

Original Research Article

Risk factors of pediatric urinary tract infections: an epidemiologic study

Maryam Esteghamati¹, Seyedeh Elaheh Mousavi^{1*}, Shervin Haj Alizadeh²

¹Department of Pediatrics, Faculty of Medicine, Clinical Research Development Center of Children Hospital, Hormozgan University of Medical Sciences, Bandar Abbas, Iran

²General Physician, Hormozgan University of Medical Sciences, Bandar Abbas, Iran

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*Correspondence:

Dr. Seyedeh Elaheh Mousavi,
E-mail: mansor110110@yahoo.com

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ABSTRACT

Background: Urinary tract infection (UTI) is the second most prevalent pediatric infection, and if it is not recognized and treated properly, it can cause severe irreversible complications such as renal failure and hypertension. In this research, some of the risk factors of UTIs were compared in children with urinary tract infections.

Methods: This is a cross-sectional study, with the urinary tract infection as the dependent variable and gender, circumcision status, history of urinary catheterization, family history, history of renal stone, hypercalciuria, constipation history, reflux, neurogenic bladder, phimosis, posterior urethral valves (PUV), ureteropelvic junction obstruction (UPJO), and ureterovesical junction obstruction (UVJO) as the independent variables. A total of 405 children were studied in this research. The data was collected using questionnaires, checklists, and examinations. Data analysis was also carried out using descriptive and analytical statistics method in SPSS.

Results: This research revealed the prevalence of urinary tract infection among children with several risk factors, and the common factors were positive family history, history of urinary catheterization, constipation, and other non-anatomical disorders (history of renal stone and hypercalciuria). The most common risk factors regardless of gender and age were non-anatomic disorders that were observed in 147 cases (43.7%) (p-value<0.001). Among the non-anatomical factors, constipation was the most common factor observed in 66 cases (16.3%). A higher rate of urinary infection was observed in the uncircumcised male patients than the circumcised patients, and there was a significant relationship between circumcision and UTI.

Conclusions: In this study, urinary tract infection staged a significant relationship with gender, circumcision status, urinary catheterization history, family history, renal stone history, hypercalciuria, history of constipation, reflux, neurogenic bladder, phimosis, PUV, UPJO, and UVJO.

Keywords: Constipation history, Family history, Hypercalciuria, Neurogenic bladder, Phimosis, PUV, Reflux, Renal stone history, Risk factors, Uncircumcision, UPJO, Urinary catheterization, Urinary tract infection, UVJO

INTRODUCTION

Urinary tract infections (UTI) are among the most prevalent reproductive system diseases in children and are the most common pediatric infections. Urinary tract infections are also the most important complaints from

children visiting clinics and they account for 20% of the medical advices provided to children.^{1,2}

The reported prevalence of UTI in neonates and children with fever and older children with fever and symptoms of urinary tract infection is approximately 7%.³

The prevalence of UTI varies by risk factor, but the most important risk factors of urinary tract infection are as follows: gender, age, circumcision status, race and family history, urinary catheterization, vesicoureteral reflux (VUR), constipation (delayed and painful excretion of hard feces), labial adhesion, hypercalciuria, urinary retention, ureteropelvic junction (UPJ) obstruction, posterior urethral valve, neurogenic bladder, and renal stone.

In terms of gender, urinary infections are more prevalent in girls due to their shorter urethra. Moreover, the likelihood of urinary tract infections in boys and girls is approximately 2% and 8%, respectively.³ This disease is the most prevalent in girls between the ages of 2 and 3 years, and it mostly occurs in the first year of boys' lives.⁴ In addition, the prevalence of urinary tract infections in the uncircumcised boys is approximately 8 times the circumcised boys due to the growth of bacteria in the urinary meatus and urethral infections.

Race and genetic factors are also known as the risk factors of urinary tract infections. Children whose immediate family members have a history of UTI are more UTI-prone than children without a family history of UTI.⁵

Obstructive anomalies and urinary tract structural disorders including PUV, UVJO, and UPJO are among the risk factors of UTI, but they are slightly prevalent in children.

