Research Article

Prevalence of urinary tract infection in febrile children;
A small cross sectional study

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ABSTRACT

Introduction: Urinary tract infection (UTI) is a problem that is frequently encountered by pediatric healthcare providers. The epidemiology of UTI during childhood varies by age, gender, and other factors. Early diagnosis and appropriate treatment is essential in order to avoid long term complications. In this study we evaluated the prevalence of UTI in febrile children and determined the predictors and associated factors.

Patients and Methods: This study was a hospital-based cross-sectional descriptive study performed between May 2013 and April 2014 in Booali Hospital, Tehran. Relevant information such as age, gender, symptoms, was obtained in a checklist for each patients. Physical examination was carried out on each subject to identify possible source of infection and other variables that could help the clinical diagnosis. Chi Square test was used for correlation between qualitative variables and T Test was used for quantitative variables. Multivariate linear regression analysis was used for predicting factors related to UTI.

Results: We included 144 febrile patients with inclusion criteria. The mean age of them was 2.17 ± 2.56 years old. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of pyuria was respectively 0.52, 0.99, 0.95 and 0.85. We showed that age, temperature, admission weight, WBC, ESR and CRP were significantly higher in UTI positive patients in febrile children ($P<0.05$). Our predicting analysis showed that delivery type, temperature, pyuria and positive nitrite can significantly UTI in febrile children ($P<0.05$).

Conclusion: We presented high prevalence of UTI among febrile children in our setting and is predicted by pyuria, type of delivery, temperature and positive nitrite test. However, the common factor in almost all study that predict the UTI in febrile children is pyuria and should be attended by physicians for screening in febrile children.

Keywords: urinary tract infection, fever, urine, predicting factor

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INTRODUCTION

Urinary tract infection (UTI) is a common cause of fever in children (1). The presence of fever in infants and young children with UTI is of significant importance because it is a clinical marker of renal parenchymal involvement (2). Renal parenchymal infections lead to renal scarring(3), which is the prelude to chronic morbidities associated with UTI, such as hypertension, reduced renal function and chronic renal failure (4). The relevance of UTI to childhood morbidity is more marked in under-fives amongst whom the risk of renal damage is more and diagnosis is often missed as the clinical features are seldom overt and in most cases not referable to the urinary tract(5). Whereas UTI episodes if appropriately diagnosed and well-

managed, can be effectively controlled with antibiotics, the attendant possible complications of untreated UTI, such as end-stage renal disease,(4) could have devastating consequences on the child, the family and the health system. The Subcommittee on Urinary Tract Infection suggested that to optimize the diagnosis of UTI, "clinicians should require both urinalysis results that suggest infection (pyuria and/or bacteriuria) and the presence of ≥50,000 colony-forming units (CFUs) per millilitre of a uropathogen cultured from a urine specimen obtained through catheterization or suprapubic aspirate" (6).

The finding of ≥10 white blood cells (WBCs) per microlitre in an uncentrifuged urine sample has been reported to be a sensitive indicator of UTI (6, 7). The sensitivity and specificity of pyuria for the diagnosis of UTI in children are 73% and 81%, respectively. Moreover, expert opinions state that the absence of pyuria does not rule out the diagnosis of UTI, specifically in infants <2 months of age (7).Unfortunately, the classic signs of UTI and pyelonephritis in older children and adults are not present or easily discerned in the toddler or young child. Fever is the most common symptom of UTI in the infant(8). Also, the presence of another source of fever on examination, such as otitis media or other viral symptoms, does not exclude a UTI(9). Screening for UTI is uncomfortable for patients, time-consuming for staff, and expensive in the aggregate.Community studies suggest that boys younger than 1 year of age and girls younger than 5 years of age are most at risk for UTI(9). The literature estimates that the prevalence of UTI in febrile children presenting for outpatient evaluation ranges from 1% to 20%(3). So, because of its prevalence and hidden nature in febrile children the aim of this study was to evaluate the frequency of UTI in febrile children with all-cause of fever referred to our center.

Patients and Methods

This study was a hospital-based cross-sectional descriptive study performed between May2013 and April 2014 in Booali Hospital, Tehran.

Inclusion & exclusion criteria

Children aged 1 month to 12 years presenting with fever (axillary temperature ≥ 37.6°C) with/without localizing sign (s) were recruited. Exclusion criteria included children with history of antibiotic treatment during last week of the day of enrolment, urologic manipulation such as catheterization and urinary tract anomalies. Children with chronic disorders such as sickle cell disease, malignancies, nephrotic syndrome, using immunosuppressing agent, glomerulonephritis and chronic renal failure were also excluded.

Data Collection

Relevant information such as age, gender, symptoms, was obtained in a checklist for each patients. Physical examination was carried out on each subject to identify possible source of infection and other variables that could help the clinical diagnosis. A clinical diagnosis of UTI was made in subjects with any of the following: Pain or crying on micturition, urinary frequency, urgency, loin pain, suprapubic tenderness, costovertebral angle tenderness. The definite diagnosis was performed based on the urine culture for UTI. The predicting factors of UTI in febrile children were evaluated, too.

