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Prevalence, Risk Factors, and Microbial Profile of Urinary Tract Infections in Pediatric Population

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A B S T R A C T

Urinary tract infections (UTIs) are among the most common bacterial infections in childhood. This study aimed to determine the clinical symptoms, laboratory test results, risk factors, and etiology of symptomatic UTIs in pediatric patients admitted to Tobruk Medical Center, with a focus on age and sex differences. The study was designed as a retrospective analysis and included data from 1 January to 31 December 2023. A total of 84 patients were included in the study. In terms of sex distribution, females were three times more prevalent than males, accounting for 77.4% of cases compared to 22.6% for males. The observed clinical presentations were as follows: dysuria (18%), suprapubic pain (17.2%), vomiting (17.2%), fever (15.2%), urinary frequency (15.2%), urgency (9.3%), and hematuria (7.8%). The age distribution of participants was as follows: 46% were between 3 and 4 years old, 40% were between 5 and 8 years old, 9.5% were between 9 and 12 years old, and 3.6% were over 12 years old.

1 Introduction

Urinary tract infections (UTIs) are among the most prevalent bacterial infections in childhood [Tullus, K., & Shaikh, N. (2020)], affecting approximately 7.8% of children under 19 years of age who present with urinary symptoms and/or fever [Stein, R et.al (2015)]. The incidence of UTIs in children varies significantly by age, race/ethnicity, sex, and circumcision status [Shaikh, N et.al (2008), Leung, A. K. C et.al (2019)]. Notably, UTIs are more common in boys (3.7%) than in girls (2%) during the first year of life and may serve as the initial clinical manifestation of congenital anomalies of the kidneys and urinary tract (CAKUT) [Shaikh, N et.al (2008),]. However, this pattern reverses after infancy, with girls exhibiting higher susceptibility to UTIs [Tullus, K., & Shaikh, N. (2020), Stein, R et.al (2015), Leung, A. K. C et.al (2019)–Schlager, T. A. (2016)]. This epidemiological shift can be attributed to anatomical and physiological factors, including the shorter female urethra, persistent perineal colonization by enteric organisms, elevated vaginal pH, and enhanced bacterial adhesiveness to vaginal epithelial cells [Leung, A. K. C et.al (2019)].UTIs are classified based on anatomical site, clinical presentation, and associated risk factors. The three primary categories include: acute pyelonephritis (APN), cystitis (CYS), and asymptomatic bacteriuria (ABU) [Tullus, K., & Shaikh, N. (2020), [Stein, R et.al (2015)]. Current global diagnostic guidelines highlight the challenges in identifying UTIs in children, particularly among those younger than 2–3 years [Stein, R et.al (2015), Pérez, R. P et.al(2019)–Robinson, J. L et.al(2014)]. In this age group, fever often constitutes the sole clinical indicator, though it may coincide with non-specific symptoms such as feeding difficulties, failure to thrive, lethargy, irritability, diarrhea, or vomiting. In contrast, toilet-trained children typically present with classic urinary symptoms, including frequency, dysuria, incontinence, suprapubic or abdominal pain, and loin tenderness [Stein, R et.al (2015), Pérez, R. P et.al(2019–Robinson, J. L et.al(2014)]. This study aimed to investigate the clinical symptomatology, laboratory-identified risk factors, and microbial etiology of symptomatic UTIs across different age groups and sexes in pediatric patients admitted to Tobruk Medical Center.

2 Materials and Methods

Study Design This was a retrospective study conducted at Tobruk Medical Center with ethical approval number NBC:004.H.25.6.

2.1 Inclusion Criteria Children aged 3–14 years (male and female)

2.2 Patients admitted to Tobruk Medical Center with suspected UTIs Availability of complete clinical history, symptom documentation, and laboratory investigations.

2.3 Exclusion Criteria Neonates and infants (<1 year old) ,Non-toilet-trained children

2.4 Data Collection Data were obtained from medical records, including :Clinical history ,Reported symptoms ,Laboratory test results

2.5 Urine Sample Collection and Processing For toilet-trained children, midstream urine was collected using the clean-catch method, which is the preferred noninvasive technique. The following protocol was followed:

2.6 Preparation: The genital area was thoroughly cleaned with soap and water prior to sample collection.

2.7 Volume: Routine urinalysis: 20–50 mL Urine culture: 30–50 mL (to ensure accurate results) Processing: Samples were processed within 30 minutes of collection to minimize contamination risk. Urine bags were not used for sample collection due to high contamination rates.

3 Results

Results should be clear and concise and presented separately from the discussion.

Tables: All tables are to be numbered using Arabic numerals.

Tables should always be cited in text in consecutive numerical order. For each table, please supply a table caption (title) explaining the components of the table.

