

Prevalence of Urinary Tract Infection among Children with Febrile Convulsion

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Abstract

Background: Febrile convulsion (FC) and urinary tract infection (UTI) account for a large number of visits to pediatric emergency departments and both are common during early childhood. The aim of this study was to determine the prevalence of UTI among children presenting with FC.

Methods: In this prospective study, children with FC who presented to a pediatric emergency department were consecutively evaluated by an attending pediatrician. Demographic data, characteristics of convulsion, signs, and symptoms of UTI, laboratory findings, and final diagnoses were collected. Catheter specimens for urine analysis and culture were obtained from all of the patients.

Results: A total of 153 children (88 boys, 57.5%) with mean age \pm SD of 21.64 ± 12.86 months were included. Urinary frequency and abdominal pain were present in 6 (3.9%) and 10 (6.5%) patients, respectively. 50 patients (32.7%) had an altered urine analysis. UCs was positive in 17 (11.1%) patients, 58.8% of whom did not have any signs or symptoms attributable to UTI. *E. coli* was the only isolated pathogen.

Conclusion: The prevalence of UTI among children with FC is relatively high and most of the patients have no signs or symptoms other than fever. Routine performance of UC is recommended in this population.

Keywords: Urinary tract infection; Febrile convulsion; Urine culture

Introduction

Urinary tract infection (UTI) is one of the most common bacterial infections in childhood and accounts for up to 14% of the pediatric visits to the emergency departments (ED) [1]. Pediatric UTI is common in the first five years of life [2]; the same age during which febrile convulsions (FC) occurs. Primary evaluation of children presenting with FC aims at diagnosing the potential sources of infection, including UTIs [3,4]. Therefore, physicians usually face a situation in which they have to make the decision of performing a urine sampling. Knowing the nonspecific presentation of the UTI in early childhood, making such decisions is hard. Therefore, the prevalence of UTI may represent an estimate of the probability of this infection prior to diagnostic testing and in part facilitate the decision-making process for the physicians. Accordingly, this study was conducted to determine the prevalence of UTI among children with FC.

Materials and Methods

This prospective study was conducted during January to September 2014 in the ED of the Children's Medical Center hospital (an affiliated hospital of Tehran University of Medical Sciences, Tehran, Iran). The study protocol was approved by Ethics Committee of the university and written informed consents were obtained from parents or caregivers of the children. Patients were eligible for enrollment if: 1) they were aged between 6 months to 5 years, 2) had a temperature of at least 38.3°C at presentation, and 3) presented to the ED with seizure or had a reliable history of seizure prior to admission. Patients with a history of unprovoked a febrile seizure, significant neurological abnormality or head trauma were excluded.

Patients were concisely evaluated by an attending pediatrician at the time of admission. Antiepileptic medications, antipyretics and antibiotics were administered as standard medical treatment when indicated. Although urethral catheterization may be associated with some complications, such as urethra rage or late urethral stricture the urine specimens were obtained by urethral catheterization to assure the certainty of infection. Urinalyses (UA), urine cultures (UC) and complete blood counts (CBC) were performed in all of the patients, regardless of the presence of signs or symptoms of a possible source of infection (e.g., upper respiratory infection). Other laboratory tests and paraclinical investigations were performed based on the decision of the ED pediatricians. A list of signs and symptoms of pediatric UTI, made through expert's opinion and literature review, was used for the documentation of the signs and symptoms of UTI. If there were 2nd or 3rd episodes children should undergone more exams such as VCUG to find vesico-ureteral reflux, which is frequently associated with recurrent UTI.

Other data including demographic characteristic, past medical history, characteristics of seizure, laboratory findings and etiology of fever were collected using a data collection sheet.

EAU or AUA definition concerning criteria for UTI in children using Urine specimen from midstream void is $\geq 10^4$ CFY/ml with symptoms or $\geq 10^5$ UFC/ml without symptoms, for urine specimen from bladder catheterization, it is $\geq 1,000$ -50,000 CFU/ml. FC was defined according to the American Academy of Pediatricians' clinical practice guideline as a seizure accompanied by fever in a child of 6 to 60 months age in absence of metabolic abnormality, central nervous system infection, or history of non-febrile seizure [5]. A positive UC was defined as the growth of at least 10^4 colony-forming units (CFU) per ml of a single pathogen from a catheter specimen. Other definitions are presented in table 1.

