Factors Associated with Urinary Tract Infection among Children Aged Less than 5 Years Visiting Department of Pediatrics of Dhulikhel Hospital

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ABSTRACT

Background

Urinary tract infection (UTI) constitutes a significant cause of morbidity, especially among children under five years old. Early diagnosis and management are essential to minimize acute morbidity and prevent the long-term complications associated with urinary tract infections.

Objective

To identify factors associated with urinary tract infections among children under five years old.

Method

A quantitative cross-sectional study was conducted at Dhulikhel Hospital, Kathmandu University Hospital in Nepal, involving face-to-face interviews with 105 parents of children under 5 years with suspected or culture-positive Urinary tract infections. Data collection occurred from July 2022 to December 2022, covering both outpatient (OPD) and inpatient cases. Logistic regression was employed to identify factors associated with urinary tract infections.

Result

The Urinary tract infection prevalence among children under five was 27.12%, with over half (55.2%) were female. Females had a seven times higher urinary tract infection risk than males (95% CI: 1.64 - 30.18; p = 0.009). Children with congenital anomalies faced a 22.8 times higher urinary tract infection risk (95% CI: 1.70 - 286.56, p = 0.01). Diaper changes exceeding 6 hours elevated the risk by 20.09 times (95% CI: 1.14 - 353.95; p = 0.04). Escherichia coli presence in urine culture correlated with a 9.43 times higher urinary tract infection risk (95% CI: 1.34 - 66.16, P = 0.02).

Conclusion

Implementing preventive measures, including maintaining personal hygiene and changing diapers frequently, can significantly reduce the incidence of urinary tract infections in children, ultimately minimizing medical costs.

KEY WORDS

Children, Cleaning, Risk factors, Urinary tract infection

INTRODUCTION

Urinary tract infection (UTI) is a prevalent health issue among the pediatric age group, particularly those under 5 years old.[1,2] In high-income countries, approximately 2.8% of under-five children are affected annually by UTI, with recurrence rates ranging from 8% to 30% depending on the age group.[3] UTIs are a common cause of febrile illness worldwide, with a prevalence of 2-20% in children.[4] The prevalence varies globally, ranging from 9% to 45%, reflecting differences between high-income and low-income settings.[5] Asian countries, such as India and Nepal, report particularly high UTI prevalence rates, reaching up to 48% and 15.8% to 57%, respectively.[6,7] It is estimated that around 8% of girls and 1-2% of boys under 5 years will experience at least one UTI episode.[1,8] Recurrent UTIs occur in approximately 30% of children under five within the first year after their initial occurrence.[4,9] Infectious diseases, including UTIs, account for 26% of deaths among children, with 98% of these deaths occurring in low-income countries.[7] UTIs rank as the second most common reason for seeking help at health centers.[10] Timely diagnosis and treatment of UTIs are crucial to prevent renal scarring and hypertension.[11,12] Various risk factors contribute to UTIs in children under five, including incomplete immune system development in neonates and infants, cleaning practices, and functional abnormalities.[13,14]

The primary aim of this study was to identify factors associated with urinary tract infections among children under five years old at the pediatric department of Dhulikhel Hospital, Kathmandu University Hospital.

METHODS

This is descriptive cross-sectional study over a 6-month period, from July 2022 to December 2022, at the Pediatric Department of Dhulikhel Hospital, Kathmandu University Hospital (DH, KUH). We enrolled 105 participants using convenient sampling. Inclusion criteria included under five children years with UTI symptoms, either admitted to the pediatric inpatient department or suspected UTI cases in the outpatient department (OPD) of pediatrics. Symptomatic UTI includes children with symptoms such as fever, increased urine frequency, abdominal pain, urine discoloration, itching, and burning sensation in the perineal area, despite normal results in routine urine examination and no growth in urine culture.[14] We excluded children with developmental delays related to UTI, defined as a significant delay in achieving developmental milestones, including motor skills, cognitive skills, and speech skills.[15]

Data were collected through 30-minute face-to-face interviews with parents, utilizing Nepali versions of questionnaires. The questionnaire, developed through literature review and expert consultation, covered socio-demographic variables (parents' age, gender, child's age, parent education) and clinical variables (UTIs symptomatic/asymptomatic, diaper use, duration, perineal cleaning practices, congenital anomalies, past UTIs). Parents were briefed on the study's purpose before interviews, and data collection ensued upon obtaining written and verbal consent, also involving biomarkers from participants' investigation cards.

