

# Frequency of urinary tract infection in febrile children of one to five years of age

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## Abstract

**Introduction:** Fever is the most common reason for children 1-5 years of age to visit Emergency / out patient departments. Little attention has been focused on the identification of urinary tract infections in febrile children, despite recent information that suggests a high prevalence of urinary tract infections and significant associated morbidity in these patients. This study is undertaken to determine the prevalence of urinary tract infection in febrile children one year to five years of age and to evaluate various diagnostic methods for a case of Urinary tract infection. **Method:** Febrile children (rectal  $\geq 38.3^{\circ}\text{C}$  or auxiliary temperature  $\geq 37.8^{\circ}\text{C}$ ) of 1 to 5 years of age were studied over a period of 12 months February 2015 to January 2016 at our tertiary care centre. History and relevant investigations were done. **Result:** The study included 200 children. The overall prevalence rate of urinary tract infection in the present study was 5.5% with prevalence in children 1-2 years of age 2%. 13.5% of cases showed significant pyuria. Among pyuric patients 40.74% were culture positive with a M:F of 1.2:6. USG done in significant pyuric cases revealed renal involvement /anomaly in 6 cases. **Conclusion:** Clinicians should consider obtaining a urine specimen as part of their diagnostic evaluation as urinary tract infection is a possibility in febrile children. Pyuria of  $\geq 5$  pus cells /HPF in 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 sequelae.

**Key words:** Children, Culture and sensitivity, Fever, Pyuria, Urinary tract infection.

## Introduction

Fever is the most common reason for children between one to five years of age to visit Emergency / outpatient departments. Unlike occult bacteremia or severe bacterial illness, little attention has been focused on the identification of urinary tract infections in febrile children in the emergency department, despite recent information suggests a high prevalence of urinary tract infections and significant associated morbidity in these patients. Urinary Tract Infections (UTI) affects approximately 7% to 8% of girls and 2% of boys during the first 8 years of life.

Fever and significant bacteriuria and pyuria in children with undocumented sources of infections must be presumed to be symptoms of Acute Pyelonephritis (APN), an invasive infection of the renal parenchyma requiring prompt treatment [1, 2]. High fever with temperature of  $39.5^{\circ}\text{C}$  or more is the single best predictive parameter [3,4]. The risk of APN increases when bladder infection occurs in patients Vesicoureteral reflux (VUR), because colonized lower tract urine then has direct retrograde access to the upper tract [5].

Pyelonephritis leads to renal scarring in 27% to 64% of children with urinary tract infections in this age group, even in the absence of underlying urinary tract abnormalities [6,7].

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A study from Sweden showed that focal renal scarring caused by Pyelonephritis in children carried a risk of 23% for hypertension, 10% for end - stage renal disease, and a risk of 15% for toxemia during pregnancy as an adult [8].

The present study was undertaken to estimate the frequency of urinary tract infection in febrile children of 1-5 years of age and to assess the validity of routine microscopic urine analysis and urine culture in the diagnosis of Urinary Tract infection.

### Aims and objectives

The study was undertaken to determine the frequency of urinary tract infection in febrile children between one to five years of age and to assess the validity of routine microscopic urine analysis and urine culture in the diagnosis of urinary tract infection.

### Materials and Method

The study was conducted in the department of pediatrics, GSL Medical College, Rajahmundry, for duration of 12 months from February 2015 to January 2016.

Febrile (rectal  $\geq 38.3^{\circ}\text{C}$  or axillary temperature  $\geq 37.8^{\circ}\text{C}$ ) children between one to five years attending the outpatient department or admitted in the hospital were included in the study.

Children who have received antibiotics 48 hours prior or those with known congenital genitourinary anomalies were excluded from the study. About 200 children were included in the study.

The data related to age, gender, nutritional status, socioeconomic status and predisposing risk factors like urethral instrumentation, bowel and bladder habits

### Results

The study included 200 children during the study period after excluding the children mentioned above. There was slight female predominance with male female ratio of 1:1.15; 93 (46.50%) were males, 107 (53.50%) were females (table1). Children less than two years of age were 89 (44.5%).

Most of the children in the study were below three years of age, 150 (75%). Youngest child in the study group was 1 year old and eldest child in the study group was 5 years old.

were noted. A complete history related to the onset, duration of fever and associated symptoms such as nausea, vomiting, diarrhea, pain abdomen, urinary disturbances, other systems involvement was obtained.

A thorough physical examination followed by blood counts, urine analysis was done. In children between one to two years of age, urine was collected by a bag, and midstream sample was collected in toilet trained children.

The urine specimens were centrifuged in a standard manner, 10ml of urine was spun at the rate of 2500 rpm for 20-30minutes, supernatant discarded off and wet mount was prepared with the sediment which was examined under microscope for hematuria, and leukocyturia.