Table 1: Definitions

| Variable | Definition |
|--------------|--|
| FC | All of the below criteria[5]: - Seizure accompanied by fever - Age of 6-60 months - Absence of metabolic abnormality, central nervous system infection and history of non-febrile seizure |
| Simple FC | FC with all of the below criteria [6]: - Generalized seizure - Duration ≤ 15 minutes - Frequency ≤ 1 per 24-hour |
| Complex FC | FC with either of the below criteria [6]: - Focal seizure - Frequency >1 per 24 hour - Duration >15 minutes |
| UTI | Growth of ≥ 10 ⁴ colony-forming units (CFU) per ml of a single pathogen from a catheter specimen. |
| Pyuria | Urine WBC ≥ 6 per HPF |
| Hematuria | Urine RBC ≥ 6 per HPF |
| Leukocytosis | Peripheral blood WBC ≥ 12,000 per μL |

Descriptive statistics of the patient characteristics, signs, symptoms and diagnostic evaluations were performed using SPSS version 15 (SPSS Inc., Chicago, IL, USA).

Results

After screening for eligibility criteria, 153 patients (88 male, 56%) entered the final sample. The mean age ± SD of the patients was 21.64 ± 12.86 months (Figure 1). Seven patients (4.6%) had a history of urogenital anomaly. History of UTI was present in 8 cases (5.2%), all of whom had undergone adequate antibiotic treatment at least 3 months prior to presentation. Out of 88 boys, 70 (79.5%) were circumcised.

Patients with first episode of FC (136 cases, 88.9%) consisted the majority of the study population. Whereas, 12 cases (7.8%) presented with second episode and 5 cases (3.2%) with third episode of FC. The mean ± SD of the seizure duration was 5.48 ± 3.17 minutes and 3 patients (2%) had prolonged seizures. Median of seizure frequency was 1 per 24 hours and 25 patients had experienced recurrent seizures. Of 33 patients with complex FC, 20 (60.6%) had one complex feature, 11 (33.3%) had two complex features and 2 (6.0%) had three complex features (Figure 2).

On medical history taking and physical examination, 137 patients (89.5%) had no sign or symptom attributable to UTI other than fever. Urinary frequency and abdominal pain were the only presenting symptoms which were present in 6 (3.9%) and 10 (6.5%) patients, respectively. Mean body temperature at presentation was 38.82 ± 0.61 °C.

153 urine samples were obtained from 153 patients. 50 patients (32.7%) had at least one abnormal parameter in urine analysis (i.e., pyuria or hematuria). The median urine RBC and WBC counts were 0 with IQRs of 0-2 and 0-5, respectively. Pyuria was present in 38 patients (24.8%) and 25 (16.3%) had hematuria. Of 153 cultured specimens, UC was positive in 17 (11.1%). *E.coli* was the single isolated pathogen and colony counts were more than 10⁵ per HPF in all of the cultures. Characteristics of the patients diagnosed with UTI are presented in table 2. Blood cultures were obtained in 101 cases (66%), with only one positive result for Brucellosis. The Mean ± SD of peripheral blood WBC was 12231 ± 4685 per μL. Lumbar puncture was performed in 68 cases (44.4%). The median CSF WBC count was zero (IQR=0- 2) and all CSF cultures were negative.

In the studied population, upper respiratory infection, with 37 cases (24.2%) was identified as the most common cause of fever and UTI was the third with 17 cases (11.1%). Other etiologies of fever along with their frequencies are presented in table 3.