The other risk factors are vesicoureteral reflux (VUR), renal stone, hypercalciuria, and constipation which are accompanied by a higher risk of UTI.⁶

Urinary tract manipulations also increase the risk of UTI. In children with urinary catheters, the risk of UTI increases by 3 to 5% for each day of catheterization.⁷

There are references to the high prevalence of UTI and its severe complications, especially at lower ages. Given the importance of the early diagnosis and treatment of UTI for reducing its complications (including kidney scarring and renal failure), it is substantially important to be aware of the UTI risk factors.

The goal of this research was, therefore, to study the frequency of the risk factors of urinary tract infection in the child inpatients and outpatients visiting Bandar-e Abbas Children Hospital.

METHODS

Determining the frequency of the risk factors of childhood urinary tract infection (UTI) in the child inpatients and outpatients of the aforementioned children hospital was the overarching objective of this research.

Statistical population: all of the UTI cases below the age of 15 years who visited this children hospital as inpatients and outpatients from 2016 to 2017.

Statistical sample: 405 patients selected through convenience sampling.

Research instruments: the research data was collected from the table of variables and the research objectives were set based on the results from the demographic information questionnaire and clinical and paraclinical examinations.

Prior to the involvement of the participants, the research conditions were explained to their parents and the children whose parents were not interested in participating were excluded from the research.

Statistical analysis

The data resulting from the demographic, clinical, and paraclinical observations was analyzed in SPSS using the descriptive statistics methods including the measures of central tendency (mean and standard deviation) and frequency distribution at a significance level of $p\text{-value} < 0.05$.

RESULTS

The diagrams were drawn for the following age groups:

- Between zero and two years
- Between two and six years
- Over six years
- All of the children.

Each figure presents the data for the girls, boys, and both genders. Of the 405 patients, 256 were female (73.3%) and 149 were male patients (36.8%), and UTI was observed in a large number of the female patients at $p\text{-value} < 0.001$.

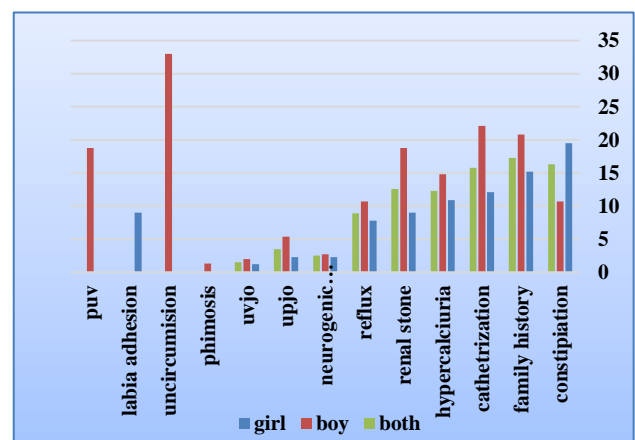


Figure 1: UTI risk factors.

Figure 1 presents the comparison between the risk factors for all children (the entire statistical population) in the girls, boys, and both genders categories. This figure implies that among the children with several risk factors, positive family history, urinary catheterization, constipation, and other non-anatomical disorders (history of renal stone and hypercalciuria) were the most common risk factors in the order mentioned. The most common risk factors regardless of gender and age were non-anatomic disorders that were observed in 147 cases (43.7%) (p -value<0.001). Among the non-anatomical factors, constipation was the most common factor observed in 66 cases (16.3%). The history of renal stone (51 cases), hypercalciuria (50 cases), and neurogenic bladder (10 cases) were known as the other common non-anatomical disorders in this study. The anatomical disorders (56 cases) were at the bottom of the list of risk factors (regardless of gender), and of the anatomic disorders, the most common risk factors were vesicoureteral reflux (36 cases), UPJO (14 cases), and UVJO (6 cases). In general, the non-anatomical disorders were the most common disorders in both gender groups: 117 male patients (81.3%) and 107 female patients (41.7%).

The most common non-anatomical disorder among boys was uncircumcision (48 cases, 33%) followed by renal stone (28 cases, 18.8%), hypercalciuria, and constipation. In girls, the most common non-anatomical disorders were constipation (50 cases, 19.5%), hypercalciuria, and renal stone. The second risk factor in both gender groups were the anatomical disorders: 57 male cases (38.2%) and 62 female cases (20.3%). As regards the anatomical disorders, PUV was the most common disorder in boys (28 cases, 18.8%) followed by reflux (16 cases), UPJO (8 cases), UVJO (3 cases), and phimosis among the other anatomical disorders causing urinary tract infections. In girls, the most common anatomical disorder resulting in labial adhesion was observed in 23 cases (9%), followed by vesicoureteral reflux (20 cases, 7.8%), UPJO (6 cases), and UVJO (3 cases) among the other anatomical disorders. The third risk factor was the history of urinary catheterization (33 cases, 22.1%) in boys and a positive family history in girls (39 cases, 15.2%). Hence, the most common risk factors of UTI are non-anatomical disorders in terms of gender and in general. Uncircumcision is the most common non-anatomical disorder in boys and constipation is the most common among girls.

