ORIGINAL ARTICLE

# Risk Factors Associated with Urinary Tract Infection in Children

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**ABSTRACT**

**Introduction:** Urinary tract infection is infection leading to an inflammatory response in the epithelium of the urinary tract. Urinary tract infection is defined as the growth of significant number of organisms of a single species in the urine, in the presence of symptoms. Significant bacteriuria is a growth with colony count of $>10^5$/ ml of a single species in a mid-stream clean catch urine sample. **Aims:** To find the prevalence of urinary tract infection in children with fever and its risk factor. **Methods:** A hospital based cross sectional observational study was performed in Nepalgunj Medical College, Kohalpur from October 2019 to October 2020. Children of age two months to 14 years admitted in Department of Pediatrics and visiting in outdoor fulfilling inclusion criteria were taken for the study. Detailed history and examination was performed. Data related to age, sex, predisposing risk factors of Urinary tract infection, symptoms and relevant investigations was carried out in all patients**. Results:** Among 135 children, maximum 62(45.92%) children were in the age group 1-5 years. There were 70(51.85) male and 65(48.14) female children. The prevalence of culture positive of urinary tract infection was 19.20%. Pyuria was more significant in females in comparison to male, more common in age group less than 5 years. 26 children were culture positive among which males to female ratio in urine culture positive cases were 1: 2.3 and majority had E.coli positive in urine culture sample. Apart from the female children urinary tract infection was commonly seen in uncircumcised male comprising of 8(11.42%) of total male children. **Conclusion:** In children presenting with fever, urinary tract infection was one of the common causes. It was most common in children less than 5 years, female gender and uncircumcised male children were two commonly associated risk factors.

***Keywords:*** Children, Infants, Prevalence, Risk factors, Urinary tract infection

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## INTRODUCTION

Urinary tract infection (UTI) is infection leading to an inflammatory response in the epithelium of the urinary tract.[1] UTI is defined as the growth of significant number of organisms of a single species in the urine, in the presence of symptoms. Significant bacteriuria is a growth with colony count of $>10^5$/ ml of a single species in a mid-stream clean catch urine sample.[2] The prevalence of UTI varies with age and sex. During the first year of life, males are more affected than females due to presence of colonized bacteria in uncircumcised penis with the male: female ratio of 2.8-5.4:1. Beyond 1-2 years, there is a female preponderance with 1:10 male to female ratio.[3]

Urinary complaints are rare below the age of 5 years. In preverbal age, UTI presents most commonly with vague signs and symptoms like fever, vomiting, lethargy and irritability. The typical triad of abdominal pain, vomiting and fever with chills, rigors or suprapubic pain are the characteristic features of upper and lower UTI.[4] Urine culture is mandatory for confirmation of diagnosis. Urine culture showing $>10^5$ organism per ml of single species confirms UTI. A lesser number should be interpreted in relation to clinical features.[5]

Recognition of UTI in children should be made as early as possible to prevent complications. Hence this study was done to determine the prevalence and risk factors of urinary tract infection in children with fever.

## METHODS

This study was hospital based cross sectional study. conducted in Department of Pediatrics Nepalgunj Medical College Teaching Hospital, Nepal The study was carried from October 2019 to October 2020 . Non probability (convenient) sampling method was used to calculate the sample size.

Febrile children with temperature >99° F (37.2 °C) those between two months to 14 years were included. Children with known congenital genitourinary anomalies, immunocompromised children and children with fever associated with other disease were excluded. Detailed history, clinical examination of all children was done. Data related to age, sex, predisposing risk factors like female, uncircumcised male, were noted. Routine blood counts, urine analysis, urine culture was done in all children. Ultrasonography of abdomen was done whenever needed. In children below two years of age, urine sample was collected under aseptic precautions by transurethral bladder catheterization. In children above two years of age, a clean-catch mid-stream specimen was used. A positive urine culture was defined as growth of $>10^5$ colonies of a single urinary tract pathogen/ml of urine specimen.

**Statistical analysis:** Data were processed and analyzed by using Statistical Package for Social Science (SPSS) software version 20. Variables were expressed in the form of frequencies and percentages. Descriptive statistics such as mean, range, standard deviation were computed. Chi-square test and Fisher's exact test were used. P-values less than 0.05 were considered statistically significant.Before starting the study, ethical approval was taken from Institutional Research Committee, every participant's willingness was considered before including them in the study. The information was kept confidential and was used only for research purpose and every participant was provided with the right to withdraw from the study at any time.