In the present study  $\geq 5$  pus cells/HPF in a centrifuged urine sample was taken as significant pyuria and urine culture and sensitivity was performed in those cases by inoculating into blood and Mac conkey agar plates with a 0.01ml calibrated loop.

All plates were incubated at  $35-37^{\circ}\text{C}$  for 24hrs under aerobic condition to obtain accurate colony count.

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 of urine. Samples showing insignificant growth, mixed growth of two or more pathogens or growth of non-pathogens were not considered as culture positive.

Ultrasonography (USG) of abdomen was done in culture positive cases, one Dimercaptosuccinic acid (DMSA) scan and one Voiding Cystourethrogram (VCUG) was done.

**Table- 1: Age and gender Wise Distribution of Study Subjects.**

Age (In months)	Gender					
	Male		Female		Total	
	Number	%	Number	%	Number	%
12 – 24	32	36.0%	57	64.0%	89	100.0%
25 – 36	42	68.9%	19	31.1%	61	100.0%
37 – 48	10	38.5%	16	61.5%	26	100.0%
49 – 60	9	37.5%	15	62.5%	24	100.0%
Total	93	46.5%	107	53.5%	200	100.0%

In this study 27 children (13.5%) showed pyuria in centrifuged urine sample of which 11 (40.7%) were males and 16 (59.3%) were females. Age and gender wise distribution of these are shown in table 2. Majority (40.74%) were between 1- 2 years of age.

**Table- 2: Age and gender wise distribution of patients with urine  $\geq 5$  pus cells/hpf.**

Age (in months)	Gender					
	Male		Female		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
12 – 24	4	36.4%	7	63.6%	11	100.0%
25 – 36	3	42.9%	4	57.1%	7	100.0%
37 – 48	3	50.0%	3	50.0%	6	100.0%
49 – 60	1	33.3%	2	66.7%	3	100.0%
Total	11	40.7%	16	59.3%	27	100.0%
Chi square calculated value is 0.382 for 3 d.f and P-Value 0.944 (Not Significant)						

Majority of children belong to lower middle class (female - 53.8%; male 46.2%) according to modified Kuppu Swamy Scale of Socio Economic Status. The details are shown in table 3.

**Table- 3: Socio economic status and sex wise distribution with urine showing  $\geq 5$  pus cells/hpf.**

Socio Economic Status	Sex					
	Male		Female		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Upper Class	0	0.0%	0	0.0%	0	0.0%
Upper Middle	2	50.0%	2	50.0%	4	100.0%
Lower Middle	6	46.2%	7	53.8%	13	100.0%
Upper Lower	1	16.7%	5	83.3%	6	100.0%
Lower	2	50.0%	2	50.0%	4	100.0%
Total	11	40.7%	16	59.3%	27	100.0%
Chi square calculated value is 1.882 for 3 d.f and P-Value 0.597 (Not Significant)						

In this study, among 200 children, 27 (13.5%) showed significant pus cells in urine, 81.4% of children with pyuria showed 5 -10pus cells / HPF and 18.5% showed more than 10 pus cells/ HPF.

In the study, growth ( $> 10^5$  CFU/ml) of single organism was considered significant growth. In children with pyuria, 16 (59.25%) showed no significant growth and 11 (40.7%) showed positive growth on urine culture. Gender distribution of urine culture is shown in table 4. Among positive cultures, E.coli was the bacteria most frequently isolated; the other organisms isolated were Klebsiella, Pseudomonas aeruginosa, and Serratia species as shown in table 5.

**Table- 4: Urine analysis of subjects.**

Pyuria	Sex					
	Male		Female		Total	
	Number	percentage	Number	percentage	Number	Percentage
< 5	82	47.4%	91	52.6%	173	100.0%
5-10	9	40.9%	13	59.1%	22	100.0%
>10	2	40.0%	3	60.0%	5	100.0%
Total	93	46.5%	107	53.5%	200	100.0%
Chi square calculated value is 0.418 for 2 d.f and P-Value 0.812 (Not Significant)						

**Table- 5: Distribution of urine culture.**

ORGANISM ISOLATED	Sex					
	Male		Female		Total	
	Number	%	Number	N %	Number	%
No growth/ Contaminated	8	50.0%	8	50.0%	16	100.0%
E.COLI	0	.0%	6	100.0%	6	100.0%
KLEBSIELLA	1	50.0%	1	50.0%	2	100.0%
Pseudomonas aeruginosa	1	50.0%	1	50.0%	2	100.0%
SERRATIA sp	1	100.0%	0	.0%	1	100.0%
<b>Total</b>	<b>11</b>	<b>40.7%</b>	<b>16</b>	<b>59.3%</b>	<b>27</b>	<b>100.0%</b>

Though children with known congenital genitourinary anomalies were excluded in the study, USG was done in all significant pyuric cases (table 6); renal involvement / anomaly was seen in six children (54.54%) of which two were males, four were females. Twenty one children showed no significant radiological abnormality. One case showed DMSA & VCUG abnormality.

