

ORIGINAL ARTICLE

A Cross-Sectional Study on the Epidemiology of Urinary Tract Infection in Children and its Associated Risk FactorsTUFAIL HUSSAIN TAHIR¹, TAJ MUHAMMAD², FARMAN ULLAH³, RIDA NAZ⁴¹Associate Professor Urology Poonch Medical College Rawalakot Azad Kashmir²Assistant professor, Department of Pediatrics, Mufti Mehmood Memorial Teaching Hospital, Dera Ismail Khan-29050-Pakistan³Associate professor, Department of Pediatrics, Gomal Medical College, Dera Ismail Khan-29050-Pakistan⁴Regional Blood Centre, Dera Ismail Khan-29050-PakistanCorresponding author: Rida Naz, Email: dr.ridaanaz@gmail.com**ABSTRACT****Background:** Urinary tract infection (UTI) is one of the most challenging and un-noticed infections in children, due to the migration of microbial flora from the fecal material to the urethra via perineum.**Objectives:** The study aimed to determine the incidence of UTI in children and their associated risk factors.**Study Design:** 362 patients were investigated and classified according to their age and gender.**Methodology:** Pediatric patients' urine samples were collected for urinalysis and urine culture for the confirmation of UTI.**Place and Duration:** This retrospective cross-sectional study was conducted at DHQ Teaching Hospital, Dera Ismail Khan, in 2020-21 and 2021-22.**Results:** Positive results were observed in 31 of 362 samples (10.22%); prevalence was higher among female children (12.39%) than males (6.25%). There was a statistically significant difference ($P < 0.05$) across three age groups, infants being the most susceptible (14.90%), followed by children aged 1-5 years (7.08%) and 5-10 years (5.40%).**Conclusion:** Considering the high frequency of UTI in children and the difficulty in its diagnosis, due to the lack of specific symptoms, the study recommended that all pediatric patients with fever without obvious cause, the only clinical indicator, should be evaluated for UTI.**Keywords:** Dysurea; Pyrexia; Uncircumcised boys; Urosepsis.**INTRODUCTION**

Urinary tract infection is one of the most prevalent and important bacterial infections affecting children with unidentified sources. Female infants and uncircumcised boys are more prone to these bacterial infections due to short urethra and bacterial flora in the fore-skin surface, respectively. Additionally, the voluntary retention of urine during toilet training during the toddler phase exacerbates UTIs. Urine stasis facilitates bacterial contamination in the urinary bladder and gives more time and opportunity for the bacteria to grow and establish the UTI¹.

In pediatrics, the usual underlying microorganisms in UTI are Gram-negative bacteria innervating the urethra by contracting from fecal material in the perineum, the most common of which is *Escherichia coli*, with an incidence of 80% in pediatrics². Other microbes involved in UTI are *Enterococcus*, *Enterobacter*, *Klebsiella* species³⁻⁴, *Pseudomonas*, *Proteus*, *Streptococcus agalactiae* and *Staphylococcus aureus*⁵. The diagnosis of UTI in pediatric patients is a clinical challenge due to the lack of specific signs and symptoms. The patients are pyrexia as the only clinical sign without apparent maladies⁶. UTI if left untreated increases the chances of recurrence and invasion of other opportunistic microbes including viruses, parasites, fungi, etc, thus accelerating the risk of renal scarring, urosepsis, and renal failure in pediatric patients⁷. Sometimes due to hematogenic transmission, the bacteria invade cerebrospinal fluid, resulting in meningitis and septic shocks and increasing the case fatality rate in infants⁸.

The prevalence of UTI is clinically characterized by biphasic mode in which the first infection is seen during the first year of life and then reoccurs at 2-4 years of age during toilet training⁸. More than 30% of the UTI-affected children experience a reoccurrence of the infection might be due to bladder-bowl dysfunction or vesicoureteric reflux⁹.

Therefore, this study was established among children of less than 10 years of age, presented at District Headquarter (DHQ)

Teaching Hospital, Dera Ismail Khan, during the year 2020-21 and 2021-22.

