

Original Research Article

The causative microorganisms and the underlying urological anomalies in children with urinary tract infection

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ABSTRACT

Background: Urinary tract infection (UTI) is among the most common bacterial infection in children and may be a presentation of variety of underlying urinary tract abnormalities. It is important to diagnose and treat UTI to prevent the long-term complications like renal scarring, hypertension and chronic renal failure. The aim of this study was to find the causative organism and underlying urological anomalies in children with UTI.

Methods: A prospective study was carried in children (aged between one month to 12 years) admitted with symptomatic UTI in a tertiary hospital from May 2013 to June 2017. The children were investigated for UTI and the urine culture was positive in 121 patients. The confirmed cases of UTI were subjected to imaging studies as per guidelines. Final study included 116 patients as five patients were excluded due to incomplete investigations.

Results: Out of 116 patients, 26 (22.41%) were below 1 year, 68 (58.62%) were between 1 to 5 year and 22 (18.96%) were more than 5 years of age. There were 44 (37.93%) males and 72 (62.06%) females. *E. coli* was the commonest organism causing UTI (78.44%). Urinary tract abnormalities were found in 49 (42.24%) cases. VUR was detected in 23 (46.9%). The other urinary tract abnormalities observed include pelviureteric junction (PUJ) obstruction, posterior urethral valve, urolithiasis, bladder neck obstruction, ureterocele, ectopic kidney, cystic kidney, bladder diverticulum, Extrarenal pelvis, and renal scar respectively.

Conclusions: In view of underlying urological anomalies and potential for renal parenchymal damage, UTI should be diagnosed at an earliest and imaging studies should be done in all confirmed cases as per guidelines.

Keywords: Organism, Urological anomaly, Urinary tract infection, Vesicoureteric reflux

INTRODUCTION

Urinary tract infection (UTI) is among the most common bacterial infection in children. UTI may be a presentation of variety of underlying urinary tract abnormalities. It is important to diagnose and treat UTI to prevent the long-term complications like renal scarring, hypertension and chronic renal failure.^{1,2} Proper urine culture is necessary for a reliable diagnosis.³ Literature reveals that the imaging studies done following an episode of UTI show a high incidence of abnormalities in the renal tract, with vesicoureteric reflux (VUR) in 30-50%, obstructive

uropathies in 1-4% and evidence of renal parenchymal damage present in 1.6-15%.^{4,5}

The aim of this study was to find the causative organisms and to determine the associated urological anomalies in children with UTI.

METHODS

The prospective study was carried in a tertiary hospital from May 2013 to June 2017. The study enrolled all the children aged one month to 12 years, who presented with

first proven UTI. Children presenting with symptoms like fever without focus, dysuria, frequency, urgency and abdominal/ flank pain with or without fever were investigated for UTI.

Patients receiving prior antibiotic therapy were excluded from the study. The patients were examined clinically. All patients had complete blood count, renal function tests, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), urinalysis, urine culture and sensitivity.

Urine samples were taken either by suprapubic aspiration, midstream clean catch technique, catheterization or sticking of a sterile bag according to age of the patient. The urine samples were transferred to the microbiology laboratory within half an hour and were inoculated into the MacConkey agar and blood agar.

The diagnosis of UTI was based on signs and symptoms of UTI such as sepsis in the newborn, fever, abdominal/flank pain, dysuria, and urinating frequency and a colony of at least 10^5 organisms/milliter in a midstream, clean voided specimen, 10^3 or more organisms/milliter in a catheterized urine or any growth in a suprapubic aspiration urine specimen.⁶

Total 121 patients were diagnosed of UTI. All patients received appropriate antibiotics for 10 - 14 days to control the infection and underwent radiological evaluation according to the Guidelines on Revised Statement on Management of Urinary tract infections formulated by the Indian Society of Pediatric Nephrology.⁷

Renal and urinary tract Ultrasonography (USG) was performed in all children within 2 to 3 days of admission to the hospital. 52(44.82%) patients were subjected to Micturating Cystourethrogram (MCU) after 6 weeks, the UTI when urine culture proved negative. Vesicoureteric reflux(VUR) was classified according to the international reflux study classification.⁸ Dimercaptosuccinic acid (DMSA) scan was performed in 94(81.03%) to evaluate renal scarring and split renal function.

A kidney uptake of 45%–55% of the total renal activity was considered normal. Renal scar was defined as focal or generalized areas of diminished uptake of the isotope associated with loss or contraction of function renal cortex. Out of 121 patients of UTI, 5 patients did not complete the radiological investigations and hence were excluded from the study. The final analysis was made in 116 patients.

Statistical analysis

Data were coded and entered into MS-Excel sheet. Statistical analysis was done using software SPSS 20 version. Descriptive and inferential statistics were used. Data were presented in percentages and tabular form.

RESULTS

Out of 116 patients, 26 (22.41%) were below one year, 68 (58.62%) were between 1 to 5 year and 22 (18.96%) were more than 5 years of age (Table 1). There were 44 (37.93%) males and 72 (62.06%) females (Table 2).

The most common organism causing UTI was *E. coli* isolated in 91 (78.44%) cases followed by *Klebsiella* in 12 (10.34%), *Proteus* in 11 (9.48%) and *Enterobacter* in 2 (1.7%) cases (Table 3).

Table 1: Age wise distribution of UTI.

AGE	Number	Percentage
less than 1 year	26	22.41
1 to 5	68	58.62
More than 5	22	18.96
Total	116	100

Table 2: Sex distribution of UTI.

