to Amikacin and majority to Ofloxacin (74.55%) and Norfloxacin 58.18%). Only 12.73% sensitivity to Cefixime and 10.91% to Ceftriaxone and 100% resistance to Cotrimoxazole and Cefotaxime were observed. This could be a result of widespread antibiotic usage, leading to recent surge in extended-spectrum beta-lactamase microorganisms. Amikacin was the most effective against Gram-negative micro-organisms, and this was also reported in earlier studies by Hernández et al. and Madhi et al.[38,39]. Amikacin has low nephrotoxicity and extended interval dosing is essential in infants with UTI[40]. ISPN guidelines recommend initiating antibiotic therapy on diagnosis, with the choice of antibiotic based on regional sensitivity patterns, and altering the antibiotic if necessary when the sensitivity data are available[37].

Conclusion

Possibility of urinary tract Infection must be considered in all febrile children and urine culture specimen must be collected as a part of diagnostic evaluation. Amikacin is the most effective antibiotic. Renal damage is notably coprevalent with UTI, making radiological screening imperative in culture-positive infants.

Acknowledgements

Authors would like to acknowledge the patients who participated in this research study.

Ethical approval

The study was approved by the institutional ethics committee

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