MATERIALS & METHODS

Study Design: This retrospective cross-sectional was conducted at District Headquarter (DHQ) Teaching Hospital, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan from July 2020 to June 2022. This is the main district-level hospital with pediatrics and nephrology departments, well equipped with the latest diagnostic machinery and experienced professionals. The patients from all the peripheral and vicinity areas of the district are provided with the healthcare facilities at this hospital and due to this high flux of patients, 362 subjects were tested for UTI and included in this study (**Table 1**). The subjects were infants below 1 year of age and children of age ranging between 1 to 5 years and from 5-10 years, presented at the hospital with clinical signs of UTI characterized by pyrexia, dysuria, backache and history of foul smelly urine, and their samples were processed for diagnosis of UTI by urine culture analysis. To prevent further risk of contamination of the urinary tract of the infants, invasive urine collection techniques were not implied in this study rather a plastic bag was attached to the genitalia of infants for urine collection by natural micturition process, while, in toilet-trained children, the mid-stream voided urine was collected adapting sterile procedure. The children, already receiving the antibiotic therapy were excluded from the study to prevent adulterated results². The metadata of the patients and complete treatment files of all the patients were duly maintained and analyzed. The study was duly approved by the Ethical Committee of the Review Board of DHQ hospital, D. I. Khan. After compilation of the results, the complete data were statistically analyzed using SPSS Software Version 2.0 at a 95% confidence interval and $P < 0.05$ was considered as statistically significant in one-way ANOVA including Tuckey HSD application and the data within the treatment groups was analyzed using Chi-square calculator.

Table 1: Data presenting the age and gender of the patients enrolled in the study

Age	Gender				Total (n)	Chi-Square value	P-value
	Male		Female				
	Number (n)	Percentage (%)	Number (n)	Percentage (%)			
1 < years	59	16.29	102	28.17	161	8.8896	0.0028*
1-5 years	41	11.32	86	23.75	127	12.902	0.000328*
5-10 years	28	7.73	46	12.70	74	3.502	0.6127
Total	128	35.35	234	64.64	362	20.304	0.00001*

*indicates the significant values

Analysis of the urine samples: The urine samples were collected from the patients for urinalysis and confirmation of UTI. Urinalysis was done on the freshly collected urine from the patients for <1 hour time. For diagnostics, two methods were implied for detection of the bacteria in urine; viz direct microscopy of urine in which the Gram staining was done for the identification of underlying Gram-positive or negative bacteria and secondly and more preferably the urine samples were cultured aerobically on two growth media i.e. blood agar and MacConkey agar, for identification of the causative bacterial pathogen based on colony characteristics, morphology and their biochemical testing. The criterion established for the positive cases was bacterial growth on the culture media presenting colony growths of $\geq 10^4$ CFU (Colony Forming Units)/ml of urine ¹⁰.

RESULTS

A total of 362 urine samples were collected from the pediatric patients complaining the febrile conditions and dysuria, backache, and a history of foul smell in urine. Among 362 samples, 128 (35.35%) were received from male children, and 234 (64.64%) urine samples were collected from female children. The data was organized among different age groups, in which 161(44.47%) urine samples were processed for infants of less than 1 year of age, 127 (35.08%) from children of age range 1-5 years and 46 (12.70%) from the children over 5 years age. A statistically significant difference ($P<0.05$) was found between the male and female patients presented at the hospital for UTI among age groups of less than 1 year and ages ranging between 1-5 years. Also, there was a significant difference in samples in the gender of patients included in this study ($P<0.05$). Out of the total samples (362) processed, 31 samples were found positive with an overall prevalence percentage of 10.22%, in which females (12.39%) showed a higher prevalence than male children (6.25%). As far as age groups were concerned, a statistically significant difference ($P<0.05$) was found among three age groups (**Table 2**), in which the infants of age less than 1 year were highly prone to the infection (14.90%), followed by children of age 1-5 years (7.08%) and 5-10 years (5.40%). Similarly, a statistically significant difference ($P<0.05$) was found between the sex groups of patients revealing that females were more highly susceptible to UTI than male children, with a two-fold ratio and showed an incidence of 12.39 and 6.25%, respectively (**Table 2**).

It was seen that the incidence of UTI was highest in children less than 1 year of age, pertaining to both sexes. Similarly, the pattern of incidence prevailed highest in females of all age groups, as compared to male groups, due to short urethra and elevated risk factors. In females, the UTI incidence was significantly high ($P<0.05$) in children less than 1 year of age, subsequently descended in other age groups of 1-5 years and 5-10 years, with a prevalence rate of 17.64, 9.30 and 6.52%, respectively. While, in males, the prevalence percentage in infants less than 1 year, between 1 and 5 years and more than 5 years of age was 10.16, 2.43 and 3.57%, respectively, with significant declination ($P<0.05$) among all the treatment groups. Table 2: Overall prevalence of UTI including gender and age groups of the patients

Table 2:

Age	Gender		Total (%)	P-value
	Male	Female		
	Number of positive samples (%)	Number of positive samples (%)		
1< years	6/59 (10.16%)	18/102 (17.64%)	24/161(14.90%)	0.00001 (Significant at $P<0.05$).
1-5 years	1/41 (2.43%)	8/86 (9.30%)	9/127 (7.08%)	
5-10 years	1/28 (3.57%)	3/46 (6.52%)	4/74 (5.40%)	
Total	8/128 (6.25%)	29/234 (12.39%)	37/362 (10.22%)	

df= 2
MS = 5.14
F= 48.303

P= 0.00001*
Between the treatment groups; the results are Significant at $P<0.05$.

