



# Incidence of primary vesicoureteral reflux in patients with febrile convulsions

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Received: 29 July 2019 / Accepted: 30 October 2019 / Published online: 11 November 2019  
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## Abstract

The aim of this study is to evaluate the incidence of vesicoureteral reflux (VUR) in patients with febrile convulsion (FC). For this, patients that were diagnosed with FC in 2018 were retrospectively reviewed. Those with epilepsy, motor/mental retardation, or spina bifida were excluded. Mid-stream urine samples were collected in children who were toilet trained while sterile bags were used in the smaller. Urinary tract infection (UTI) was defined as  $> 5$  leucocytes/HPF in urinalysis and a subsequent positive urine culture ( $\geq 10.000$  CFU/ml). Children with UTI were further investigated via voiding cystourethrogram (VCUG) and dimercaptosuccinic acid (DMSA) scintigraphy for VUR. Urinalysis was present in 79 among a total of 181 patients (43.6%). Forty-five of the patients were male (57%). Mean age was  $2.6 \pm 1.4$  years. UTI was diagnosed in 6 (7.6%) patients (5 females, 1 male). Three of the girls had recurrent febrile UTI and subsequently, VUR was diagnosed in two of them. VUR is found in 2.5% of the FC cases with urine sampling. Urinalysis should not be ignored in patients with FC as it may lead to diagnosis of VUR.

**Keywords** Febrile convulsion · Fever · Urinary tract infection · Vesicoureteral reflux

## Introduction

Febrile convulsions (FC) are the most common cause of seizures during childhood and have an incidence of 2–5% in children 6 months to 5 years of age<sup>1</sup>. In definition, patients should have body temperature  $> 38^{\circ}\text{C}$  and there should be no signs of an intracranial event or electrolyte imbalance<sup>1</sup>. Etiology is multifactorial and it is thought to be the result of increased susceptibility of the central nervous system to fever.

Reports indicate viral infections are the most common reason for FC<sup>1, 2</sup>.

On the other hand, urinary tract infections (UTI) are the second most common bacterial infections in children that have an increased incidence during infancy<sup>3</sup>. Difficulties in obtaining urine samples, especially in the emergency room (ER) setting, prevent us to detect its true incidence. UTI has been found to be the cause of FC in 5–6.9% of the patients<sup>4–6</sup>. However, there has been no study to date that looked into the incidence of vesicoureteral reflux (VUR) that was diagnosed after a FC.

The aim of this study is to evaluate the incidence of VUR in FC patients.

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## Material and methods

After obtaining local board approval, data of patients that were diagnosed with FC in the ER of our children's hospital in 2018 (January 1, 2018–December 31, 2018) were retrospectively reviewed. All patients with urinalysis were included. Those with epilepsy, motor/mental retardation, or spina bifida were excluded. Urine samples were collected as voided mid-stream in children who were toilet trained or via sterile bags in the remaining. However, infants that had pyuria ( $> 5$  leucocytes/

HPF) were catheterized under sterile conditions for urine culture. UTI was defined as > 5 leucocytes/HPF in urinalysis and the presence of a positive urine culture (> 10,000 CFU/ml). VUR was investigated in patients with a confirmed UTI via voiding cystourethrogram (VCUG) and dimercaptosuccinic acid (DMSA) scintigraphy.

## Results

A total of 201 patients were diagnosed with FC in 2018. Out of these, 20 were excluded due to epilepsy, motor/mental retardation, or spina bifida. Urinalysis was present in 79 patients within the remaining 181 patients (43.6%). Mean age of the study group was  $2.6 \pm 1.4$  years. Forty-five of them were male (57%) while 34 (43%) were female. UTI was diagnosed in 6 (7.6%) patients (5 females, 1 male). Urine culture was obtained via mid-stream urine in 3 patients (50%) and via catheterization in 3 (50%). Of note, the male patient was uncircumcised.

Three of the 5 girls had recurrent febrile UTI and VCUG showed VUR in two (Table 1). One of them was a 5.5-year-old with bilateral VUR (left: grade 4, right: grade 3) and DMSA revealed renal scarring on the left side. The other, who was 11 months old, also showed bilateral dilating VUR (left: grade 3, right: grade 5). However, no renal scars were detected in the DMSA scan. As a result, incidence of VUR in FC was found to be 2.5%.

## Discussion

FC can be observed following any febrile infection with upper respiratory tract infections being the most common followed by otitis, pneumonia, and gastroenteritis in descending order

**Table 1** Clinical and demographic characteristics of patients

	Frequency (n)	Percent (%)
Gender		
Male	103	56.9
Female	78	43.1
Patients with urine analyses	79	43.6
Male	45	57
Female	34	43
Urinary tract infection	6	7.6
Male	1	16.7
Female	5	83.3
Vesicoureteral reflux	2	2.5
Female	2	100
Male	-	-

7. Clinically, UTI is suspected when there is no obvious source of infection and urinalysis is obtained 2. Difficulties in obtaining urine samples might cause suboptimal evaluation for UTIs, especially in hospitals with a huge patient load. In a cross-sectional study, only 38% of 455 cases with FC have undergone urine culture evaluation 4. Moreover, Lee et al. have found that urine culture was performed in only 56% of their cohort of FC 5. Our results show a similar rate of urine sampling (44%), which might also indicate an incomplete evaluation and reporting for UTI in patients with FC.

In a recent study that looked into retrospective results of 225 FC patients, urine culture results were present in 94%; however, the rate of UTI remained similar to previous reports (6.9%) 6. In their study, Lee et al. have found that 5% of the FC patients had UTI but they stated that 66% of the samples were obtained using sterile plastic bags and 33% of them turned out to have contamination 5. UTI in FC is found in 7.6% of the patients in our cohort, which is in accordance with the previously published research.

VUR is one of the most prominent urological anomalies and it is a risk factor for recurrent febrile UTIs that may lead to renal scarring, proteinuria, and finally chronic kidney disease 8. Incidence of renal scarring in the setting of febrile UTI and VUR varies between 36 and 56% 9. It has been shown that VUR increases chances of acute pyelonephritis and renal scarring 2.8-fold when compared with controls 10. In a nicely written meta-analysis, it has been stated that prevalence of VUR in children with UTI is 31.1% in addition to 17.2% prevalence in those with normal kidneys 11. To date, there has been no study that investigated incidence of VUR in patients with FC. Our results indicate 2.5% of the patients (that urine samples were obtained) had dilating VUR. We believe referring FC patients to pediatric nephrology or pediatric urology who were diagnosed during an episode of UTI may be crucial for preventing VUR associated morbidities.

Even though there are several limitations of our study such as retrospective nature, relatively low urine sampling rate, and presence of suboptimal collection techniques, our results show a cross-sectional view of FC in 1 year. Furthermore, it is the first report in the literature giving an incidence of VUR in FC patients. Finally, our results underline two issues. First of all, there is a relatively high threshold for pediatricians to investigate UTI in FC. Secondly, VUR detected after a FC should be regarded as a complication of VUR. We believe that early diagnosis of VUR may prevent a FC episode as well as its sequelae even in a small group of patients.

## Conclusion

VUR is found in 2.5% of the FC cases with urine sampling. Urinalysis should not be ignored in patients with FC as it may lead to diagnosis of VUR.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical standards** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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