Original Research Article

Prevalence of UTI in Febrile Children aged lessthan Five Years

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Abstract

Introduction: Fever is often the only symptom in children with Urinary Tract Infection (UTI). Pyelonephritis and progressive renal damage can be caused by urinary tract infection, Which is not treated. Hence this study was done to assess the prevalence of urinary tract infection in febrile children attending to a tertiary care centre.**Materials and methods:** A cross-sectional descriptive study was conducted in the department of paediatrics in a tertiary care hospital on 370 children between the ages of 1 month to 5 years. Routine blood counts, urine analysis, was done, and those are showing pus cells > 5 per HPF (pyuria) in centrifuged urine sample were considered for urine culture sensitivity. A diagnosis of urinary tract infection was made with a positive urine culture. Data were entered in Microsoft Excel, and analysis was carried out with IBM SPSS version 22. P value < 0.05 was considered statistically significant.**Results:** 44.59% of the study subjects were boys. The overall prevalence of urinary tract infection was 3.5% in febrile children between1 month to 5 years. It was 4.1% in children <2 years and 7% in children <1 year of age. Among pyuric patients, (n=128) 27% were culture positive. Escherichia coli(69%) was the most common organism identified culture-positive cases.**Conclusions:** The prevalence of urinary tract infection was high in infants. In all children presenting with fever, the possibility of urinary tract infection must be kept in mind, and a sample of urine must be collected for urine microscopy and urine culture.

Keywords: Urinary Tract Infection (UTI), Febrile children, Infant, Urine culture, Pyuria, Pyelonephritis, Pediatrics.

Introduction

Fever is one of the most common reasons for children under five years of age to visit the hospital. [1, 2] Infections of the urinary tract are very common in infants and young children presenting with fever. A UTI (Urinary Tract Infection) is defined as the growth of a significant number of organisms of a single species in the urine, in the presence of symptoms. Significant bacteriuria is growth with a colony count of $>10^5$ per ml of a single species of micro-organism in a midstream clean catch urine sample.[3, 4] Unlike occult bacteremia or severe bacterial illness, little attention has been only given on the identification of UTIs in febrile children. The overall prevalence of UTI in febrile infants was 7% with 95% confidence interval (C.I.) of 5.5 to 8.4% in the meta-analysis by Shaikh N et al. [5] observed that the prevalence varied according to age, race, gender and circumcision status of the child. The pooled prevalence rate of febrile UTI's in females aged 0-3 months, 3-6 months, 6-12 months, >12 months was 7.5%, 5.7%, 8.3%, and 2.1% respectively. The prevalence of UTI in south Indian children between 2 months to 5 years was 9% in the hospital-based study by Mathivanan M et al.[6] Quite often, children receive antibiotics empirically, without adequate evaluation for urinary tract infection. Fever, however, is often the only symptom in children with UTIs. Fever and significant bacteriuria and pyuria in children with undocumented sources of infections must be presumed to be symptoms of pyelonephritis, an invasive infection of the renal parenchyma requiring prompt treatment. Although the majority of UTI occurs in the lower urinary tract, only a minority results in pyelonephritis. [7, 8] Progressive renal damage from unrecognized pyelonephritis in childhood may lead to hypertension and chronic renal failure in later life. Hence it is essential to identify urinary tract infections in febrile children and institute prompt treatment to reduce the potential for lifelong morbidity. Studies have revealed that more than 10% of children with a febrile UTI and pyelonephritis subsequently develop renal scarring. [9, 10] The data regarding the prevalence of UTI lacks in our region. Hence this study was done to assess the prevalence of UTI in febrile children attending to a tertiary care centre.

Objectives

To assess the prevalence of UTI in febrile children less than five years of age, attending a tertiary care centre.