*indicates the significant values

The clinical signs and patients' complaints were also correlated with the incidence of UTI and it was found that the patients with febrile conditions, complaining of dysuria, failure to thrive, having a previous history of UTI, backaches and urine alterations had incidence ratios of 93, 71, 39, 27, 26 and 41.9%, respectively (**Figure 1**).

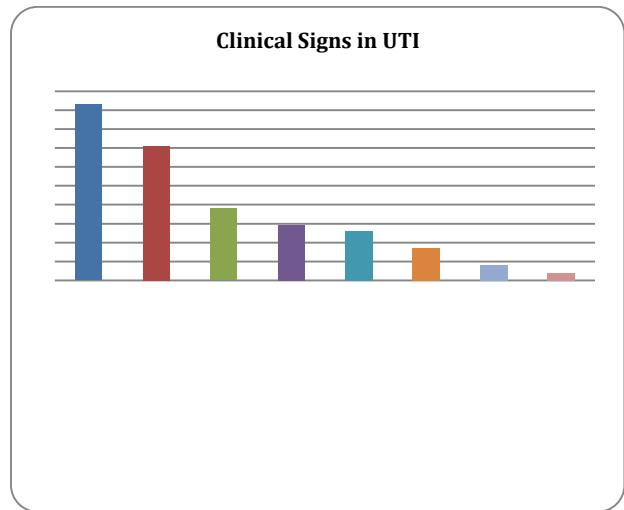


Figure 1: The ratio of clinical signs to the positive cases of UTI

DISCUSSION

A statistically significant difference ($P<0.05$) was found between the male and female patients presented at the hospital for UTI among age groups of less than 1 year and ages ranging between 1-5 years. Also, there was a significant difference in samples in the gender of patients included in this study ($P<0.05$). As far as age groups were concerned, a statistically significant difference ($P<0.05$) was found among three age groups. Similar nature studied correlated with our findings whereby, a study was conducted for the prediction of UTI in children in Cameroon, which also stated that the overall prevalence of UTI in children was 12% and the predominant bacteria infecting their urinary tract was E. coli ¹¹. The findings were in accordance with our study in which the overall prevalence of UTI in children was 10.22%. But a study reported a very high prevalence of UTI in children in the Hazara Division of Pakistan (37.5%) ¹². These variations in the results might be due to unhygienic circumstances in the area, which was already acknowledged by the authors. In another study, the prevalence of UTI in boys and girls in their first year of life was 2 and 7% ¹³, which was in close liaison with our findings of UTI incidence in the infants.

Our results were supported by a study conducted on pediatric UTI, in which it was reported that the incidence of UTI in male infants is highest below 1 year of age in both sexes ². In agreement with our findings, it was reported that the incidence of UTI was seen significantly high ($P<0.05$) among female candidates of all age groups as compared to males. And the estimated prevalence percentage in infants was 10.6 and 4.8%, in females and males, respectively. While, for 1-2 years of age, females and males showed a prevalence of 13.3 and 2.4%, for 2-3 years, 16 and 1.3%, for 3-10 years, 10.4 and 0.1% and 10-15 years of age, the incidence in females and males was 13.3 and 0%, respectively ¹². It was also reported the same that the incidence of UTI was significantly higher in females as compared to boys, prevailing at the rate of 52.9 and 47.1%, respectively ¹⁴. Another study also

confirmed our results that girls are more susceptible to UTI owing to their short urethra and subsequent migration of the pathogens from fecal material at the perineum to the urethra¹⁵.

Similar results were retrieved in a study that common presentation of UTI-infected children was fever (91%), dysuria (4-60%), recurrence (30%), abdominal pain (22%) and lumbar tenderness were evident clinical signs¹⁶. Others reported that 10% of urethral discharges and 9% of lower abdominal pains were apparent in children with UTIs¹⁷. The signs of fever, abdominal ache, dysuria and reoccurrence of the infection were also reported¹¹. Another study reported that pyrexia conditions were closely associated with UTI by 91%^{14, 17}. All these studies strongly supported our findings of the clinical presentation of UTI.

CONCLUSION

Considering the high frequency of UTI in children and the difficulty in diagnosing UTI in pediatric patients due to the lack of specific symptoms, the study recommended that all pediatric patients with fever without obvious cause, the only clinical indicator, should be investigated for UTI. Because untreated UTI increases the likelihood of recurrence and invasion by other opportunistic microorganisms, such as viruses, parasites, and fungi, hence increasing the risk of renal scarring, urosepsis, meningitis, and renal failure in juvenile patients, which can be fatal.

Recommendation: The study recommended that all pediatric patients with fever without obvious cause, the only clinical indicator, should be investigated for UTI

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