Sex	Number	Percentage
Male	44	37.93
Female	72	62.06
Total	116	100

Table 3: Microorganisms isolated from urine cultures.

Microorganisms	Number	Percentage
<i>E. coli</i>	91	78.44
<i>Klebsiella</i>	12	10.34
<i>Proteus</i>	11	9.48
<i>Enterobacter</i>	02	1.7

Urinary tract abnormalities were found in 49 (42.24%) cases (Table 4).

Table 4: Findings of radiological studies (urological abnormalities type, number and VUR without other abnormalities) and their sex distribution.

Type of abnormality	N (%)	Male	Female
VUR	23 (46.9)	11	12
Pelviureteric junction obstruction	7 (14.2)	5	2
Posterior urethral valve	5 (10.2)	5	0
Urolithiasis	3 (6.1)	2	1
Ureterocele*	2 (4.08)	1	1
Bladder neck obstruction	2 (4.08)	0	2
Ectopic kidney	2 (4.08)	1	1
Cystic kidney	1 (2.04)	0	1
Bladder diverticulum	1 (2.04)	1	0
Extra renal pelvis	1 (2.04)	0	1
Renal scar	2 (4.08)	1	1
Total	49	27	22

*Had associated VUR

VUR was detected in 23 (46.9%) cases out of which 11 (47.8%) were males and 12 (52.17%) were females (Table 5). Grade-wise VUR was grade 1 in 4 (17%), grade 11 in 4 (17%), grade 111 in 5 (21.7%), grade 1V in 6 (26.08%) and grade V in 4 (17%) cases respectively. Only 6 cases had bilateral VUR.

The other urinary tract abnormalities observed include pelviureteric junction (PUJ) obstruction in 7 (14.2%), posterior urethral valve in 5 (10.2%) boys, urolithiasis in 3 (6.1%), bladder neck obstruction in 2 (4.08%), ureterocele in 2 (4.08%), ectopic kidney in 2 (4.08%), cystic kidney in 1 (2.04%), bladder diverticulum in 1 (2.04%), Extrarenal pelvis in 1 (2.04%), and renal scar without any abnormality in 2 (4.08%) cases respectively.

Table 5: Grades of VUR.

Grade of VUR	N (total= 23)	Male (N=11)	Female (N=12)
1	4	2	2
11	4	2	2
111	5	2	3
1V	6	3	2
V	4	2	3

DISCUSSION

Infants and children are at a greater risk of acute kidney injury following UTI. Congenital anomalies of the urinary tract are well known causes of UTI in children.⁹ In present study 81.03% patients of UTI were less than 5 years of age, majority (58%) of them being between 1 to 5 years of age and females outnumbered the boys. An observation from Sudan showed that 74% of affected children with UTI were less than 5 years, and 35% were infants.¹⁰ Similar observations were also reported in many other studies.^{11,12} However, present results differed from the report of So and Davies where 86% of boys and 60% of girls presented in the first year.¹³ Hoberman et al and Downs also reported a female predominance in UTI cases similar to our study.^{14,15} E.coli was the predominant organism causing UTI in present study, isolated in 91 (78.44%) cases, followed by Klebsiella 12 (10.34%), Proteus 11 (9.48%) and Enterobacter 2 (1.7%) respectively. Present results are similar to many published studies.^{11,16,17} However, many published studies have reported Klebsiella as the commonest organism isolated in urine cultures and very low incidence of Ecoli causing UTI.¹⁸⁻²¹ This difference could be because of difference in demography and sampling techniques in different studies. In present study the associated urological anomalies were detected in 42.24% cases of symptomatic UTI. Aboud et al reported 43% urinary tract abnormalities in their study.¹² The prevalence of VUR in children with UTI varies among different racial groups, being highest in white children with symptomatic UTI. Studies from the United States, United Kingdom, and Italy show the highest prevalence of VUR (41%-63%).²²⁻²⁴ The lowest prevalence for VUR

in children with UTI was 18.3% reported in an Asian study.²⁵ In present study VUR was the most common associated abnormality detected in 23 (46.9%) patients, of these 11 (47.8%) were boys and 12 (52.17%) were girls. Present results were similar to findings reported by Howard et al, which reported the presence of VUR in 39% of symptomatic Chinese children with UTI.²⁶ In present study associated urological anomalies other than VUR were detected in 26 (53%) patients. Among these PUJ obstruction was the predominant abnormality detected in 14 cases, PUV 10.2%, urolithiasis 6.1%, bladder neck obstruction, ureterocele, ectopic kidney 4% each, cystic kidney, bladder diverticulum, extrarenal pelvis and renal scar 2% each respectively. In the study conducted by Aboud et al associated abnormality other than VUR was detected in 21 (44.6%) cases, renal stone 11 (23.4), obstructive hydronephrosis 6 (12.7%), neurogenic bladder 3 (6.3%), PUV 2 (4.2%) and ureterocele 1 (2.1%) of patients with urological anomalies respectively.¹²

CONCLUSION

The commonest organism causing UTI was E coli in present study. Authors observed that in children with UTI, urological abnormality was present in 42.24%. Hence even a single confirmed UTI should be taken seriously, especially in young children, due to the potential for renal parenchymal damage. Imaging studies should be done in all cases of confirmed UTI as per standard guidelines to identify the anomaly at an earliest and treat it to prevent serious kidney damage.

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