

Original Research Article

Study of urinary tract infection in febrile children below 2 years of age

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ABSTRACT

Background: Urinary Tract Infection (UTI) in age group 0-2 years is of special interest to clinicians and assumes importance as it can lead to pyelonephritis, septicemia or meningitis in newborn and infants which can be fatal. This study is undertaken to calculate the incidence of UTI in febrile children less than 2 years of age and to compare the incidence with afebrile children visiting pediatric OPD and IPD of SRMS IMS.

Methods: Two hundred and two febrile infants and children constituted the case group. A control group, constituted of one hundred and ninety seven, age and sex matched afebrile patients from IPD/OPD. Urine collected was subjected to microscopic and microbiological examination.

Results: There were ten cases of UTI in the study group and none was found in the control group. The overall incidence of UTI in febrile infants and children less than 2 years was 4.95%. Infants and children admitted with diagnosis other than UTI were screened for UTI and it was found in 4.6% of the cases whereas babies admitted without definite focus had an incidence of 5.56% which signifies that UTI should be screened in all febrile infants irrespective of their other etiologies of fever. Maternal illiteracy was found to be statistically significant as 5 out of 10 cases of UTI were associated with illiterate mothers.

Conclusions: In the present study, we found that the screening of the infants for identification of UTI is useful irrespective of the presence of other etiologies thus early initiation of treatment prevents most complications of UTI, so the importance of early diagnosis cannot be overemphasized.

Keywords: Bacteriuria and pyuria, Failure to thrive, Pyelonephritis, Urinary tract infection

INTRODUCTION

The urinary tract is a common site of infection in pediatric age group. It follows a benign course in adult. However, in pediatric age group; Urinary Tract Infection (UTI) is well recognized cause of acute morbidity as well as chronic conditions such as hypertension and end stage renal disease. The incidence of pediatric UTI varies by age and gender. In less than one year of age, the incidence is 0.7% in female and 2.7% in males but beyond 2 years of age, there is female preponderance.¹

In developed countries, Urinary Tract Infection in children is second most common cause of morbidity after upper respiratory tract infections. In developing

countries, due to paucity of studies on this subject, variable data is available for incidence and prevalence of UTI.^{2,3} These studies conducted were predominantly in hospital settings, particularly in malnourished children. However, many of these studies have been conducted with small sample size using variable source of urine specimens.^{4,5}

There is a wide spectrum of presentation of UTI in younger age group. In preverbal age, UTI presents most commonly with vague signs and symptoms like fever, vomiting, lethargy and irritability. Poor feeding, failure to thrive, jaundice, hematuria or offensive urine are less common as presenting features. In verbal age group, the symptoms and signs become more specific like increased

frequency, dysuria, abdominal pain or loin tenderness which is pertaining to urinary tract.⁶

Certain individuals are prone to develop UTI as they are at high risk of predisposition like females, uncircumcised males, improper early enthusiastic toilet training, wiping from back to front in girls, history of urethral instrumentation, pinworm manifestations, constipation etc. These risk factors should be taken into account while dealing with the febrile infants and young children and should be screened for UTI by urine microscopy and culture sensitivity.⁷

The diagnosis of UTI in infancy is difficult as clinical presentation is non-specific in this age group which is not referable to urinary tract. This fact leads to a major problem in early diagnosis of UTI. High index of suspicion, especially in individuals who are at high risk is required, to investigate such cases by urine microscopy and culture sensitivity to reach the diagnosis as early as possible. Taking into account, all of the above factors like non-specific presentation of UTI, hindrances in diagnosis of UTI, morbidity caused by untreated UTI and above all the paucity of studies and data on UTI and its associated morbidities, clinical features, risk factors etc. In developing countries like ours, more so in Rohillkhand region, this study was planned and proposed.

METHODS

The study has been conducted in Department of Pediatrics and Microbiology of Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly from December 2014 to May 2016. It is a hospital based, prospective, cross-sectional and observational study.

Inclusion criteria

- All febrile infants and children up to 2 years of age,
- With axillary temperature $>37.8^{\circ}\text{C}$ who reported to Pediatric OPD/emergency or admitted to pediatric ward/nursery.

Exclusion criteria

- Children above the age of 2 years,
- Any child who has received antibiotics 48 hours prior to evaluation,
- Parents/guardians not willing to enroll the child in the study.

Febrile infants and children up to 2 years of age reporting to Pediatric OPD/emergency were evaluated by detailed history and physical examination. The patients were clinically assessed and were subjected to the relevant investigations. Two hundred and two febrile infants and children meeting the inclusion criteria constituted the case group. A control group, constituted of one hundred and ninety seven, age and sex matched afebrile patients from IPD/OPD.