Table 2: Characteristics of the patients diagnosed with UTI.

| Case No. | Age (months) | Gender | History of UTI | Sign/ Symptom | Body temp. (°C) | Blood WBC (μL) |
|----------|--------------|--------|----------------|----------------|-----------------|----------------|
| 1 | 30 | Male | No | Abdominal pain | 40.00 | 12800 |
| 2 | 8 | Female | No | Frequency | 39.40 | 15800 |
| 3 | 15 | Female | No | - | 39.50 | 23600 |
| 4 | 28 | Female | Yes | Abdominal pain | 39.00 | 11900 |
| 5 | 7 | Male | No | - | 39.20 | 19500 |
| 6 | 16 | Male | No | Abdominal pain | 39.00 | 12900 |
| 7 | 17 | Female | Yes | - | 39.00 | 21200 |
| 8 | 21 | Female | No | - | 39.50 | 18000 |
| 9 | 24 | Male | No | Abdominal pain | 39.00 | 17000 |
| 10 | 20 | Male | Yes | - | 38.50 | 12500 |
| 11 | 15 | Female | No | Frequency | 39.00 | 14700 |
| 12 | 28 | Male | No | - | 39.00 | 19800 |
| 13 | 22 | Female | No | - | 40.00 | 10000 |
| 14 | 18 | Male | No | - | 39.00 | 16200 |
| 15 | 18 | Male | No | - | 39.00 | 14100 |
| 16 | 33 | Male | No | Frequency | 38.50 | 9800 |
| 17 | 50 | Male | No | - | 38.50 | 9300 |

Table 3: Etiology of fever in patients presenting with FC.

| Etiology | n | % |
|-----------------------------|-----|------|
| Upper respiratory Infection | 37 | 24.2 |
| Viral Syndrome | 29 | 20.9 |
| UTI | 17 | 11.1 |
| Otitis media | 16 | 10.5 |
| Gastroenteritis | 8 | 7.2 |
| Pneumonia | 8 | 5.2 |
| Viral meningitis | 7 | 4.6 |
| Post vaccination meningitis | 5 | 3.3 |
| Post vaccination fever | 2 | 1.3 |
| Bronchiolitis | 1 | 0.7 |
| Primary Herpes | 1 | 0.7 |
| Viral meningo-encephalitis | 1 | 0.7 |
| Brucellosis | 1 | 0.7 |
| Unknown | 14 | 9.2 |
| Total | 153 | 100 |

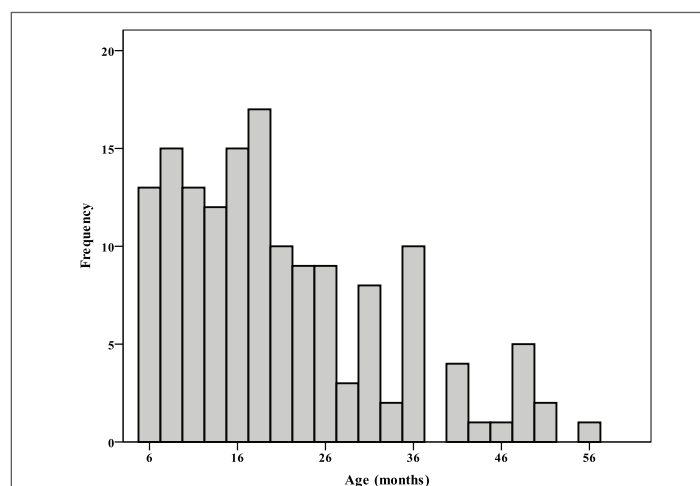


Figure 1: Histogram of the age distribution of study population.

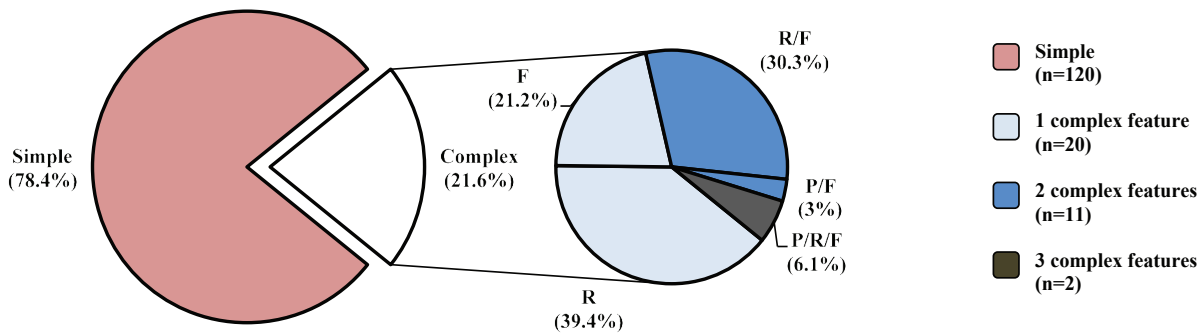


Figure 2: Characteristics of FC in the study population. R- Recurrent seizure; F- Focal seizure; P- Prolonged seizure.