In Figure 2, the risk factors for children below the age of two years are depicted. In this age group, the most common risk factors of UTIs in boys and girls were the non-anatomical disorders: 95 male cases (82.9%) and 42 female cases (30%). Moreover, of the functional disorders, uncircumcision was the most common in boys (44 cases and app. 37.9%) and constipation was the most common in girls (19 cases and app. 13.5%). The other non-anatomical disorders causing UTIs in boys of this age were renal stone (22 cases, 19%), hypercalciuria (17 cases), and constipation (10 cases), whereas the most

common non-anatomical causes of UTIs in girls were renal stone and hypercalciuria.

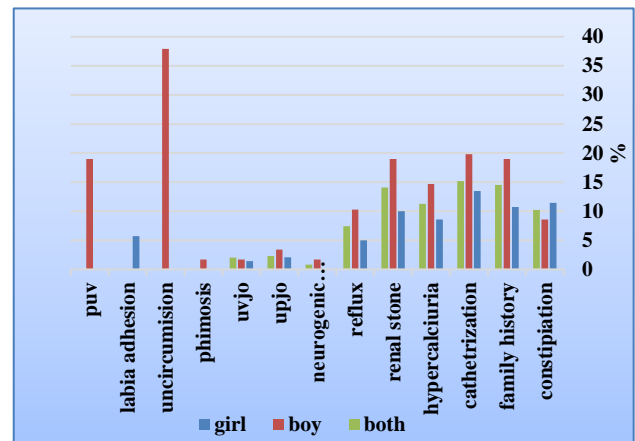


Figure 2: UTI risk factors for 1-24 month.

The second risk factors of UTI in boys of this age were the anatomical disorders, which were observed in 42 cases (36.1%). Moreover, PUV (22 cases, app. 19%), vesicoureteral reflux (12 cases), UPJO, UVJP, and phimosis were the most common anatomical disorders in the order mentioned. In girls, the second risk factors of UTI were also the anatomical disorders (20 cases, app. 14.2%). In addition, labial adhesion was the most common anatomical disorder causing UTIs (8 cases and approximately 5.7%) followed by reflux (7 cases), UPJO, and UVJO. The history of urinary catheterization was the third risk factor in both genders of this age group: 15 female cases (p -value <0.001) and 23 male cases (19.8%).

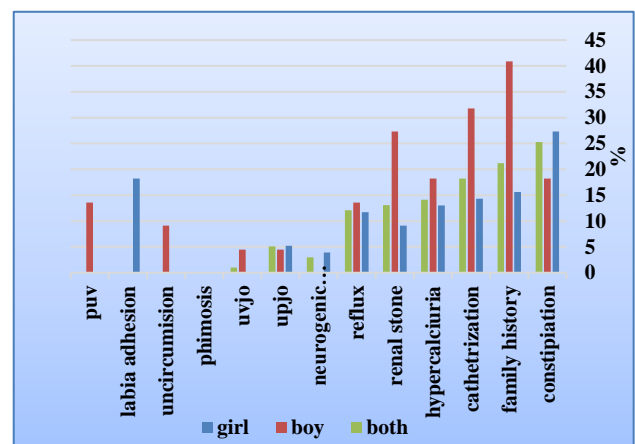


Figure 3: UTI risk factors for 2-6 years.

In Figure 3, the risk factors are shown for children between the ages of two and six years. In general, in the 2-6 age group, the non-anatomical disorders (renal stone in 6 boys and constipation in 21 girls) were the most common risk factors of UTI followed by the anatomical disorders (PUV in boys and labia adhesion in 14 girls) and positive family history (12 cases).