Urine was collected by catheter collection in all study as well as control cases after obtaining the consent from parents. Urine collected was subjected to microscopic examination for identification of bacteriuria and pyuria. Urine was inoculated on cystein lactose electrolyte deficient media. The plates were then incubated overnight for 18 hours at 37°C and were read the following day. The plates showing the growth were selected for quantification of bacteria. UTI was considered to be positive in samples with at least fifty thousand colonies of a single pathogen in an asymptomatic child or even in ten thousand colonies of a single pathogen were present in a symptomatic child.^{7,8}

All patients with UTI below 6 months of age were subjected to Ultrasonographic examination to view kidneys, ureters and bladder. Those patients who were more than 6 months of age were only subjected to USG examination if features of atypical infection including failure to respond within 48 hr of appropriate antibiotics, poor urine flow, abdominal flank or suprapubic mass, non-*E. coli* pathogen or elevated creatinine levels were present. Micturating cystourethrograms were only performed if USG suggested some abnormalities.

Statistical analysis

Excel sheet version 2011 for windows was used for data collection. This data was presented in form of tables, charts, graphs and figures. The data were entered into statistical package SPSS version 17. The observations were interpreted by applying chi-square test of significance. P value <0.05 was considered as significant.

RESULTS

This was a prospective, cross sectional, case – control study amongst febrile infants and children up to age of two years. Two hundred and nineteen febrile children were selected, 13 children were excluded because they declined to participate in the study. 206 were taken up in the study group.

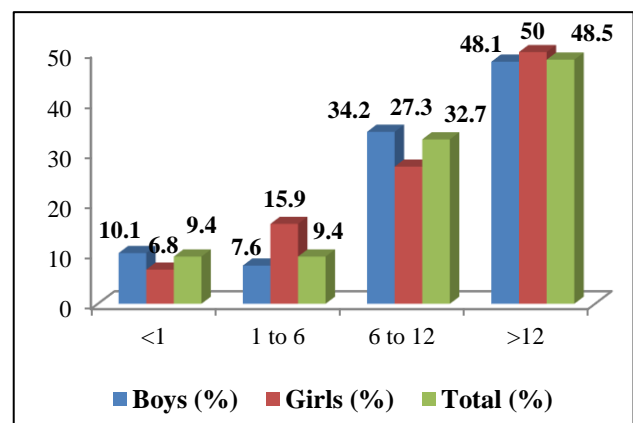


Figure 1: Population characteristics in study group.

Incidence of UTI could be assessed in 202 febrile children only as four of the guardians declined catheterization and thus were excluded. One hundred and ninety seven afebrile children with matched age and sex were selected as the control group (Figure 1).

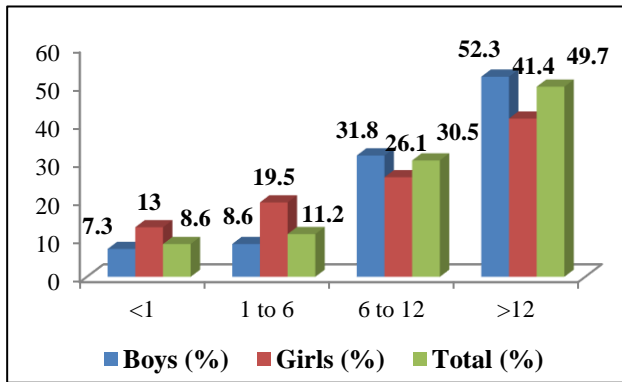


Figure 2: Population characteristics in control group.

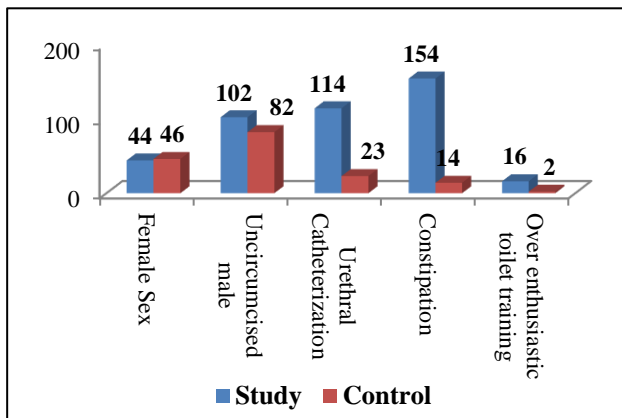


Figure 3: Clinical assessment of risk factors in study and control group.