**Table- 6: Abdominal USG findings in culture positive children.**

Abdominal ultra sound	Sex		Total
	Male	Female	
Bilateral hydronephrosis with thickened bladder wall with cystitis		1	1
Crossed fused ectopic left kidney/mild hepatosplenomegaly	1		1
Evidence of large bladder calculi		1	1
Features suggestive of bilateral moderate hydronephrosis		1	1
Massive hydronephrosis (lt side)		1	1
Rt sided hydronephrosis with PUJ obstruction with dysplastic kidney	1		1
Suggestive of hepatosplenomegaly		1	1
No significant radiological abnormality	1	4	1
<b>Total</b>	<b>3</b>	<b>8</b>	<b>11</b>

**Table- 7: Symptoms and signs in culture positive cases (N=11).**

	Symptoms and Signs	culture positive cases	PERCENT(%) Approx
1	Fever	11	100
2	Dysuria	6	55
3	Vomiting	3	63
4	Chills & rigors	7	27
5	Passing high colored urine	5	64
6	Burning micturition	6	55
7	Refusal of feeds	5	45
8	Foul smelling urine	1	1
9	Abdominal pain	4	36
10	Temperature $\geq 37.8^{\circ}$ C	11	100
11	Ill toxic appearance	6	55
12	Supra pubic tenderness	4	36
13	Phimosis	3	27
14	Puffiness of face	1	1
15	Hypertension	1	1

Among the culture positive cases, fever (temperature of  $\geq 37.8^{\circ}\text{C}$ ) is most common symptom (100%), followed by passing of high colored urine (64%) and vomiting (63%). Ill toxic look (55%) and suprapubic tenderness (36%) were also found (table 7).

## Discussion

Urinary tract infections are common, potentially serious infections of childhood. It may lead to renal scarring, hypertension, and end stage renal disease. Although children with pyelonephritis tend to present with fever, it can be difficult on clinical grounds to distinguish cystitis from pyelonephritis, particularly in young children (those younger than two years) [9]. Its diagnosis in young children is important as it may be the marker of urinary tract abnormalities. Early diagnosis is important to preserve renal function of the growing kidney.

UTI is one of the most important risk factor for development of renal insufficiency or end stage renal disease. A high index of suspicion is required for the diagnosis as signs and symptoms in younger age group are not localized. Therefore, early detection and therapy are needed to prevent scarring and further renal damage [10]. Accurate diagnosis of UTI is important 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.

A total of 200 febrile children were included in the study, among them, 93 (46.50%) were males and 107 (53.50%) were females with Male: Female ratio 1:1.1 and majority of them i.e.75 % were between one to three years of age. Out of 200 children, 27 children showed significant pyuria (11 cases male and 16 female.); amongst these, 11 cases showed bacterial growth.

The overall prevalence is 5.5%, which is comparable to many studies. Roberts k.et al [11] have reported prevalence of 4.1% and Fallahzadeh M.H et al [12] have reported a similar prevalence of 4.4%. Shaikh N et al [13] and Bauchner et al [14] have reported a prevalence rate of 7.8% and 8% respectively.

In this study prevalence of UTI in 1-2 years age group was 2% which was similar to that reported by P. R. Srivastha et al [15] which is 2.48% in children <2 years. Shaikh N, et al [13] have reported a prevalence of 4.5% in this age group (table 8).

**Table- 8: Comparative analysis of prevalence and gender distribution.**

S.no	Study	Prevalence		Male: female ratio
1	Shaikh N, et al [13]	12-24 mon	4.5%	
		1-5yrs	7.8%	
2	Bauchner et al [14]	12-24 mon	5.4%	
		1-5yrs	8%	
3	Roberts k.et al [11]	4.1%		
4	Fallahzadeh M.H et al[12]	4.4%		1:10
5	Jack S Elder et al [16]			1:10
6	Present study	12-24 mon	2%	1:2.6
		1-5yrs	5.5%	

In this study, significant pyuria was more prevalent in females [11(40.7%) were males and 16 (59.3%) were females], and was more common in one to three years age group [18 (66.7%)] than in three to five years age [9 (33.3%)].

