

Clinical and microbiological profile of urinary tract infection in children less than five years of age

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ABSTRACT

Background: Urinary tract infection (UTI) is a common bacterial illness of pediatric age group. UTIs, especially in young children, have non-specific signs and symptoms that can be undetected or misdiagnosed. Delaying diagnosis and treatment of UTIs may result in long-term renal complications. **Objectives:** The objectives were to study the clinical presentation of UTI, common uropathogens, and antimicrobial sensitivity pattern among children <5 years of age. **Materials and Methods:** This is a hospital based prospective descriptive study which included 100 children <5 years of age who presented with UTI over a period of 1 year. Detailed history, clinical examination, and laboratory investigations including urine analysis and culture were documented. **Results:** Out of the 100 children below 5 years who presented with UTI, 32% were below 1 year age. Male to female ratio in our study was 2.8:1. The most common presenting symptom was fever followed by crying during micturition. 92% of the cases had significant pyuria. *Escherichia coli* is the most common pathogen isolated (68%), followed by *Klebsiella* and *Enterococcus*. 62% had abnormal ultrasonography findings, most common being hydronephrosis (36%). **Conclusions:** The presentation of pediatric UTIs varies widely with age and sex. Knowledge of the varied presentation of UTI, its risk factors and local antimicrobial sensitivity patterns are of great significance in preventing future complications in children.

Key words: Culture and sensitivity, *Escherichia coli*, Pyuria, Urinary tract infection

It is one of the most common serious bacterial illnesses affecting children, particularly infants and young children [1,2]. It is estimated that around 2% of boys and 8% of girls will experience a urinary tract infection (UTI) by 7 years of age, and 7% of febrile infants will have a UTI [3,4]. The prevalence and incidence of pediatric UTI vary by age, sex, race/ethnicity, and circumcision status of the children [4]. There is a wide spectrum of clinical features in pediatric UTI that varies with different age group, leading to underdiagnosis and misdiagnosis.

The microbiological profile of UTI and the antibiotic susceptibility of uropathogens in both the community and hospitals have been changing, and drug resistance has become a major problem. UTIs may be the sentinel event for underlying renal abnormality, although normal anatomy is more common [5]. Imaging studies are the standard of care for young children with UTI. It is of utmost importance to identify possible abnormalities of the urinary tract such as vesicoureteric reflux, ureterocele, obstruction of urinary tract, acute inflammation, and renal scarring that may predispose the child to recurrent infections or adverse long-term outcomes.

The aim of the study is to describe the clinical and microbiological profile of UTI among children <5 years in a tertiary care hospital in Bengaluru.

MATERIALS AND METHODS

It is a prospective descriptive study conducted in a tertiary care hospital in Southern India over a period of 1 year (January 2016 to December 2016). All children below 5 years of age presented to the hospital with symptoms of UTI and a positive urine culture were included in the study. Children, who have received antibiotics 48 h before evaluation, and neonates (<28 days), were excluded. A written informed consent for the study was taken from the parents. A detailed history of the present complaints including the bowel and bladder habits, any antenatally detected abnormalities and previous history of UTI was taken in a systematically designed pro forma (Table 1). A detailed clinical examination was done. Urine sample collected using midstream clean catch method or by bladder catheterization for incentive care unit patients. Parents were explained in detail about the method of collecting clean catch urine with the help of posters, to avoid contamination of the sample.

Midstream urine was collected by cleansing the perineum and meatus before collection with antiseptic solution and collecting the urine in the middle of the stream after retracting the labia and foreskin. Catheterized samples were directly taken from the catheter.

Significant pyuria is defined as >10 leukocytes per cumm in a fresh uncentrifuged sample or >5 leukocytes per high power

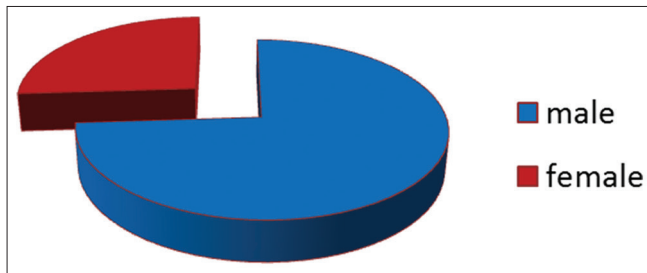


Figure 1: Sex distribution of the urinary tract infection cases

field in a centrifuged sample. Children with positive urine culture were enrolled in the study and antibiotics changed according to sensitivity pattern and continued for 10–14 days. Culture positive patients were subjected to further imaging studies according to the age of the child as per ISPN guidelines 2011 [6]. The details of the study were entered into an Excel sheet and analyzed. Comparison of proportions between the two age categories was done using Chi-square test or Fisher's exact test. p value of <0.05 was considered significant.

