Original Article

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Prevalence of Urinary Tract Abnormalities in Children with First Urinary Tract Infection at Tertiary Care Institute of Gujarat

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Abstract

Background: Pediatric urinary tract infections (UTIs) are a major health-care issue. UTI may be a harbinger of variety of underlying urinary tract abnormalities. This study was conducted to identify the prevalence of urinary tract abnormality in children following the first episode of UTI. **Subjects and Methods:** This was a hospital-based prospective observational study conducted in children with culture-proven first episode of UTI attending the outpatient department or admitted in the tertiary hospital of Gujarat over a period of 12 months. During the study period, 80 children were diagnosed as culture proved first UTI. Ultrasonography (USG) abdomen, micturating cystourethrography (MCU), and dimercaptosuccinic acid (DMSA) kidney scan were done. **Results:** The most common pathogen isolated in urine culture was E. coli. About 17.5% had abnormal finding in USG abdomen. Structural Among them, majority (21.4%) had hydroureteronephrosis. DMSA scan was done in 45 children who showed abnormalities in 11. MCU was done in 32 children, which showed abnormalities in 11. The most common anomaly detected was VUR. Among eight children with VUR, majority 37.5% had Grade I VUR. **Conclusion:** UTI is a common pediatric problem with the potential to produce long-term morbidity. In children below 5 years, symptoms and signs are non-specific and routine urine examination may not yield persistent findings. Hence, high index of suspicion is necessary. The presence of VUR is a risk for recurrence of UTI and renal scarring.

Keywords: Dimercaptosuccinic acid, Micturating cystourethrography, Ultrasonography, Urinary tract infections.

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Introduction

Urinary tract infections (UTIs) are the most common source of bacterial infections in young children. Overall 3–5% of young febrile children have UTIs, including 5–7% of those "without a source of fever".[1,2] The male-to-female ratio is 2.8:5.4 in infants, whereas it is 1:10, beyond 1–2 years.[3] Escherichia coli is the most common infecting pathogen in children, accounting for up to 54–67% of UTIs. Other pathogens include Staphylococcus and Streptococcus species, a variety of enterobacteria (Klebsiella and Proteus), and occasionally Candida albicans. The virulence of the invading bacteria and the susceptibility of the host are of primary importance in the development of UTI.[4]

The incidence of UTI reported from various epidemiologic studies is 1.1–1.8% of boys and 3.3–7.8% of girls.[5,6] UTI is 2–5 times more common in males than in females in the first few months of life; beyond this, male-female ratio is 1:10.[7] Sobel et al. reported bacteria as the most common etiological agents of UTI and may occasionally be caused by viruses and fungi.[8] Infection can reach the urinary tract in two ways: (1) The ascending route and (2) the hematogenous route; UTI in most of the cases results from an ascending infection; bacteria arise from the fecal flora, colonize the perineum, and enter the bladder through the urethra. In uncircumcised boys, the bacterial pathogens usually arise from the flora beneath the prepuce. These organisms ascend through the urethra to invade the urinary tract and cause asymptomatic bacteriuria, acute cystitis, or acute pyelonephritis in the host.

Escherichia coli adheres to uroepithelium with the help of adhesions or fimbriae which binds to specific receptors in the uroepithelium.[9,10] The organism is then internalized into epithelial cells which lead to apoptosis, hyperinfection, and invasion of the surrounding epithelial cells or an establishment of bacterial focus which forms a base for recurrent UTI where drugs cannot reach the focus. UTI can be grouped into three clinically distinct presentations: (1) Cystitis, (2) acute pyelonephritis, and (3) asymptomatic bacteriuria. Cystitis occurs when infection is limited to the bladder and urethra, and it is mostly seen among girls who are more than 2 years old.

Patients often present with localizing symptoms that include pain on urination (dysuria), frequency, urgency, cloudy urine, and lower abdominal discomfort. Acute pyelonephritis is an infection of the kidney and is the most severe form of UTI in children.

In neonates, the usual route of infection is hematogenous.[11] Later in life, infection is usually caused by ascent of bacteria into the urinary tract.[12] Any condition leading to urinary stasis (renal calculi, obstructive uropathies, vesicoureteral reflux [VUR], and voiding disorders) may be predisposing to the development of UTI in children. UTI recurs easily if it is accompanied with anatomical anomalies of the urinary system. Parenchymal infection and scarring are well-established complications of infections of the upper urinary tract in children leading to reduced glomerular filtration rate hypertension, and kidney failure. Parenchymal scarring develops in 10–15% of children with UTI. Children less than 1 year of age are at much greater risk of kidney scarring than older children.[13] This study was conducted to identify the prevalence of urinary tract abnormality in children following the first episode of UTI.

Subjects and Methods

This was a hospital-based prospective observational study conducted in children with culture-proven first episode of UTI attending the outpatient department or admitted in the tertiary hospital of Gujarat over a period of 12 months. During the study period, 80 children were diagnosed as culture proved first UTI.

Inclusion criteria

1. Children between 1 month and 12 years of age with the first episode of confirmed diagnosis of UTI during the study period.
2. Children who are followed up for a minimum period of 6 months after diagnosis and starting the treatment.