Data analysis employed descriptive statistical methods, including frequency and proportion for categorical variables, and mean and SD for continuous variables. Logistic regression was utilized to explore factors associated with UTI. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.

The study commenced after receiving approval from the Institutional Review Committee-Kathmandu University School of Medical Sciences (IRC-KUSMS). Additional permissions were obtained from the Director of Clinical Nursing, Academic Nursing, and the Head of the Pediatric Department at DHKUH.

RESULTS

During the study period, 915 suspected UTI cases were identified from 3,373 inpatients and outpatient department (OPD) visits for under five children. Confirmed culture-positive UTI cases were observed in the inpatient department, resulting in a 27.12% prevalence of UTI cases during the study period.

Table 1 displays demographic characteristics, with 55.2% of the children being female. The majority (41.0%) were in the pre-school age group, and Janajati ethnicity constituted the highest percentage (46.7%). About 62% of respondents came from the OPD. For children admitted with UTI, the average hospital stay was 7 days (SD = 2.0), and the mean weight was 12.7 kg (SD = 5.1).

Table 2 outlines key findings, with 76.2% of children having symptomatic UTI. Nineteen percent had a congenital anomaly (Phimosis), while 69.5% had no previous UTI history. Diaper use was reported by 53.3% of children, and among them, 32.4% changed diapers for over six hours. Regarding cleaning practices, 73.3% cleaned from outer to inner, moving from the anus to the urethra site.

Table 3 displays urine culture results, highlighting Escherichia coli (Ecoli) as the predominant organism at 23.8%. Klebsiella and Enterobacter were found in 3.7% and 2.9% of cases, respectively. Mixed growth, indicating multiple organisms, occurred in 9.6% of cases. Notably, 58.1% showed no bacterial growth in the urine culture.

Table 4 outlines antibiotic sensitivity and resistance patterns in the study population. Gentamycin demonstrated 26.7% sensitivity and 5.7% resistance, while Amikacin showed 20% sensitivity and 15.2% resistance. Nitrofurantoin had notable sensitivity (28.6%) and low resistance (6.7%).

Table 1. Socio-demographic Information of Children (n =105)

Characteristics	Frequency	Percent
Gender of child		
Female	58	55.2
Male	47	44.8
Age of Child		
Infant	28	26.7
Toddler	34	32.4
Pre-scholar	43	41.0
Ethnicity of Child		
Janajati	49	46.7
Brahmin/Chhetri	41	39.0
Dalit and others	15	14.3
Residence		
Urban	53	50.5
Rural	52	49.5
Inpatient	40	38.1
Outpatient	65	61.9
Duration of hospital stay in days (mean ± SD)	7.0	±2.0
Weight of child in kg (mean ± SD)	12.7	± 5.1

Table 2. Clinical Characteristics of Children (n = 105)

Characteristics	Frequency	Percent
Symptomatic UTI	80	76.2
Asymptomatic UTI	25	23.8
Congenital anomaly (Phimosis)	20	19.0
UTI in the Past		
Yes	32	30.5
No	73	69.5
Diaper use		
Yes	49	46.7
No	56	53.3
Diaper change		
> 6 hourly	34	32.4
< 6 hourly	19	18.1
Perineal cleaning practice		
Back to front	77	73.3
Front to back	28	26.7

Table 3. Organism Isolated in Urine Culture Test (n = 105)

Organism	Frequency	Percent
Ecoli	25	23.8
Klebsiella	6	3.7
Enterobactor	3	2.9
Mixed growth	10	9.6
No growth	61	58.1

Norfloxacin displayed 21.0% sensitivity and 6.7% resistance, and Ciprofloxacin showed 15.2% sensitivity and 17.1% resistance. Cefazolin, however, had minimal sensitivity (1.0%) and higher resistance (30.5%).