There were ten cases of UTI in the study group and none was found in the control group. The overall incidence of UTI in febrile infants and children less than 2 years was 4.95%. Infants less than 12 months of age are at higher risk to develop UTI compared to those in second year of life as eight out of ten cases of UTI were less than 12 months in age. Boys are at higher risk of developing UTI in the initial 12 months of life when compared to girls whereas the ratio reverses after 12 months of age as out of eight cases of UTI found in the initial 12 months of age, seven were boys whereas all the cases beyond 12 months of age were found in girls. Infants and children admitted with diagnosis other than UTI were screened for UTI and it was found in 4.6% of the cases whereas babies admitted without definite focus had an incidence of 5.56% which signifies that UTI should be screened in all febrile infants irrespective of their other etiologies of fever (Table 1). Uncircumcised males were not found to be statistically significant as a risk factor to develop UTI as six out of seven boys with UTI were circumcised. Four out of ten cases of UTI used to wear tight perineal

clothing which shows a significant correlation of developing UTI in such cases.

Table 1: Distribution of cases of UTI among study group.

	Cases with definite focus		Cases without definite focus	
	Non UTI N (%)	UTI N (%)	Non UTI N (%)	UTI N (%)
Boys (age in months)				
<1	8 (8.7)	1 (25)	6 (10.2)	1 (33.3)
1-6	6 (6.5)	2 (50)	5 (8.5)	1 (33.3)
6-12	31 (33.7)	1 (25)	19 (32.2)	1 (33.3)
>12	47 (51.1)	0 (0)	29 (49.1)	0 (0)
Total	92	4	59	03
Girls (age in months)				
<1	2 (6.5)	0 (0)	1 (10)	0 (0)
1-6	5 (16.1)	0 (0)	2 (20)	0 (0)
6-12	7 (22.6)	1 (50)	2 (20)	0 (0)
>12	17 (54.8)	1 (50)	5 (50)	1 (100)
Total	31	02	10	01
Grand total	123	06	69	04

Table 2: Association with risk factors.

Factors	UTI	Non UTI	Odd's ratio (95% CI)	P value
Tight clothing (13)	4	9	13.56 (3.24 to 56.72)	<0.001
Wiping from back (156)	7	149	0.67 (0.17 to 2.72)	0.578
VUR (2)	2	0	113.24 (5.03 to 2546.88)	0.003
Obstructive uropathy (3)	2	1	47.75 (3.91 to 583.19)	0.003

Table 3: Mother's educational status.

Educational status	UTI (10)	Non UTI (192)	Odd's ratio (95% CI)	P value
Illiterate and primary (27)	5	22	7.73 (2.07 to 28.83)	0.002
Middle (142)	4	138	0.26 (0.07 to 0.96)	0.043
Secondary and senior secondary (33)	1	32	0.56 (0.07 to 4.54)	0.583

Anatomic abnormalities of the urinary tract are the significant risk factors for developing UTI as three out of four cases with anatomic abnormality were found to have UTI (Table 2). Maternal illiteracy was found to be statistically significant as 5 out of 10 cases of UTI were associated with illiterate mothers or qualified only up to primary class, whereas there was no significant

association of fathers' education with incidence of UTI (Table 3).

DISCUSSION

Urinary Tract Infection (UTI) is one of the commonest bacterial infections and its occurrence below 2 years of age is of special significance. The epidemiology of UTI in the pediatric population is clouded not only by the variability but also by non-specificity of signs and symptoms of this infection in infants and young children. Also, the incidence of UTI varies further with age and sex.⁹

The present study has been conducted in Pediatric Department, SRMS IMS. It included the febrile infants and children up to age of 2 years. A formal written consent was taken from the attendants after explaining about the study and the procedure of sampling. These children were subjected to urine examination. An approximate age and sex matched control group without fever was selected that also underwent urine examination after attaining the consent in a similar fashion as the study group.

UTI occurs in 1% of boys and 1-3% of girls, but the prevalence varies with age.⁷ Authors found, 4.95% febrile infants up to 2 years were suffering from UTI. Approximately 50% of which were found in the first six months of life followed by 30% in the next six months. In the two other Indian studies done by Dharnidharkar et al, and Srivaths et al. done on the similar setting of febrile infants and children upto 2 years found the resembling findings of 80% UTI occurring in initial 12 months of life with an overall prevalence of 2.48%.^{10,11} Bauchner et al, found a relatively low prevalence of 1.7% in their study.¹² This can be attributed to inclusion of children upto 5 years of age which suggests that incidence of UTI is lower above 2 years of age when compared to infancy. A study from English general practice published in 1979 found incidence of UTI to be 5% for girls and 2.7% for boys during childhood up to fifteen years of age but the samples collected were midstream samples, which might be the cause of comparable results with infancy.¹³