Hypothesis(only explorative)

The prevalence of UTI in febrile children attending to our tertiary care centre is comparable to similar hospital-based studies in the literature

Materials and Methods

The present cross-sectional descriptive study was conducted in the department of paediatrics, Mamata Academy of Medical Sciences,Bachupally,Hyderabad,Telangana and Great Eastern Medical School and Hospital, Srikakulam Andhra Pradesh, India**.** for 18 months from 01/03/2019 to 30/09 /2020. The study population included all children between the age of 1 month to 5 years attending the paediatrics department during the study period. The subjects were recruited consecutively till the desired sample size was reached. For a prevalence of UTI in febrile children of 9% from the study by Mathivanan M et al. [6], the minimum required sample size was calculated as 370 using the formula z^2pq/d^2. Absolute precision was taken as 3% and nonresponse at 5%. The sampling was done by convenient sampling. Febrile children (rectal temperature of ≥ 38.3° C or axillary temperature of ≥ 38.3° C) aged between 1 month to 5years of age attending the outpatient department or admitted in the hospital were included in the study after getting consent the parents

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or guardian. Children who have received antibiotics within the previous 48 hours, children with known congenital genitourinary anomalies, children of unwilling parents or guardian were excluded from the study. Data related to age, sex, nutritional status, socioeconomic status and predisposing risk factors like urethral instrumentation, bowel habits etc. were noted using a questionnaire. A complete history related to the onset, duration of fever and associated symptoms such as nausea, vomiting, diarrhoea, urinary disturbances, other system involvement was also obtained. A thorough physical examination with relevant investigations was carried out in all the patients. Routine blood counts, urine analysis, was done, and those are showing pus cells > 5 per HPF in centrifuged urine sample were considered for urine culture sensitivity.

Collection of Urine Sample

From all 370 cases, a sample of urine was collected. In children under two years of age, urine was collected by a bag, and in others,a midstream clean-catch sample was collected.

Collection of Bag Sample

In children below two years of age, the genitalia were cleaned with soap and water. The person collecting sample washed hands before touching the sterile container or bag for collecting the urine sample. In males,the prepuce is retracted if possible. In females below two years of age, labia were split apart and washed. Urine around 10ml was collected in the sterile container and sent for urine culture and sensitivity. In children above two years of age, midstream clean catch urine sample was collected.

Method of Collection of Midstream Clean Catch Sample

After taking the above precautions,the child was allowed to pass urine, midstream sample was collected in a sterile container and was sent for culture and sensitivity.

Urine Analysis

The fresh urine sample obtained from the above techniques was subjected for routine urine examination, culture and sensitivity. The urine specimens were centrifuged in a standard manner; 10ml of urine was spinning at the rate of 2500 rpm for 20-30minutes. The supernatant decanted off and sediment resuspended in the remaining 0.2ml. The urine was examined under a microscope for hematuria and leukocyturia.In the present study, more than five pus cells/HPF in a centrifuged urine sample was taken as significant pyuria and culture, and sensitivity was performed in that patient/case.

Urine Culture: The midstream clean catch urine was inoculated into the blood and MacConkey agar plates with a 0.01ml calibrated loop. All plates were incubated at 35-370C for 24hrs under the aerobic condition to obtain accurate colony count. On the culture of midstream sample of urine, a colony count of more than 105/ml organisms of a single species was considered as significant. Samples showing insignificant growth, mixed growth of two or more pathogens or growth of non-pathogens were not considered as culture positive. The following definitions were employed in the present study.

Significant pyuria was defined as the presence of more than five pus cells /HPF in a centrifuged urine sample. A positive urine culture was defined as the growth of $>10^5$ colonies of a single urinary tract pathogen/ml of the specimen in a midstream of urine.

Statistical Analysis

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables with their 95% CI. Figures like Bar chart and Pie chart were used wherever necessary. Independent sample t-test/ ANOVA/Paired t-test was used to assess statistical significance for quantitative variables while the Chi square test was used to assess statistical significance for categorical variables. P value < 0.05 was considered statistically significant.Data was entered in Microsoft excel and coGuide version V.1.0 was used for statistical analysis[11].