Amongst 27 significant pyuric cases sent for urine culture 11 cases showed growth, of which 3 were males and 8 were female giving overall incidence of 3.32% in males and 7.47% in females with male: female ratio of 1:2.6 which is similar to Jack S Elder et al [16] (table 8). This can be easily attributed to short urethra in female. Male: female ratio of culture positive cases in the age group of 12-24 months was 1:1.5 and above 24 months it was 1:2.5. As the age advances prevalence is more in female children.

There was no consistent symptom common to all patient with UTI other than fever. However chills and rigors, burning micturition, dysuria are were the predominant symptoms, with other nonspecific refusal of feeds, vomiting,. Hypertension was noted in one case with UTI which is similar to the observation made by Jaya et al [17]. Fever appears to be consistently present in children with urinary tract infection; no other signs or symptoms accurately predict the presence of urinary tract infection. Most of the children had no other signs other than fever indicating the importance of recognition of UTI in such patients.

In the present study 45% of children who showed pus cells >10 /HPF were culture positive and 27.27% of children showing  $\geq 5$ pus cells were culture positive. Hence the presence of  $\geq 5$  leukocytes/HPF in a centrifuged sample is a significant indicator of UTI but pus cells in urine does not always indicate UTI. They can be noted in any inflammatory condition of the renal system such as Glomerulonephritis, Systemic lupus erythematosus, Henoch Schonlein Purpura vasculitis etc.

Gram- negative bacilli were isolated from all culture positive cases. The organisms isolated were *Escherichia coli* 54.54% and 18.18% each of *Pseudomonas aeruginosa* and *Klebsiella*, *Serratia* species 9%, which correlates with other studies. Bryan C.S et al [18] reported *E. coli* as the common urinary pathogen in 85% of cases, this result is nearly similar to Arvind Bagga et al [19] who reported about 90% of first symptomatic urinary tract infection and 70% of recurrent infections are due to *E. coli*.

According to Srivaths P.R et al [15] , *E. coli* was the most common bacteriological agent isolated from UTI cases, similar to the studies by Bell LE, et al [20] and Bensman A et al [21] in which , it accounted for 80% of UTI. Other organisms *Klebsiella*, *Proteus*, *Enterobacter* and *Enterococcus* species can also cause UTI.

According Mohammed et al [22], of the 920 tested sample, 100 samples showed growth of pathogens among which the most prevalent were *E. coli* (61%) followed by *Klebsiella* spp (22%). The majority (66.66%) of the isolates were from female while the remaining was from male ( table 9).

**Table- 9: Analysis of culture report.**

Organism isolated	Mohammed et al [22]	Present study
<i>E. coli</i>	61%	54.54%
<i>Pseudomonas aeruginosa</i>	4.0%	18.18%
<i>Klebsiella</i>	22%	18.18%
<i>Serratia spp</i>	-	9.10%
<i>S.aureus</i>	7.0%	-
<i>A. baumannii.</i>	3.0%	-
<i>Citrobacter spp.</i>	2.0%	-
<i>E. faecalis</i>	1.0%	-

This is consistent with the findings of previous studies in which *E. coli* was the predominant pathogen isolated from patients with UTIs. In the present study the majority (72.72%) of the isolates were from female while the remaining was from male.

Studies by Copp et al [23] and Dahle et al [24] reported *E. coli* as most commonly isolated organism in pediatric UTI with prevalence ranging from 80 to 90 percent, followed by others such as *Enterococcus* species, *Enterobacter* species, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Proteus mirabilis* and *Staphylococcus* species.

Because of economic constraints urine cultures were done only in children who showed significant pyuria which revealed positive culture in 40.74%. Hence validity of urine examination could not be accurately ascertained. Though children with known congenital genitourinary anomalies were excluded in the study, USG done in all significant pyuric cases revealed renal involvement / anomaly in 6 cases (54.54%) among 11 cases, 2 were males 4 were females. Five cases showed no significant radiological abnormality. One case showed DMSA & VCUG abnormality.

Among the 11 children with culture proven UTI, one child who underwent VCUG scan had Vesicouretral reflux (VUR). Renal scarring was noted in the child who underwent DMSA scan. DMSA scan is a useful investigation for the diagnosis of renal scarring and it is indicated in febrile children with recurrent UTI after the febrile period is over. An abnormal DMSA is a strong indication for work up for VUR.

## Conclusions

Clinicians 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.

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.

Present study reveals overall prevalence of UTI (5.5%) in febrile children 1 year to 5 years and 2% in children 1-2 years of age. Radiological evaluation plays an important role in culture positive cases of UTI.

In the study urine culture was done in only those children showing significant pyuria of  $\geq 5$  pus cells/

HPF of centrifuged urine sample and found that 40.74% of febrile pyuric children were culture positive. Hence we conclude that pyuria of  $\geq 5$  pus cells /HPF in 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 sequelae.

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