



Prevalence of Vesicoureteral Reflux and Urinary Tract Infection in Children with and without Urolithiasis

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Abstract

Background: Vesicourethral reflux (VUR) is a common urinary tract disorder in children, which may be associated with urolithiasis.

Objectives: The current study aimed to investigate vesicoureteral reflux in children with and without urolithiasis.

Methods: In this case-control study, 130 children younger than 10 years, with a confirmed diagnosis of urinary tract infection (UTI) are investigated. The demographic information and clinical status of all participants were recorded. Ultrasonography was performed for all children, and they were divided into two groups of 65 subjects based on the results: group 1, children with UTI+stone; and group 2, children with UTI+ non-stone. All children received Voiding Cystourethrogram to evaluate Vesicourethral reflux.

Results: The mean age of participants was 7.48 ± 3.2 years, and 68 (52.7%) of them were male. Also, VUR was observed in 33 (25.38%) cases. The frequency of reflux in the UTI + stone group was 21 (32.3%), which was significantly higher than the other group (12 cases, or 18.46%) ($P = 0.011$). However, the association between UTI and stone ($P = 0.3$, $CC = -0.01$) was not significant.

Conclusions: This study demonstrated a significant correlation between urinary tract stones and VUR in children with urinary tract infections. It is recommended to investigate the presence of stone or VUR in children suffering from any of the described disorders.

Keywords: Urolithiasis, Vesicoureteral Reflux, Children

1. Background

Vesicoureteral reflux (VUR) as abnormal return of urine from the bladder to the ureter or kidneys is one of the most common urinary tract disorders in children. There is evidence which indicates that VUR may be genetic in origin, as 30% of brothers and sisters of children with VUR have similar conditions with different degrees (1). The most common type of VUR causes by congenital insufficiency of the ureteral bladder. Reflux can lead to urinary tract infections (UTIs), which in turn can damage the kidneys, glomerulonephritis, and reflux nephropathy (2-4).

Also, a series of environmental and genetic factors contribute to urolithiasis. It's less common in children so that its incidence ranges from 2 to 2.7%; however, it causes more severe complications in children. According to the evidence, metabolic disorders and genitourinary anomalies are involved in the formation of urolithiasis, especially in younger children (5).

Based on the previous studies, several anatomical ab-

normalities such as UPJO (Uretero Pelvic Junction Obstruction), urethrocele, VUR, tubular ectasia (modular spongy kidney), and horseshoe kidney can play a key role in the formation of urolithiasis (6, 7). The evidence also indicates an association between congenital anatomical abnormalities and urolithiasis; however, the exact etiology of the disease is not identified yet.

2. Objectives

The current study aimed to compare the frequency of VUR in children with and without urolithiasis.

3. Methods

3.1. Study Setting

The current case-control study is conducted on patients with UTI and urolithiasis referred to the pediatrics clinic of Amir-Kabir hospital in the city of Arak.

3.2. Study Population

In this study, 130 children (65 cases of urolithiasis as case group and 65 cases without urolithiasis as control group) are investigated.

Inclusion criteria: (1) Children younger than 10 years of age; (2) Parents' willingness for their baby to participate.

Exclusion Criteria: (1) Not willing to continue the study; (2) Having a history of urolithiasis for those in the control group; (3) The presence of any congenital anomaly in the kidney or urinary tract.

3.3. Measurement

In this case-control study, 130 children younger than 10 years, with a confirmed diagnosis of urinary tract infection (UTI) are investigated. The children were enrolled based on the inclusion and exclusion criteria. After obtaining parental written informed consent, the demographic data and clinical information were collected using checklists (e.g. age, gender, drug resistance resident of town or village), and history and type of UTI. Kidney and urinary ultrasound were performed for all children. Ultrasonography was performed for all children, and they were divided into two groups of 65 subjects based on the results: group 1, children with UTI+stone; and group 2, children with UTI+ non-stone. All children received Voiding Cystourethrogram to evaluate VUR.

3.4. Ethical Considerations

The ethical considerations were observed, such as obtaining written informed consent to participate in the study, ensuring the participants about the confidentiality of the results, and patients were informed that they can stop participating in the study at any time. The study is also approved by the Ethics Committee of the Arak University of Medical Sciences (ethical code: IR.ARAKMU.REC.2059.173.12).

3.5. Statistical Analysis

The data were analyzed using SPSS software. Descriptive statistical methods were used to determine the frequency of descriptive variables. Also, the Student's t-test was used to analyze the quantitative variables. Statistical significance was considered when P-value < 0.05.