During first year of life, UTI most commonly occur in boys with a male: female ratio of 2.8-5.4: 1. However this ratio reverses to 1: 10 beyond 1-2 years of age.⁷ Similar results were found in this study, with a high preponderance of UTI in boys in the initial twelve months of life. This finding is similar to Krober et al, Crain EF et al, and Dayan et al, with a male to female ratio 1.95:1, 2.46:1 and 3.6:1 respectively when evaluated in their studies in febrile infants with varying age up to 12 months.¹⁴⁻¹⁶ On the contrary, Hoberman et al, Shaw et al, Herr et al, and Newman et al, described a female preponderance to UTI even in initial twelve months of life.¹⁷⁻²⁰ This variation in the results of the latter studies can be attributed to the data collected from developed countries with good hygiene practices and circumcision

in male children in comparison to poor hygiene and illiteracy in the developing countries. Non-specificity of the symptoms and the presenting features especially in infancy are the major hindrance to the diagnosis of UTI. Non-specific symptoms including failure to thrive, vomiting, diarrhea, poor feeding, lethargy or jaundice may be caused by UTI. Fever without any obvious focus may be the only presentation in children up to 24 months of age.²¹ In present study, the major presenting complaints were found to be jaundice, poor feeding and lethargy distributed in the children with UTI up to 2 years of age but inability to gain weight was found more common in cases beyond infancy. Although the non-specific symptoms were the major observation in all the cases but the symptoms of lower abdominal pain, burning micturition and foul-smelling urine being relatively specific for UTI were also found significant in some of the cases of verbal age group which suggests that the specific signs and symptoms are more common presentation of UTI in verbal children and elderly (Table 4).

Table 4: Symptoms and signs.

Complaints	Study (202)	Control (197)	Odd's Ratio (95% CI)	P value
Non-specific presenting complaints				
Vomiting	67	53	1.39 (0.90-2.14)	0.128
Lethargy	189	167	0.32 (0.16-0.64)	0.002
Poor feeding	156	123	0.46 (0.30 to 0.70)	<0.001
Jaundice	42	22	2.15 (1.23 to 3.75)	0.007
Seizures	34	11	3.51 (1.73 to 7.15)	<0.001
Inability to gain weight	74	32	3.07 (1.91-4.94)	<0.0001
Specific presenting complaints				
Abdominal pain	26	13	2.15 (1.07-4.31)	0.032
Burning micturition	28	12	2.48 (1.22-5.03)	0.011
Foul smelling urine	108	45	4.00 (2.60-6.17)	<0.0001

All the major presenting complaints were more frequently observed in the study group population except vomiting which was more or less similar in both the groups.

A study by Kaushal RK et al, found urinary symptoms (pertaining to the urinary tract) including dysuria, burning micturition, increased frequency, and malodorous and turbid urine in 11.5% of cases only.²² A few other studies have found that the presenting symptoms of UTI are uncommon and generally non-specific. On contrary, Messi et al, Nayir et al, in their studies to know about signs and symptoms of UTI in febrile children up to 14 years of age found the features of dysuria and increased

frequency of urination to be associated with 41% and 34% of the cases respectively.^{23,24}

Authors also found, a history of perineal tight clothing (40%) to be the most common risk factor, which was associated with the cases of UTI. On the other side, female sex, urinary catheterization, constipation and the hygiene practices including bathing and direction of wiping the perineal region were not found to be the significant risk factors (Figure 3).

Similar parameters were evaluated in a case-control study by Hoi LV et al to know the correlation of UTI with the poor hygienic practices. They also found no significant association of such practices with risk of developing UTI.²⁵ On the other hand, data from another study suggested bathing habits less than daily, holding of urination during daytime and washing habit after defecation might have risk effects on UTI. Significant correlation of encopresis (p value <0.05) with recurrent UTI was found in a Swedish study.²⁶

Anatomic abnormalities which preclude normal micturition like labial adhesions, phimosis or are associated with reflux like vesico-ureteral reflux are at high risk for developing UTI.²¹ Though anatomic abnormalities were found to be significantly associated with risk of developing UTI, but the cases with such abnormalities were too small in number to draw a definitive conclusion. Various other authors like Tseng et al, Parada et al, Tsai et al, and Honkinen et al, found an association of VUR with UTI to be 29.6%, 18.7%, 29% and 30% in their respective studies.²⁷⁻³⁰

Mother's educational status came out to be a major predisposing factor for UTI as evident from the significant p value. Similar observations were noted by Hashemiparast et al, in a study done on children for prevention of UTI in Iran which stated that well educated mothers are more confident and equipped with better knowledge in prevention UTI by practicing hygiene, thus leading to a definite decline in morbidity.³¹

CONCLUSION

The purpose of this study was to know about the incidence of urinary tract infection in febrile infants and young children up to the age of 2 years. In the present study, we found that the screening of the infants for identification of UTI is useful irrespective of the presence of other etiologies for fever as children of any age with a febrile UTI can have acute pyelonephritis and subsequent renal scarring, but the risk is highest in those younger than 2 year of age. The morbidity and mortality due to UTI still remains considerably high despite the advent of numerous effective antimicrobial agents. Besides this, early initiation of treatment prevents most complications of UTI, so the importance of early diagnosis cannot be overemphasized.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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