## RESULTS

The overall prevalence of culture positive UTI in children was 19.2%. The positive urine culture was common in the age group between two months to five years. (Table I)

| Age | Urine culture | | Total |
|---|---|---|---|
| | Negative | Positive | |
| 2 months - 1 year | 19 (17.4%) | 7 (26.9%) | 26 (19.25%) |
| 1- 5 years | 50 (45.8%) | 12 (19.35%) | 62 (45.9%) |
| 5-10 years | 21 (19.2%) | 4 (16%) | 25 (18.5%) |
| 10 -14 years | 19 (17.4%) | 3 (13.6%) | 22 (16.3%) |
| **Total** | **109** | **26** | **135 (19.20%)** |

***Table I: Prevalence of culture positive UTI according to age***

Total number of patient was 135. Among them 70 (51.8%) were male and 65 (48.2%) were female with an overall male to female ratio being 1:1.07. Out of 135 children, maximum children were from age group 1-5 years. (Table II)

| Age | Sex | |
|---|---|---|
| | Female | Male |
| 2 months - 1 year | 7 (5.18%) | 19 (14.00%) |
| 1- 5 years | 30 (22.2%) | 32 (23.7%) |
| 5-10 years | 13 (9.6%) | 12 (8.8%) |
| 10 -14 years | 15 (11.1%) | 7 (5.18%) |
| **Total** | **65 ( 48.08%)** | **70 ( 51.8%)** |

***Table II: Age and sex distribution***

| S.N. | Symptoms | Frequency |
|---|---|---|
| 1 | Fever | 26 (100%) |
| 2 | Dysuria | 13 (50%) |
| 3 | Vomiting | 11.7 (45%) |
| 4 | Chills and rigor | 10.4 (40%) |
| 5 | Loss of appetite | 9.1 (35%) |
| 6 | Increased frequency | 9.1 (35%) |
| 7 | Irritability | 8.32 (32%) |
| 8 | Decreased urine output | 7.8 (30%) |
| 9 | Passing high coloured urine | 7.8 (30%) |
| 10 | Burning micturition | 6.5 (25%) |
| 11 | Puffiness of face | 5.2 (20%) |
| 12 | Loose stool | 5.2 (20%) |
| 13 | Abdominal distension | 5.2 (20%) |
| 14 | Abdominal pain | 5.2 (20%) |
| 15 | Refusal to feed | 3.9 (15%) |
| 16 | Dribbling of urine | 3.9 (15%) |
| 17 | Foul smelling urine | 2.6 (10%) |

***Table III: Various symptoms associated with culture positive UTI***

Fever was the most common symptom which was seen in all patient whose UTI was established by urine culture. Most of the symptoms shown were associated with each other (Table III)

| Sex | Total no.of cases | Culture Positive cases Number | P value |
|---|---|---|---|
| Male | 70 | 8 (11.42) | 0.04 |
| Female | 65 | 18 (27.69) | |
| **Total** | **135** | **26** | |

***Table IV: Sex wise distribution of urine culture positive cases***

Among 135, the culture positive cases of UTI was 26(19.25%). Out of which 8(11.42%) were male and 18(27.69%) were female. Culture positive cases were more common in female children in comparison to male children and was statistically significant.(P= 0.04). (Table IV)

| Organisms | Frequency |
|---|---|
| E coli | 22 (84.6) |
| Klebsiella | 3 (11.53) |
| Proteus | 1 (3.84) |
| **Total** | **26** |

***Table V: Organism causing UTI***

Out of total study population only 26 children were having organism in their urine culture among which E.coli was the most commonest organism 22(84.6%), followed by Klebsiella 3(11.53%) and Proteus 1(3.84%) Table V

| Condition | Number of patients | Urine culture positive |
|---|---|---|
| Circumcised | 0 | 0 |
| Non circumcised | 70 | 8 |

***Table VI: Association of uncircumcised male with urine culture***

In the present study, out of 26 culture positive cases, there were 8 (30.7%) male cases and all were uncircumcised males. (Table VI)

**DISCUSSION**

Out of 135 children, urine culture was positive in 26(19.3 %) cases only, with male to female ratio of 1: 2.3 which is comparable to other studies done by Bhat et al, Ganesh et al, Aiyegoro O.A et al and Raghubanshi et al the prevalence of culture positive reported in their study were 13.2%[6], 12.3%.[1] 11.96%.[7] and 18.49%.[9] respectively however in the similar study done by, S Sharma K et al the prevalence of 37.35%.[8]