Results

In our study,55.41% of the subjects were girls. The overall prevalence of urinary tract infection was 3.5% in febrile children aged between 1 month to 5 years. (Table 1) It was 4.1% in children < 2 years and 7% in children <1 year of age. Escherichia coli (69%) was the most common organism identified in culture-positive cases. The difference in urine culture report between gender was insignificant with a P-value of 0.532, with 30.77% of male participants reported to be urine culture positive. The difference in age group across gender was found to be insignificant with a P-value of 0.864, with the majority of 10 (38.46%) male participants belonging to 1 to <2 years age group. The difference in a number of pus cells in urine report between gender was insignificant with a P-value of 0.426, with the majority of 18 (69.23%) male participants reported having>5 to 10 pus cells/HPF. (Table 2)The difference in the age group between positive and negative urine culture report was found to be insignificant with a P-value of 0.554. The difference in a number of pus cells in urine between positive and negative urine culture report was found to be insignificant with a P-value of 0.283. (Table 3) Out of 8 male participants, 12.5% had bilateral hydronephrosis with thickened bladder wall with cystitis, 12.5% had crossed fussed ectopic left kidney/mild hepatosplenomegaly, 12.5% had evidence of large bladder calculi features suggestive of bilateral moderate hydronephroureterosis/cystitis, 12.5% had left-sided minimal pleural effusion minimal free fluid in the peritoneal cavity, massive hydronephrosis (left side), 12.5% had Right-sided hydronephrosis with PUJ obstruction with dysplastic kidney on Right side and 12.5% had picture suggestive of hepatosplenomegaly respectively. Out of 5 female participants, 20% had bilateral moderate pleural effusion with ascites, 20% had dilated non-peristaltic bowel loops (small) possibility of paralytic ileus/intestinal obstruction, 20% had gross ascites punctate discrete spots in lung parenchyma seen, 20% had mild hepatosplenomegaly, and 20% had normal findings respectively. (Table 4)

Table 1: Baseline Characteristics of The Study Population (N=370)

Characteristics	n (%)
Gender	
Boy	165 (44.59)
Girl	205 (55.41)
Pyuria (> 5 pus cells/ HPF)	48 (12.9)
Prevalence of UTI (Positive Urine culture)	13 (3.5)

Table 2: Characteristics of subjects with pyuria (> 5 pus cells/HPF) (N=48)

Characteristics	Sex		Total (N=48)	P value
	Boys(N=26)	Girls (N=22)		
Urine culture report				
Positive	8 (30.77%)	5 (22.73%)	13 (27%)	0.532
Negative	18 (69.23%)	17 (77.27%)	35 (73%)	
Age group				
< 1 year	4 (15.38%)	5 (22.73%)	9 (18.75%)	0.864
1-<2 years	10 (38.46%)	8 (36.36%)	18 (37.50%)	

2-<3 years	4 (15.38%)	2 (9.09%)	6 (12.50%)	
3-4 years	8 (30.77%)	7 (31.82%)	15 (31.25%)	
Socio-economic status				
Class I	20 (76.92%)	19 (86.36%)	39 (81.25%)	*
Class II	3 (11.54%)	2 (9.09%)	5 (10.42%)	
Class III	1 (3.85%)	1 (4.55%)	2 (4.17%)	
Class IV	2 (7.69%)	0 (0%)	2 (4.17%)	
Nutritional status grading				
Normal	23 (88.46%)	18 (81.82%)	41 (85.42%)	*
I	0 (0%)	0 (0%)	0 (0%)	
II	1 (3.85%)	0 (0%)	1 (2.08%)	
II with k	1 (3.85%)	2 (9.09%)	3 (6.25%)	
III	1 (3.85%)	2 (9.09%)	3 (6.25%)	
IV	0 (0%)	0 (0%)	0 (0%)	
Number of pus cells in urine				
> 5 to 10 pus cells /HPF	18 (69.23%)	16 (72.73%)	34 (70.83%)	0.426
> 10 pus cells /HPF	4 (15.38%)	5 (22.73%)	9 (18.75%)	
Numerous cells	4 (15.38%)	1 (4.55%)	5 (10.42%)	

Table 3: Difference in characteristics of UTI between subjects with positive and negative urine culture (n=48)