4. Results

The mean age of participants was 63.3 ± 2.6 years. Of the total 130 participants, 68 (52.3%) were male. Also, 49 (37.69%) cases had a history of UTI, and the most common organism was E.coli (89 cases, or 68.4%). According to the findings, there was no significant difference between the

two groups concerning age (P = 0.2) and gender (P = 0.7) (Table 1). Also, 33 children (25.4%) were positive for VUR (21 patients (32.3%) in the case group and 12 patients (18.5%) in the control group), so the difference between the two groups was statistically significant (P = 0.011) (Table 2).

Table 1. Basic Demographic and Clinical Information of Children with or without Urolithiasis

Variables	Urolithiasis		P-Value
	Negative	Positive	
Age			0.23
Mean \pm SD	3.5 \pm 2.5	3.2 \pm 1.7	
Gender			0.7
Male	33 (50.7)	34 (52.3)	
Female	32 (49.3)	31 (47.7)	
UTI history			0.3
Positive	26 (40)	33 (50.7)	
Negative	39 (60)	32 (49.3)	
UTI organisms			0.13
<i>E. coli</i>	45 (69.2)	44 (67.6)	
<i>Staphylococcus aureus</i>	10 (15.3)	11 (16.9)	
<i>Klebsiella</i>	3 (4.6)	5 (7.06)	
<i>Enterococcus</i>	3 (4.6)	2 (3.07)	
<i>Enterobacter</i>	3 (4.6)	1 (1.53)	
<i>Pseudomonas</i>	1 (1.53)	2 (3.07)	

Table 2. Urolithiasis Condition in Patients with Vesicoureteral Reflux

Variables	VUR		Statistical Results
	Positive	Negative	
Urolithiasis			
Positive	21 (32.3)	44 (67.7)	P-value ^a : < 0.0001, CC: 0.04
Negative	12 (18.5)	53 (81.5)	
Total	33 (25.9)	97 (74.1)	

Abbreviation: VUR, vesicoureteral reflux; CC, correlation coefficient.
^aP-value, based on Spearman Analyze.

5. Discussion

In the present study, we evaluated urinary bladder reflux in two groups of children with or without urolithiasis and, based on the findings, 33 children (25.4%) were positive for VUR (21 patients (32.3%) in the case group and 12 patients (18.5%) in the control group), so the difference between the two groups was statistically significant (P =

0.011). However, in other studies, the exact association between urolithiasis and congenital malformations is not fully understood, in the following, a series of related studies are described.

Regarding the importance of urolithiasis in children and its consequent anomalies, several studies have investigated the association between urinary anomalies (e.g., VUR) and urolithiasis, especially in children with predisposing factors such as urinary tract infection (8, 9). Milline et al. have also mentioned that the most common type of urolithiasis was calcium oxalate (44.7%), and of the predisposing factors for urolithiasis, hypercalciuria (33.8%) was the most common factor (8), which is in agreement with the results of the present study. In addition, Shokrollahi et al., in a cross-sectional descriptive study on 167 children with UTI, found that 29.3% of children with genitourinary anomalies were prone to urolithiasis, the highest anomaly was VUR (23.3%). Based on the findings, 3% of children with UTI and VUR had urolithiasis. Shokrollahi has examined the frequency of urolithiasis in children with VUR and reported that urolithiasis was associated with urinary anomalies (10). Also, García-Nieto et al. also found that 58.6% of children, based on Stapleton's criteria, had hypercalciuria. In other words, this study showed a significant correlation between hypercalciuria (a predisposing factor for urinary calculi) and VUR, which is consistent with the results of the present study (11). In addition, the results of the present study concerning the type of organisms causing UTI are consistent with similar studies in this field (12, 13). The present study demonstrated a significant association between VUR and urolithiasis, therefore special attention should be paid to disorders reported in children with urolithiasis and VUR; however, since evidence in this regard are not sufficient, the authors suggest performing further studies.

5.1. Conclusion

This study demonstrated a significant correlation between urolithiasis and VUR in children with UTI. So the authors recommend investigating the presence of urolithiasis or VUR in children suffering from any of the described disorders.

Footnotes

Authors' Contribution: All authors were equal in manuscript preparation and submission.

Conflict of Interests: The authors declare no conflict of interest.

Ethical Approval: The study is approved by the ethical committee of the Arak University of Medical Science (IR.ARAKMU.REC.1395.38).

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Informed Consent: Written informed consent was obtained from all participants.

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