Figure 4 presents the UTI risk factors for children over the age of 6. In the male children over the age of 6, the frequencies of the anatomical and non-anatomical disorders were equal (7 cases, app. 63.7%). The anatomical disorders included UPJO, PUV (3 cases), and vesicoureteral reflux (1 case). The non-anatomical disorders included 2 cases of constipation, 2 cases of neurogenic bladder, and 1 case of hypercalciuria. In this group, the most prevalent risk factors among girls were the non-anatomical disorders (24 cases, app. 61.5%). Of the non-anatomical disorders, constipation was the most common risk factor (13 cases, 33.3%), followed by hypercalciuria (6 cases), neurogenic bladder (3 cases), and renal stone (2 cases) in the order mentioned. The second risk factors in the girls and boys of this age were the positive family history (12 cases, 30.8%) and catheterization history (3 cases, 27.3%), respectively. In girls, the anatomical disorders, which were observed in 6 cases (15.4%), were among the other causes of UTI and included 4 cases of vesicoureteral reflux and 2 cases of labia adhesion.

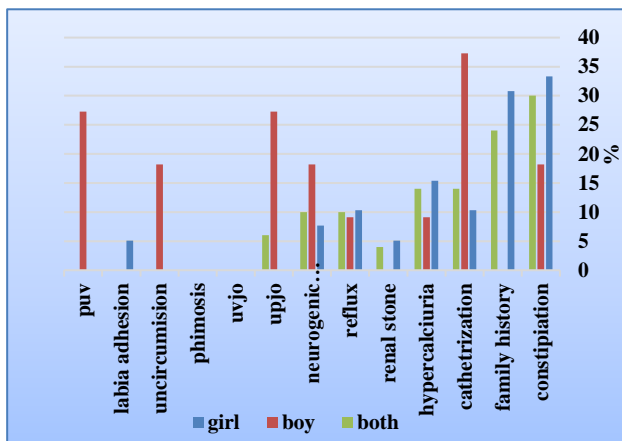


Figure 4: UTI risk factors for over 6 years.

Therefore, similar to the other age groups, in the girls and boys older than 6 years, the non-anatomical disorders, especially constipation, were the most common risk factors of UTIs. In boys, the anatomical and non-anatomical disorders had equal frequencies. Among the anatomical disorders, PUV and UPJO were the most common risk factors, and among the non-anatomical disorders constipation, neurogenic bladder, and uncircumcision were the most common.

DISCUSSION

In a study conducted in 2018 by Kavitha, 214 children with UTIs were studied.⁸ Of the studied children, 128 were male and 86 were female. In their research, the most common risk factor of UTI was uncircumcision in boys (=86.7%). This finding was also confirmed in our research where the most prevalent male disorder was uncircumcision (48 cases, 33%). In a study by Qeysari et al, hypercalciuria was introduced as the risk factor of UTI mainly in girls (42.9%) than boys (17.1%).⁹

In our research, hypercalciuria had a large share of the non-anatomical disorders (after constipation, uncircumcision, and renal stone) involved in the outbreak of urinary tract infections (50 cases, app. 12.3%). However, unlike the research by Qyesari, there was no significant difference between the roles of hypercalciuria in the outbreak of UTIs in boys and girls in this study and both had equal shares.

In a study by Hoque SA, the rate of positive urine culture in children suffering constipation was 8.9%, while it was 1.3% in children without constipation.¹⁰ Hence, they found out that the prevalence of UTI was approximately seven times higher in children with constipation. In this paper, we realized that among the non-anatomical factors, constipation was the most common factor (66 cases, 16.3%). More importantly, Figures 2, 3, and 4 suggest that the number of children with constipation increased with age. Hence, in children over the age of 6 years, constipation was observed in 30% of the boys. In this part of the discussion it was tried to analyze some of the risk factors and conduct a confirmatory comparison of our findings to other studies. However, diagrams 1 to 4 clearly illustrate all UTI risk factors in all age groups and both gender groups.

CONCLUSION

Since urinary tract infections are among the factors influencing and determining the irreversible renal damage in children and since these infections can cause dangerous complications if they are not recognized and treated timely, an understanding of the related factors can effectively contribute to the prevention of these infections. The identification of these factors can also result in more healthcare measures and caution in children prone to UTI as well as more periodical analyses of these risk factors for prevention purposes. The identification of these factors also informs the medical team of the necessity of further examinations of children for UTIs. Consequently, adequate information and training on circumcision and other risk factors are provided to reduce the prevalence of the urinary tract infections.

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