Characteristics	Urine culture report		Total (n=48)	P-value
	Positive (n=13)	Negative (n=35)		
Gender				
Boys	8 (61.54%)	18 (51.43%)	26 (54.16%)	0.532
Girls	5 (38.46%)	17 (48.57%)	22 (45.83%)	
Age group				
< 1 year	4 (30.77%)	5 (14.29%)	9 (18.75%)	0.554
1-<2 years	5 (38.46%)	13 (37.14%)	18 (37.50%)	
2-<3 years	1 (7.69%)	5 (14.29%)	6 (12.50%)	
3-4 years	3 (23.08%)	12 (34.29%)	15 (31.25%)	
Socio-economic status				
Class I	10 (76.92%)	29 (82.86%)	39 (81.25%)	*
Class II	1 (7.69%)	4 (11.43%)	5 (10.42%)	
Class III	0 (0%)	2 (5.71%)	2 (4.17%)	
Class IV	2 (15.38%)	0 (0%)	2 (4.17%)	
Nutritional status grading				
Normal	12 (92.31%)	29 (82.86%)	41 (85.42%)	*
I	0 (0%)	0 (0%)	0 (0%)	
II	0 (0%)	1 (2.86%)	1 (2.08%)	
II with k	0 (0%)	3 (8.57%)	3 (6.25%)	
III	1 (7.69%)	2 (5.71%)	3 (6.25%)	
IV	0 (0%)	0 (0%)	0 (0%)	
Number of pus cells in urine				
> 5 to 10 pus cells /HPF	7 (53.85%)	27 (77.14%)	34 (70.83%)	0.283
> 10 pus cells /HPF	4 (30.77%)	5 (14.29%)	9 (18.75%)	
Numerous	2 (15.38%)	3 (8.57%)	5 (10.42%)	

**** No statistical test was applied-due to 0 subjects in the cell***

Table 4: Abdominal ultrasound diagnosis in culture-positive children (N=13)

Abdominal ultrasound	Sex	
	Male	Female
Bilateral hydronephrosis with thickened bladder wall with Cystitis	1 (12.5%)	
Bilateral moderate pleural effusion with ascites		1 (20%)
Crossed fused ectopic left kidney/mild Hepatosplenomegaly	1 (12.5%)	
Dilated non-peristaltic bowel loops (small) possibility of Paralytic ileus/Intestinal obstruction		1 (20%)
Evidence of large bladder calculi	1 (12.5%)	
Features suggestive of bilateral moderate hydronephroureterosis/cystitis	1 (12.5%)	
Gross ascites punctate discrete spots in lung parenchyma seen		1 (20%)
Left-sided minimal pleural effusion minimal free fluid in the peritoneal cavity	1 (12.5%)	
Massive hydronephrosis (Left side)	1 (12.5%)	
Mild hepatosplenomegaly		1 (20%)
Normal		1 (20%)
Right-sided hydronephrosis with PUJ obstruction with dysplastic kidney on Right side	1 (12.5%)	
Suggestive of Hepatosplenomegaly	1 (12.5%)	
Total	**8**	**5**