Discussion

The aim of this study was to determine the prevalence of UTI among children presenting with FC. Although the incidence of a febrile seizure is not an independent risk factor for serious bacterial infections [7], diagnosis of such infections is of particular importance in the treatment of children with FC. UTI is no exception, since a delayed or missed diagnosis of UTI in a pediatric patient may result in long-term complications, including renal scars, hypertension and subsequent chronic renal failure [8-10]. Accordingly, knowing the true prevalence of UTI in children presenting with FC may help physicians determine to which extent further diagnostic tests are helpful.

In this study, the prevalence of UTI was 11.1%. Over the past decades, numerous studies have investigated the prevalence of UTI, along with other causes of the fever, among children with FC and it has been reported to range from 0.4 to 10.3% [7,11-17] (Table 4). This wide range of the reported prevalence may be due to differences in population characteristics, urine sampling methods, diagnostic criteria and rate of urine sampling. To the best of our knowledge, only in one study [17] urine specimens of all admitted children were obtained. Bello et al. [17] prospectively evaluated the prevalence of UTI among 145 Nigerian children with FC and determined it to be 10.3%, which is consistent with our findings. Although the use of clean catch method may be responsible for a proportion of their positive cultures, the reliability of their results is supported by the fact that all of their positive cultures had a pure growth of a single bacterium.

For several reasons, timely diagnosis of UTIs in febrile children, including those presenting with FC is difficult. For instance, unlike adults, fever may be the sole manifestation of UTI in children, particularly during infancy. Results of this study showed that 58.8% of the patients with UTI did not have any signs or symptoms associated with UTI other than fever, demonstrating that signs and symptoms are not adequate indicators of UTI in children with FC. In an earlier study, McIntyre et al. [12] prospectively investigated the prevalence of UTI by obtaining UCs from 272 out of 307 children with FC, and compared it to a period in which UCs were not routinely obtained. Although the prevalence of UTI was substantially low (2.6%), they reported that out of children with UTI, this diagnosis was not suspected in 6. It is not surprising that in their study, the prevalence of UTI was significantly higher when compared to the period in which cultures were not routinely performed, especially in the under 2 years age group. Moreover, it has been reported that even when signs and symptoms of UTI are present, they are likely to be underrated by the physicians [18]. Thus, restricting UCs to symptomatic patients would be of low diagnostic yield, leading to missed diagnosis of UTI in a considerable number of the patients.

Table 4: Comparison of the findings of this study with previous studies regarding the rate of urine sampling and prevalence of UTI.

| Study | Total sample size | Rate of urine sampling (%) | Positive urine culture (n) | Prevalence of UTI (%) | |
|--|-------------------|----------------------------|----------------------------|-----------------------|----------------|
| | | | | Study population | Cultured cases |
| Rutter and Smales [11] | 328 | NR* | 4 | 1.2 | NR |
| McIntyre et al. [12] (routine UC study period) | 307 | 88.6 | 7 | 2.3 | 2.6 |
| Lee and Verrier jones [13] | 403 | 56 | 19 | 5 | 8** |
| Teach and Geil [14] | 243 | 53.5 | 1 | 0.4 | 0.7 |
| Trainor et al. [7] | 455 | 38 | 10 | 2.2 | 5.9 |
| Donaldson et al. [15] | 59 | 68 | 3 | 5 | 7 |
| Momen et al. [16] | 137 | NR | 9 | 6.6 | NR |
| Bello et al [17] | 145 | 100 | 15 | 10.3 | 10.3 |
| This study | 153 | 100 | 17 | 11.1% | 11.1% |

*NR, Not reported; **Prevalence of UTI was 12% in uncontaminated urine samples (n=155).

Conclusion

In conclusion, knowing the relatively high prevalence of UTI, it must be considered as a possible diagnosis for any child presenting with FC. We recommend the routine performance of UCs in this population. Future studies may focus on developing decision rules which will optimize the patient care by estimating the probability of UTI prior to further investigations.

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