RESULTS

A total of 100 children presented with culture-positive UTI during the study period, of which 32% were <1 years age and 68% were between 1 and 5 years age. Majority of the children were males (74%). Males were significantly more in <1 year age group compared to older children ($p = 0.029$). The age and sex distribution of these cases were as shown in Table 2 (Fig. 1).

The most common presenting symptom was fever (76%) followed by crying during micturition (46%). Refusal to feed and irritability were more common in children <1 year while fever is more common in older children (Table 3).

Nearly 92% of the cases with urine culture positive had significant pyuria. *Escherichia coli* is the most common pathogen isolated (68%), followed by *Klebsiella* (22%) and *Enterococcus* (4%). Out of 100 urine culture positive cases, first line antibiotics such as amikacin, cotrimoxazole, and gentamicin had higher sensitivity (Tables 4 and 5). 80% of the cases were sensitive to piperacillin-tazobactam. Among the 68 cases with *E. coli* growth, more than 50% were sensitivity to aminoglycosides, cotrimoxazole, nitrofurantoin, and piperacillin-tazobactam.

Out of the 62 cases with abnormal ultra-sonogram findings, hydronephrosis was the most common finding seen in 36% of cases, followed by bladder wall thickening in 32% of cases and dilated ureter in 28% of cases. 48% of cases had abnormal micturating cystourethrogram finding. Vesicoureteric reflux was identified in 87.5% of them. 48% of cases had an abnormality in technetium-99m-labelled dimercaptosuccinic acid renal scan (DMSA) scan.

DISCUSSION

A total of 100 cases were included in the study, with a male to female ratio of 2.8:1. Similar study was conducted by Lee *et al.* which included a total of 699 children aged 2–24 months observed a male to female ratio of 2.2:1 [7]. A study by Taneja

Table 1: Pro forma used to collect details of the cases

Name
Age
Sex
ID no
Address
Phone no
Clinical presentation
Fever
Dysuria/cry during micturition
Frequent micturition
Pain abdomen
Diarrhea
Constipation
Failure to thrive
Vomiting/nausea
Irritability
Refusal to feed
Altered urine color
Urethral discharge
Foul smelling urine
Previous episodes of UTI
Birth history
Others
Urine routine
Albumin
Sugar
Pus cells
Epithelial cells
RBC
Urine culture
Method of collection
Growth/colony count
Sensitive to
Resistant to
Other investigations
B. urea
S. creatinine
Others
Treatment given
USG abdomen and pelvis
MCU
DMSA

UTI: Urinary tract infection, MCU: Micturating cystourethrogram, DMSA: Technetium-99m-labelled dimercaptosuccinic acid renal scan

et al. which studied 558 children with culture-proven UTI below 12 years age, noted a ratio of 4.3:1.0 among children <1 year, and 2.5:1 in children between 1 and 5 years age [8].

In our study, fever (76%) is the most common presenting symptom in both the age groups, followed by dysuria (46%) and increased frequency (30%). This is comparable to the results noted in studies by Singh and Madhup, Saleh *et al.*, and Bay [9–11]. We can note that non-specific symptoms like refusal of feeds and

Table 2: Age and gender distribution of study participants (n=100)

Gender	n (%)		
	<1 year	1–5 years	Total
Male	30 (93.7)	44 (64.7)	74 (74.0)
Female	2 (6.3)	24 (35.3)	26 (26.0)
Total	32 (100.0)	68 (100.0)	100

Fisher's exact p=0.029

Table 3: Presenting symptoms of study participants (n=100*)

Symptoms	n (%)		
	<1 year (n=32)	1–5 years (n=68)	Total (n=100)
Fever	16 (50.0)	60 (88.2)	76 (76)
Dysuria/crying during micturition	12 (37.5)	34 (50.0)	46 (46)
Frequent micturition	8 (25.0)	22 (32.4)	30 (30)
Pain abdomen	0 (0.0)	10 (14.7)	10 (10)
Diarrhea	6 (18.8)	8 (11.8)	14 (14)
Constipation	0 (0.0)	2 (2.9)	2 (2)
Failure to thrive	4 (12.5)	4 (5.9)	8 (8)
Vomiting/nausea	4 (12.5)	6 (8.8)	10 (10)
Irritability	12 (37.5)	2 (2.9)	14 (14)
Refusal to feed	12 (37.5)	4 (5.9)	16 (16)