Discussion

Urinary tract infections are potentially serious infections of childhood, capable of causing acute morbidity besides leaving a long-term sequel. In the present study, the overall prevalence of UTI was 3.5% in febrile children between 1 month to 5 years, as shown in Table 1. It was 4.1% in children <2 years and 7% in children <1 year of age. These results were similar to other studies reported in the literature [5], 12.9% of cases showed significant pyuria. Among pyuric patients, 26% were culture positive. Among culture-positive cases majority (69%) grew E.coli. The prevalence of culture positivity was much more in children who showed >10 pus cells / HPF. In our study, there was no significant difference between boys and girls with regard to pyuria as shown in Table 2.Accurate diagnosis of urinary tract infection is important as they cause acute morbidity as well as long term sequel, including hypertension and impaired renal function. It is necessary to facilitate appropriate management of acute illness and to ensure appropriate evaluation and follow up. Equally important is accurately ruling out a urinary tract infection to avoid unnecessary cost and potentially harmful treatment and evaluation.The overall prevalence of febrile UTI in infants in our study (7%)was higher compared to the report by Shaw KN et al. [12], who reported a prevalence of 3.3% in febrile infants. Kaushal RK et al. [13] in their study observed a very higher prevalence of 12.3% in infants. Mathivanan M et al. [6] in their study also observed a very higher prevalence of 11.5% in their study in infants. Dharnidharaka VR et al[14] in their study reported a prevalence of 5.4% in febrile infants.Similarly, Hoberman A et al. [15] reported a prevalence of 5.3% in their study.The overall prevalence of UTI in febrile children in our study was 3.5% in children <5years, in contrast, to study conducted by Kaushal RK et al. [13] who reported a higher prevalence of 8.4% in children <5years respectively. Kaushik V et al. [16] in their study observed the prevalence of UTI was 5%. This difference in the prevalence among various studies could be due to the social and cultural factors related to the study population besides the criteria used to diagnose UTI. Shaikh N et al[5] in their study observed uncircumcised male infants <3 months and female infants <12 months had the highest baseline prevalence of UTI. The overall prevalence of UTI was 3.5% in febrile children between 1 month to 5 years in the present study. In our study,the prevalence of UTI in < 2years age group was 4.1% which was very lower than reported in the study by Mathivanan M et al[6],where prevalence in 1-2 years age group was 10.6 %. O'Brien K et al. [17] in their study observed the prevalence of UTI was 5.9% overall, with 7.3% in those less than three years and 3.2% in those between 3 to 5 years.Mathivanan M et al[6]in their study observed the prevalence of UTI was higher among females (5.5%)than males (4%). In our study, the prevalence of UTI was slightly higher among boys compared to girls, but without any statistical significance. In the present study, in those with UTI, there was no significant difference between boys and girls with respect to urine culture positivity, age group, socio-economic status, nutritional status and number of pus cells in urine.Among pyuric patients (n=128), 27% were culture positive in our study. But in those with UTI, there was no significant difference between subjects with positive and negative urine culture reports with regards to gender, age group, socio-economic status, nutritional status and number of pus cells in urine. E.coli (69%) was the most common organism identified positive culture cases in the present study. Naik RR et al[18]. in their study also observed that, out of 200 children, in 29 cases urine culture showed E. coli growth. Mathivanan M et al.[6]in their study also observed E. coli followed by Klebsiella contributed the maximum number of cases. Leung AKC et al.[7]in their study also observed E.coli accounts for 80 to 90% of UTI in children. In our study, 40% of children who showed numerous pus cells were culture positive and 44%who showed >10% were culture positive, and 2.5% of children showing >5pus cells were culture positive. Among UTIs, the proportion of asymptomatic bacteriuria or cystitis may be higher than APN (acute pyelonephritis). However, patients with APN have been the main subjects of UTI studies because of the possibility of chronic kidney disease. Mathivanan M et al[6]in their study observed that among the 19 UTI cases, only 2 cases were without any underlying foci of infection, the remaining 17 cases had a definite source of infection. In our study, out of the 13 culture-positive cases, where USG was done, only one had normal ultrasound findings. Other 12 had either some evidence supporting infection or obstruction that may predispose to infection.UTIs are very common in children and are caused by micro-organisms entering the urethra and moving towards the kidneys. Infant boys are more prone to develop UTI compared to girls, but after infancy, girls are at added risk because of their short urethra. Shaikh N et al.[5]in their study also observed uncircumcised male infants <3 months and female infants<12 months had the highest baseline prevalence of UTI. Because of economical constraints, urine cultures were done only in children who showed significant pyuria, which revealed a positive culture in 26%.Hence the validity of urine examination could not be accurately ascertained. In our study, 40% of children who showed numerous pus cells were culture positive and 44% showed >10% were culture positive and 2.5% of children showing >5pus cells were culture positive. Hence the presence of pyuria of >5leukocytes/HPF in a centrifuged sample could be a significant indicator of UTI. Hence we conclude that pyuria of > 5 pus cells /HPF in the centrifuged sample should be considered as significant pyuria and further evaluation should be done promptly to initiate treatment and to prevent morbidity and long term sequel.

"What is new in this study."

- The prevalence of urinary tract infection was high in infants.
- Among pyuric patients, 27% were culture positive.
- Escherichia coli (69%) was the most common organism identified culture-positive cases.
- Possibility of UTI must be kept in mind in children presenting with fever
- A sample of urine must be collected for urine microscopy and urine culture in suspected UTI

Limitations: Our study was a single centre, hospital-based study. Not all the febrile children come to the hospital. A multi-centre community-based study representing a wider array of the population could better answer our research question. The sampling was only convenient because of practical constraints. Hence, the generalizability of our results may not be valid.

Conclusion and Recommendations

In all children presenting with fever, the possibility of UTI must be kept in mind, and a sample of urine must be collected for urine microscopy and urine culture if needed. Primary care paediatricians should be aware of the possibility that febrile children may have urinary tract infection and should consider obtaining a urine culture specimen as part of their diagnostic evaluation.

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