Ethical Issue

This study was approved by ethical committee of medical aculty of Islamic Azad University of Tehran.

Statistics

The data were entered in SPSS software version 21.0. We presented descriptive quantitative data as mean ± S.D. Chi Square test was used for correlation between qualitative variables and T Test was used for quantitative variables. We also used multivariate linear regression for predicting factors of UTI in febrile children. P Value lesser than 0.05 was considered as significant.

RESULTS

Demographic data

We included 144 febrile patients with inclusion criteria. The mean age of them was 2.17±2.56 years old. Fifty-six patients (38.9%) were female

and 88 of them (61.1%) were male. Seventy-six of them (52.8%) were born as normal vaginal delivery and others (68, 47.2%) as caesarian section. The mean of birth weight was 1820.35±1582.61 grams and the mean admission weight was 7947.62±8508.77 grams.

Signs, symptoms & risk factors

Twenty-one patients (14.6%) had history of previous UTI. Eleven patients had history of

constipation in recent 2 weeks (7.6%). Growth retardation was reported in 32 patients (22.2%). Signs, symptoms & risk factors of patients are listed in Table1. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of pyuria was respectively 0.52, 0.99, 0.95 and 0.85.

Table1- Risk factors of UTI in febrile children

Characteristics	Frequency	Percent
Gastroenteritis	71	49.3
Otitis Media	10	6.9
Pneumonia	46	31.9
Previous positive urine culture	21	14.6
Pyuria	38	26.4
Hematuria	12	8.3
Positive Urine Nitrite	3	2.1
VUR history	14	9.7
Vomiting	71	49.3
Irritability	73	50.7
Diarrhea	65	45.1
Abdominal Pain	16	11.1
Pharyngitis	6	4.2

There were no cellulitis or arthritis and abdominal mass. Positive urine culture is more frequent in female than male patients. Prevalence of urine culture according to gender distribution is listed in Table2.

Table2- Distribution of urine culture in children based on gender

Gender / Positive Urine Culture	Male	Female	Total	P-Value
Yes (N, %)	1, 4.8	20, 95.2	21, 100	
No (N, %)	55, 44.7	68, 55.3	123, 100	0.0001
Total	56, 100	88, 100	144, 100	

Nine patients with previous UTI had positive urine culture (P=0.0001). History of constipation, otitis media, growth retardation, positive Nitrite test were not related to positive urine culture (P>0.05). Patients presented with gastroenteritis (P=0.04) and pneumonia (P=0.0004) had lower positive urine culture significantly. There was significant relationship between pyuria and hematuria and positive urine culture (P=0.001).

Clinical and laboratory quantitative data of febrile patients are summarized in Table3 according to positive or negative U/C groups.

Table3- Clinical and laboratory data of febrile patients

Variables	u/c	Mean	Std. Deviation	P Value
Age (years)	yes	3.63333	3.490644	0.001
	No	1.92573	2.302760	
PR (Per/minute)	yes	107.05	28.239	0.21
	No	114.80	18.631	
RR (Per/minute)	yes	27.90	11.291	0.88
	No	32.42	14.035	
Temperature (Axillary) ºC	yes	38.5619	.64844	0.02
	No	38.3106	.55335	

Weight (born) (gram)	yes	1677.38	1516.891	0.43
	No	1844.76	1598.272	
Weight (admit) (gram)	yes	11828.57	13120.876	0.001
	No	7279.59	7310.581	
WBC (g/L)	yes	11974.286	6932.9565	0.014
	No	10571.545	4853.2146	
Hb (g/dL)	yes	11.0524	1.06378	0.42
	No	20.1951	98.35112	
ESR	yes	20.067	32.8535	0.002
	No	19.054	20.8038	
CRP	yes	70.2857	239.97810	0.001
	No	10.4795	19.69048	

Our predicting analysis showed that delivery type, temperature, pyuria and positive nitrite can significantly UTI in febrile children (Table4).

Table 4- Linear regression test for predicting UTI in febrile children

Characteristics	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
Delivery Type	-.159	.055	-.222	-2.884	.005	-.269	-.050
T(axillary)	-.105	.050	-.164	-2.086	.039	-.205	-.005
Pyuria	.489	.093	.598	5.280	.000	.305	.673
Positive Nitrite	.547	.254	.182	2.152	.034	.043	1.052

DISCUSSION

The present study found that UTIs were present in 14.58% of children one month to 12years of age febrile hospitalized. UTI in febrile children has been widely studied in different parts of the world (3, 8, 10). Festo et al. reported the prevalence of UTI by culture as 39.7% (11). This value is comparable with the figures of 9% and 13% documented in studies among febrile children of similar ages in Benin(12) and Maiduguri (13)respectively. Reddy and Sri Laxmi reported a prevalence of 4% of UTI in febrile children (14). Ibeneme et al. reported 11% of UTI in febrile children (3). The slightly higher prevalence in Maiduguri may be attributed to subjects' characteristics as this study included patients with PEM, a condition associated with a high incidence of UTI. Lower value of 1.7% was obtained by Bauchner et al. (15)in USA among febrile children of similar ages. The higher prevalence of UTI in the mentioned studies and our studyin comparison with studies in USA can be related to the higher incidence of bacterial infections in developing countries compared with the developed countries.