Exclusion criteria

1. Children with previously known urinary tract anomalies.
2. Children with comorbid medical renal diseases.

Detailed data on history and examination were recorded. More than 5 pus cells/high-power field in a centrifuged urine sample was taken as significant pyuria. On culture of urine, a colony count of >105 colony-forming unit (CFU)/mL microorganisms of a single species in midstream clean catch specimen, >50×103 CFU/mL microorganisms of a single specimen in catheterized sample, and any number of pathogens in suprapubic aspirated sample was considered significant. Samples showing insignificant growth, mixed growth of two or more pathogens, or growth of non-pathogens were not considered as culture positive. Ultrasonography (USG) abdomen and pelvis were done in all children with culture-positive UTI. Dimercaptosuccinic acid (DMSA) evaluation was done at 2 months following UTI in all children with culture-positive UTI 5 years of age if USG was abnormal. MCU was performed with strict aseptic precautions, after the urine was sterile after 3–4 weeks following therapy. Information on bladder dynamics, reflux, and amount of residual urine was noted.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

Majority were in the age group of >5 years [Table 1]. Majority presented with fever. Urinary symptoms were present in 13% of the cases. Out of 80 children with culture proved UTI, only 44.5% had significant pyuria in centrifuged urine sample. The most common pathogen isolated in urine culture was E. coli. About 17.5% had abnormal finding in USG abdomen. Structural Among them, majority (21.4%) had hydroureteronephrosis. DMSA scan was done in 45 children who showed abnormalities in 11. MCU was done in 32 children, which showed abnormalities in 11. The most common anomaly detected was VUR. Among eight children with VUR, majority 37.5% had Grade I VUR. MCU was abnormal in two children who had normal USG findings. The results are compiled in [Table 2].

Discussion

UTI is one of the most common bacterial infections among infants and children. It may unmask underlying structural or functional anomalies of the urinary tract. Early detection and management are pivotal to reduce significant morbidity, with kidney scarring, being the most worrisome long-term squeal. A total of 80 children with culture-proven first episode UTI were enrolled to determine associated urinary tract abnormalities. Majority were in the age group of above 5 years, followed by 1–5 years. Male predominance was noted with a male to-female ratio of 4:1 in < 1 year. In a similar hospital-based study conducted by Singh et al,[14–17] of 135 patients, 32.5% were males and 67.4% were females forming a ratio of 1:2. Males outnumber females in children below 5 years and females outnumber males above 5 years in the study. Age and sex distribution obtained in the current study was similar to other hospital based studies done by Ali et al in UAE,

Table 1: Age and sex distribution of the study group

Age (Years)	Sex		Total
	Male	Female	
<1	12	3	15
1-5	20	10	30
>5	17	18	35

Table 2: USG, MCU, and DMSA findings

Findings	USG (n=80)	DMSA (n=45)	MCU (n=32)
Normal	66	34	21
Cystitis	4		
Bilateral hydroureteronephrosis (HUN)	3		3
Vesicoureteral reflux (VUR)	1		3
Distended bladder with residual urine suggestive of posterior urethral valve	1		1
Obstructive uropathy suggestive of posterior urethral valve	1		
Pelviureteric junction obstruction	1		1
Right hydronephrosis	1		1
Pyelonephritis		2	
Left ureterocele	1	1	1
Right megaureter	1	1	1
Kidney scarring		7	

Raghubanshi et al in Lalitpur, Nepal, April Bay and Anacleto in Philippines.[18–20]

We found that E. coli was the most common organism isolated, followed by Klebsiella, which was similar to the studies done by Zamir et al, Ahmadzadeh et al, Ponvelil et al and Saadeh et al.[21–24] Bryan et al reported E. coli as the most common urinary pathogen accounting for 85% of community-acquired UTI.[25] Bagga et al reported that about 90% of first symptomatic UTI and 70% recurrent infections were due to E. coli.[26] The studies by Mantadakis et al and Islam et al showed E. coli as most common organism but with varying proportions.[27,28] Gulati and Kher reported Gramnegative bacteria as the most common etiologic agents, among which E. coli was the most common.[29]

In the present study, 16% had abnormal finding in USG abdomen. Structural abnormality was seen in 14% which was similar to the studies by Hoberman et al of the 11 children with abnormalities in MCU,[30] majority were under 5 years of age which was similar to the studies done by Zamir et al,[21] In contrast, studies done by Ahmadzadeh et al,[22] and Sinha et al,[31] showed a higher incidence rate as their study group consisted only of children under 5 years of age. Kidney scarring was seen in 10% of children with UTI which was similar to the study done by Andrich et al. (10–15%).[10] Of the 9 children with kidney scarring, 8 had underlying urinary tract abnormalities and 2 were without underlying urinary tract abnormalities who were under 2 years. In the current study, the overall prevalence of urinary tract abnormalities was 14%, which was similar to the study done by Zamir et al,[21] In contrast, Ahmadzadeh et al,[22] reported a higher incidence of abnormalities (60.6%), as majority (77%) of their study group were children aged less than 5 years.

Conclusion

UTI is a common pediatric problem with the potential to produce long-term morbidity. In children below 5 years, symptoms and signs are non-specific and routine urine examination may not yield persistent findings. Hence, high index of suspicion is necessary. The presence of VUR is a risk for recurrence of UTI and renal scarring. The relative risk of recurrence of UTI is 14 times in the presence of renal scarring than in children without renal scar formation, and thus, renal scarring is a good predictor of recurrence.

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