Table 4. Antibiotic Sensitivity and Resistance Pattern (n=105)

Antibiotic	Sensitive	Resistant	Unchecked
Gentamycin	28 (26.7%)	6 (5.7%)	71 (67.6%)
Amikacin	21(20.0%)	16 (15.2%)	68 (64.8%)
Nitrofurentoin	30 (28.6%)	7 (6.7%)	68 (64.8%)
Norfloxacilline	22 (21.0%)	7 (6.7%)	76 (72.4%)
Piperacilline	15 (14.3%)	16 (15.2%)	74 (70.5%)
Cefixime	16 (15.2%)	21 (20.0%)	68 (64.8%)
Meropenam	15 (14.3%)	16 (15.2%)	74 (70.5%)
Imipenam	16 (15.2%)	15 (14.3%)	74 (70.5%)
Ciprofloxacilline	16 (15.2%)	18 (17.1%)	71 (67.7%)
Cotrimoxazole	15 (14.3%)	18 (17.1%)	72 (68.6%)
Ceftriaxone	14 (13.3%)	21 (20.0%)	70 (66.7%)
Tazobactam	12 (11.4%)	20 (19.0%)	73 (69.5%)
Amoxyclav	8 (7.6%)	23 (21.9%)	74 (70.5)
Ampiciline	5 (4.8%)	26 (24.8%)	74 (70.5)
Cephalexin	7 (6.7%)	26 (24.8%)	72 (68.6%)
Cefazolin	1 (1.0%)	32 (30.5%)	72 (68.6%)

Table 5 presents logistic regression findings on child UTI in relation to independent variables. A significant association was observed between child UTI and gender (p = 0.009). Female children exhibited a sevenfold higher likelihood of developing UTIs compared to males (OR: 7.04; 95% CI: 1.64 - 30.18), adjusting for age, parents' age, ethnicity, education, diaper use, perineal cleaning, congenital anomalies, diaper change intervals, and urine culture organism growth.

Congenital anomalies significantly increased UTI risk, with an adjusted OR of 22.08 (95% CI: 1.70 - 286.56, p = 0.01). Diaper change timing also played a crucial role (p = 0.04), as parents changing diapers more than 6 hours had a 20.09 times higher likelihood of their children developing UTIs compared to non-diaper users (95% CI: 1.14 - 353.95, p = 0.04) after adjusting for confounders. Additionally, the study revealed a higher UTI likelihood when Escherichia coli was present (p=0.02). Children with Escherichia coli in urine cultures had a 9.43 times increased chance of UTIs (95% CI: 1.34 to 66.16) after adjusting for confounders. Unadjusted models also showed significant associations with the age of parents and diaper use.

DISCUSSION

UTI poses a common health challenge for children under the age of five, representing a significant contributor to childhood morbidity and mortality.[2] This study aimed to identify factors associated with UTI among children under five with suspected or confirmed cases, both in the outpatient department (OPD) and the inpatient department of pediatrics. The prevalence of UTI in this specific population was 27.12%, while previous research in general hospitals across Nepal reported rates ranging from 23.1% to 37.4%.[16] A study conducted in Nigeria

Table 5. Factor association with child UTI (n=105)

	Crude			Adjusted		
	OR	**95% CI**	**p-value**	**OR**	**95% CI**	**p-value**
Age of children	1.23	0.95 - 1.58	0.11	1.00	0.61 - 1.65	0.96
Sex of children						
Male	ref			Ref		
Female				7.04	1.64 - 30.18	**0.009**
Age of parents	1.10	1.01 - 1.21	**0.02**	1.10	0.97 - 1.24	0.11
Ethnicity						
Brahim/ Chhetri	ref			Ref		
Janajati	0.36	0.10 - 1.22	0.10	0.46	0.08 - 2.53	0.37
Newar	0.77	0.21 - 2.77	0.69	0.51	0.94 - 2.79	0.44
Dalit	0.58	0.09 -3.50	0.55	1.03	0.07 - 14.48	0.97
Other	0.24	0.51 - 1.13	0.07	0.52	0.61 - 4.54	0.56
Education of parents	1.02	0.90 - 1.15	0.70	1.03	0.83 - 1.28	0.72
Diaper use						
No	ref			Ref		
Yes	0.37	0.14- 0.95	**0.03**	2.58	0.32 - 20.28	0.36
Perineal cleaning						
Front to back	ref			Ref		
Back to front	1.68	0.64 - 4.41	0.28	1.22	0.26 - 5.60	0.79
UTI History						
No				Ref		
Yes	1.16	0.43 - 3.15	0.75	1.21	0.26 - 5.46	0.26
Congenital anomalies						
No	ref			Ref		
Yes	7.47	0.94 - 58.98	**0.06**	22.08	1.70 - 286.56	**0.01**
Diaper change						
No use	ref			Ref		
< 6 hourly	1.27	0.41 - 3.97	0.67	1.92	0.33 - 10.95	0.45
> 6 hourly	6.00	1.65 - 21.7		20.09	1.14 - 353.95	**0.04**
Organism Present						
No organism growth	ref					
Escherichia coli	4.81	1.02 - 22.59	**0.04**	9.43	1.34 - 66.16	**0.02**
Klebsella	2.09	0.22 - 19.20	0.51	4.31	0.14 - 128.06	0.39
Mixed organism	0.94	0.25 - 3.45	0.92	1.02	0.15 - 6.93	0.91