Our frequency was nearly compatible with other studies.

We showed that in our study pyuria had a sensitivity of 52% and specificity of 99% with high PPV and NPV. Goldsmith et al recorded a sensitivity of 82% and specificity of 81% (16) while Reddy and Sri Laxmi showed in their study, its sensitivity as 85% and specificity as 88% with lowPPV (25%)(14). Hoberman et al obtained figures of 54% and 96% respectively(10).Rabassa and Gofama showed significant pyuria in their patients (13). Festo et al. reported the sensitivity of pyuria in diagnosing UTI using culture as a gold standard as 44.2% with specificity of 86.5% (11). Other studies confirmed the significance of pyuria in detection of UTI in febrile patients (17). It showed that despite of low sensitivity of pyuria it has high specificity and can be useful simple laboratory finding for suspicion to UTI in febrile children. So it can be used by physicians in their first evaluation.

We showed that UTI was significantly higher in female rather than male patients. Rabassa and Gofama also showed that female preponderance in their study(13). This has been demonstrated by Ibeneme et al. study with females having about 3

times the risk of infection than male children in the same age group (3). Such finding was noted by Aiyegoro et al. (18).

Similarly, Okafor et al. in Enugu documented higher rate of asymptomatic bacteriuria among female preschool children (19). This may be attributable to the small number of infants studied. Furthermore, children especially males with a history suggestive of urinary tract abnormalities such as obstructive uropathy were excluded in our study and may have contributed to the observed trend.

It was reported in Reddy and Sri Laxmi study in this way and our study was in line with other studies (3, 14, 15). It is probably attributable tothe anatomy of the female urinary tract. The shorturethra in females makes it easy for organisms toenter the bladder from the vulva.

We showed that age, temperature, admission weight, WBC, ESR and CRP were significantly higher in UTI positive patients in febrile children. Other study showed that age andhigher temperature at presentation were not foundto be significant, poor nutritional statushoweverwas significantly associatedwithUTI(13). Jeena et al., in South-Africa documented infrequency of urinary tract signs in their series as only 13% of patients with UTI in their study had signs attributable to the urinary tract (20).

Asinobi et al. in South-western Nigeria found 11% of patients with UTI to have symptoms of UTI (21). This suggests that UTI may be present in a febrile child below the age of 5 years with or without symptoms and signs referable to the urinary tract. This further supports the need for a high index of suspicion for UTI.

It is therefore, suggested that UTIshould be investigated even in the absence ofspecific urinary symptoms, in the presence of feverespecially in young children.

Our predicting analysis showed that delivery type, temperature, pyuria and positive nitrite can significantly UTI in febrile children. Festo et al. demonstrated that on multivariate logistic regression analysis positive urine culture was strongly predicted by age below 2 years (OR 2, p=0.008), female sex (OR 2.6, p<0.001), positive WBC microscopy (OR 4.9, p<0.001), positive nitrite test (OR 11.5, p<0.001), diarrhea (OR 2.3, p=0.001) and prolonged fever for more than 5 days (OR 1.6, p=0.04) (11). H

endaus et al. revealed that being female (OR 1.94; P=0.025) and older age at diagnosis (OR 2.41; P=0.006) were significantly associated with an increased risk for UTI andin multivariable logistic regression analysis controlling for all potential covariates, such as sex, age at diagnosis, gestational age and older age at diagnosis remained significantly associated with UTI(22). It is clear that factor predicting UTI in febrile children is varying by the local environment and is unique for every study.

CONCLUSION

We presented high prevalence of UTI among febrile children inour setting and is predicted by pyuria, type of delivery, temperature and positive nitrite test. However, the common factor in almost all study that predict the UTI in febrile children is pyuria and should be attended by physicians for screening in febrile children. Due to more time for definite diagnosis of UTI by urine culture, using pyuria in urine analysis as a cheap and available and rapid test for predicting UTI can be helpful in young children and can be used for better treatment. According to high prevalence of UTI in female young children should be considered as a key point for evaluation of febrile children. Therefore, the need toestablish the pattern of organisms in UTI andantimicrobial sensitivities in the local environment isrecommended.

In conclusion, it is recommended thatUTI should be suspected and actively investigated inchildren presenting with fever. Regular surveillanceof urinary tract pathogens and their antibioticsensitivity pattern is important. Performing large population study and multi-centric ones are suggested for determining the pattern of predictor factors in every local environment in Iran.

Conflict of Interest

Authors declare any conflict of interests.

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