In the present study, UTI in febrile children was most common in < 1 year was 26.9.%, and is almost similar to studies by Singh SD and Madhup SK (2012)[15], Rabina Ganesh et al (2015)[1] and Raghubanshi BR et al (2010)[9] reported prevalence of 32.5%, 27.9% and 33.3%. In the present study, UTI in febrile children second most common age 1 – 5 years was 19.3%, which was similar to study done by Bhat et al[6] 12.8%, Shrestha LB et al[12] 14.9% and Raghubanshi BR et al[9] 19.6% In contrast in age group of 1-5 year of other studies were Rabina Ganesh et al (2015)[1] 45.6%, Singh SD and Madhup SK(2012)[15] 47%, GK Rai et al (2007)[14] 40%. The present study showed female preponderance with a male to female ratio of 1:2.3 which was statically significant. This study was comparable to Singh SD and Madhup SK, where male to female ratio was 1:2.[15] Hellstrom et al (1991) found that 8.4% of girls and 1.75% of boys aged upto 7 years had culture proven UTI.[17] Both Hoberman et al and Roberts et al reported statistically significant increase in UTI in febrile female children.[18] Parajuli NP (2015) reported that urinary tract infection was significantly more prevalent in the female children of age group 1-4 and 5-9 years and also, more inpatients were found with UTI (p< 0.05).[19]

There was no consistent symptoms common to all patients with UTI other than fever. However, the dysuria and vomiting were the predominant symptoms. Other nonspecific symptoms like loss of appetite (35%) irritability (32%) and abdominal pain (20%) were also noted. These finding were comparable to Ginsburg et al where symptoms were like irritability (55%), poor feeding (38%), vomiting (36%) diarrhea (31%) and abdominal distention (8%).[20] Hoberman et al reported vomiting, diarrhea, irritability and poor feeding in 40%, 30%, 80% and 65% respectively in infants with UTI.[18]

In the present study, E.coli was the most commonest organism 22(84.6%), followed by Klebsiella (11.53%) and Proteus (3.84%). This study was in consistent to Bryan C.S et al which reported E.coli as the common urinary pathogen in 85% of cases.[21] Study done by Zamir G et al reported E.coli (85%), Klebsiella Sp. (7.1%), Proteus Sp. (4.7%).[22]

Bhat et al. found out E. coli (85%) Klebsiella (10%) and Citrobacter in (5%).[6] According to Bagga A et al about 90% of first symptomatic UTI and 70% of recurrent infections are due to E.coli.[24]

In the present study out of 135 cases, 26 had positive urine culture of which 18 were female and was statistically significant. Study done by both Hoberman et al and Roberts et al reported statistically significant increase in UTI in febrile female children.[18] Gorelick et al reported 4.3% of prevalence of UTI in febrile girls younger than two years.[16] Sharma A et al found out that male : female ratio was 1:1.9.10 Bhat et al reported the ratio of male : female to be 1:3.[6] There is a high association of female with UTI because female urethra is shorter than the male and hence, it provide the easy access to pathogens to urinary bladder.

Among the 26 urine culture positive cases, uncircumcised males accounts for 30.7% of cases of UTI, This study was comparable to Thomas et al where the incidence of UTI in uncircumcised male was greater than circumcised male infant[23] (P<0.01).[26] Study done by Saeed CH et al, the percentage of UTIs in uncircumcised boys 30(76.9%) was significantly higher than that of circumcised boys 9(23.1%).[13] Uncircumcised males experience a higher rate of UTI through several mechanisms, including heavy periurethral colonization by uropathogens, and an inability to fully retract the foreskin.

**LIMITATIONS**

This is not a randomized study. There is no comparison between the circumcised and uncircumcised children so the significance could not be analyzed. There are patients with both cultures positive as well as negative (but with symptoms of UTI and presence of pus cell in urine analysis) are present in study. Better would be to have only culture positive patients.

**CONCLUSION**

UTI was most common in age group of less than one year followed by between 1-5 years. Both male and female children were almost equally affected but the culture positivity rate was higher in females. E.coli was the most common organism found in urine culture. Factors like female gender, uncircumcised male, and age below 5 years had a strong relationship with UTI.

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