revealed varying prevalence rates of UTI in pediatric cases, ranging from 6% to 37%, emphasizing differences between developed and developing countries.[17]

In our study, females accounted for half of the respondents (55.2%), and the majority fell within the preschool age group (41.0%), consistent with similar findings in a study on the epidemiology of urinary tract infection and antimicrobial resistance in a pediatric hospital in Nepal.[12,16] While minimal variations were observed in age groups among infants, toddlers, and preschoolers, our study indicated a higher prevalence of UTI in females (55.2%) after the first year of life. This aligns with a study conducted on the prevalence of urinary tract infections in infants and children in Arak, Iran.[18] However, our findings differ from a study on predictors of bacterial UTIs among febrile children under the age of five.[19] The increased UTI prevalence in this age group may be attributed to factors such as immune status, sanitation, ascending infection of fecal flora, shorter urethral distance in female children, and intentional bladder retention during toilet training, creating a favorable environment for organisms.

This study revealed that the majority of children (61.9%) came from the outpatient department, and a significant proportion of them (76.2%) had symptomatic urinary tract infections (UTIs). Perineal hygiene practices were predominantly from back to front (73.3%). A higher prevalence of UTIs was identified in children with congenital anomalies (19.0%), especially those who were uncircumcised and had a past history of UTIs. Escherichia coli was the most common organism in urine culture and sensitivity tests, accounting for 23.8%. Children with suspected UTIs were mostly found to have febrile conditions. These findings are consistent with results from other studies.[16,20,21]

The study revealed a significant association between UTIs and gender, congenital anomalies, and diaper change timing in children. Females had a seven times higher chance of developing UTIs compared to males, and those with congenital anomalies had nearly 22 times higher odds of UTIs. Additionally, children using diapers for more than six hours had a 20 times higher chance of UTIs. These results are consistent with findings from other studies.[21-23]

The study has several limitations to consider. The relatively small sample size restricts the generalizability of findings to a broader population, echoing a need for caution in interpreting results. Convenience sampling introduces potential bias, impacting the external validity of the study. The cross-sectional design hinders the establishment of causal relationships and the observation of temporal changes. Relying on self-reported data, especially regarding hygiene practices and diaper change frequency, poses risks of recall or social desirability bias. The single-center setting further restricts generalizability to populations with different demographics and healthcare practices.

Focusing on children under five excludes older age groups, narrowing the applicability of findings to a broader pediatric population. Addressing these limitations is crucial for enhancing the robustness of future research endeavors.

CONCLUSION

This study sheds light on the prevalence and associated factors of UTIs in under five children. Notably, it establishes a significant correlation between gender, congenital anomalies, diaper using timing, and UTIs. These findings offer valuable insights into the understanding of UTIs in this pediatric population, providing a foundation for preventive measures and guiding future research initiatives. Crucially, maintaining proper hygiene practices, including appropriate wiping techniques, dryness maintenance, and regular diaper changes, is essential for mitigating UTIs in children.

We recommend conducting public health awareness campaigns and educational interventions for parents and caregivers, focusing on proper hygiene practices, wiping techniques, and frequent diaper changes to mitigate UTIs. It is also recommended to integrate hygiene education and parental counseling into routine pediatric care. Additionally, future research should explore the factors associated with UTIs and the relationship between developmental delays and UTIs in children.

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