*Multiple responses allowed

Table 4: Comparison of urine culture results of study participants (n=100)

Uropathogen	n (%)		
	<1 year	1–5 years	Total
<i>E. coli</i>	20 (62.5)	48 (70.6)	68 (68.0)
Enterobacter	0 (0.0)	2 (2.9)	2 (2.0)
<i>Enterococcus</i> *	2 (6.3)	2 (2.9)	4 (4.0)
<i>Klebsiella</i>	8 (25.0)	14 (20.6)	22 (22.0)
Proteus	0 (0.0)	2 (2.9)	2 (2.0)
<i>S. aureus</i>	2 (6.3)	0 (0.0)	2 (2.0)
Total	32 (100.0)	68 (100.0)	100

*Includes a case with both *Enterococcus* and *Candida*, *S. aureus*: *Staphylococcus aureus*, *E. coli*: *Escherichia coli*

Table 5: Urine culture sensitivity of study participants (n=100*)

Sensitive antibiotic	<1 year	1–5 years	Total
	n (% out of 32)	n (% out of 68)	n (% out of 100)
Amikacin	22 (68.8)	50 (73.5)	72 (72)
Gentamicin	20 (62.5)	38 (55.9)	58 (58)
Piperacillin-Tazobactam	24 (75.0)	56 (82.4)	80 (80)
Nitrofurantoin	18 (56.3)	30 (44.1)	48 (48)
Cotrimoxazole	22 (68.8)	48 (70.6)	70 (70)
Cefepime	8 (25.0)	12 (17.6)	20 (20)
Nalidixic acid	2 (6.3)	0 (0.0)	2 (2)
Ciprofloxacin	2 (6.3)	8 (11.8)	10 (10)
Vancomycin	4 (12.5)	2 (2.9)	6 (6)
Cefoperazone	2 (6.3)	0 (0.0)	2 (2)
Cefuroxime	0 (0.0)	4 (5.9)	4 (4)

*Multiple responses allowed

irritability are more common among infants presenting in around 37.5% of cases in that age group. We can appreciate a wide spectrum of symptoms and signs in children with UTI. Hence, a high index of suspicion is required, and urine culture is essential for the diagnosis of UTI.

The most common causative agent of UTI in the present study was *E. coli* (68%) followed by *Klebsiella* (22%). A study by Gupta *et al.* on 186 culture-proven UTI cases showed similar results with *E. coli* being the most common pathogen, seen in 52% cases.

The antibiotic sensitivity pattern in our study showed more than 70% of organisms being sensitive to amikacin and cotrimoxazole among the first line. Piperacillin-tazobactam was found to be a good second line antibiotic. A study by Gupta *et al.* found most of the organisms sensitive to nitrofurantoin followed by cefoperazone sulbactam and aminoglycosides [12]. According to the study on UTI by Singh and Madhup 80% of the cases were sensitive to amikacin, gentamicin, ceftriaxone, ofloxacin, nalidixic acid, imipenem, and vancomycin [9]. However, these two studies have included children of older age groups also. High sensitivity of *E. coli* to aminoglycosides and nitrofurantoin was also observed by Gupta *et al.*

Hydronephrosis, bladder wall thickening and dilated ureter were the common abnormalities seen in ultrasonogram. Other anomalies noted include pelviectasis, renal atrophy, calculus, and horseshoe kidney. In a prospective study by Nelson *et al.*, who studied 2259 cases of UTI below 5 years of age, abnormal USG findings were noted in 25% of case with hydronephrosis being the most common finding [13]. There is wide variation in the percentage of cases with abnormal USG in different studies. The relatively higher frequency of abnormality in our study can be attributed to the inclusion of cases with antenatally detected abnormalities also.

CONCLUSION

Our results indicate that UTI varies with age and gender. Due to their higher incidence, extensive evaluation is required in boys

below 1 year of age with UTI. This is due to higher incidence of anatomical abnormalities in this group. Knowledge on local microbiological profile and its sensitivity pattern is essential to choose appropriate empirical antibiotics and to prevent long-term sequelae following UTI.

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