Footnotes to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data) and included beneath the table body. Footnotes to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data) and included beneath the table body

Table 1. Demographic data age and sex

age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3 _ 4	39	46.4	46.4	46.4
	5 _ 8	34	40.5	40.5	86.9
	9 _ 12	8	9.5	9.5	96.4
	more than 12	3	3.6	3.6	100.0
	Total	84	100.0	100.0	

sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	19	22.6	22.6	22.6
	female	65	77.4	77.4	100.0
	Total	84	100.0	100.0	

Table 2. signs and symptoms

	Frequency	Percent	Valid Percent	Cumulative Percent
vomiting	35	17.2	17.2	17.2
fever	31	15.2	15.2	32.4
dysuria	37	18.1	18.1	67.6
Valid				
frequency	31	15.2	15.2	82.8
urgency	19	9.3	9.3	92.2
hermaturia	16	7.8	7.8	100.0
Total	204	100.0	100.0	

Table 3. duration stay of the hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1_3day	41	48.8	48.8	48.8
	4_6day	27	32.1	32.1	81.0
	7_9day	8	9.5	9.5	90.5
	more than10day	8	9.5	9.5	100.0
	Total	84	100.0	100.0	

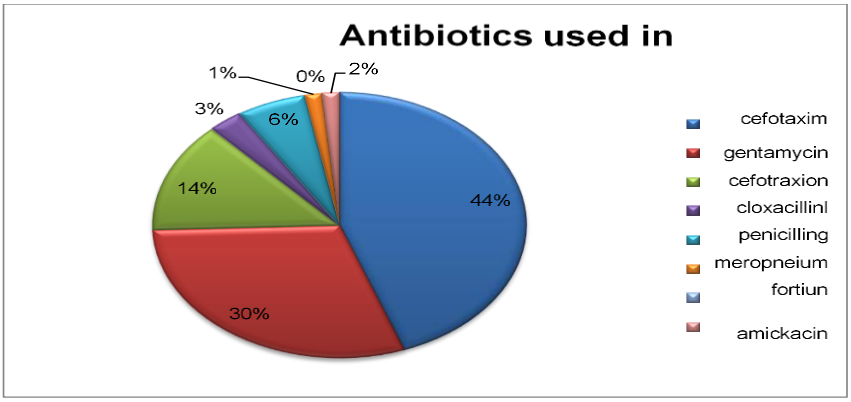

Table 5. urine analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2-10 puscell	17	20.2	20.2	20.2
	10-50 puscell	31	36.9	36.9	57.1
	50-100 puscell	10	11.9	11.9	69.0
	> 100	26	31.0	31.0	100.0
	Total	84	100.0	100.0	

Table 4. abdominal uss

	Frequency	Percent	Valid Percent	Cumulative Percent
normall	39	46.4	46.4	46.4
picture of cystitis	20	23.8	23.8	70.2
Valid				
not done	25	29.8	29.8	100.0
Total	84	100.0	100.0	

4 Discussion

Urinary tract infections (UTIs) represent one of the most prevalent bacterial infections in the pediatric population [Marcus Riccabona. Curr Opin(2003). Empirical evidence demonstrates that UTIs serve as significant precursors to acute pyelonephritis and subsequent renal scarring [Simões e Silva, A. C et.al (2020)]. This progression is clinically important as renal scarring has been strongly associated with progressive renal dysfunction, hypertension development, and potential progression to end-stage renal disease (ESRD) [Simões e Silva, A. C et.al (2020)], underscoring the critical need for enhanced preventive strategies. The diagnosis of UTIs in pediatric patients presents particular challenges, with relatively few comprehensive studies examining the frequency, sensitivity, specificity, and predictive value of associated symptoms and clinical signs. While fever constitutes the most common symptom in infants, the identification of alternative fever sources during clinical examination cannot definitively exclude UTI. Younger children typically present with nonspecific symptoms, whereas older children more frequently exhibit distinct urinary symptoms including loin/abdominal pain, urinary frequency, dysuria, urgency, hesitancy, enuresis, and hematuria [Mori, R., Lakhanpaul, M(2007)]. Our findings align with these clinical patterns, demonstrating the following symptom prevalence: dysuria (18%), suprapubic pain (17.2%), vomiting (17.2%), fever (15.2%), urinary frequency (15.2%), urgency (9.3%), and hematuria (7.8%). The study population showed a marked sex disparity, with females representing 77.4% of cases compared to 22.6% males. Age distribution revealed 46% of patients were 3-4 years old, 40% were 5-8 years, 9.5% were 9-12 years, and 3.6% were over 12 years. Microbiological analysis identified Gram-negative bacteria as the predominant causative organisms, with Escherichia coli being most prevalent, followed by Staphylococcus species. These findings correlate with data from Messalata Central Hospital, where E. coli similarly emerged as the primary pathogen (80% of acute community-acquired uncomplicated infections), followed by Klebsiella pneumoniae [Mori, R., Lakhanpaul, M(2007), Abujilban, S. K et.al (2016)]. The uropathogen distribution typically follows this pattern: E. coli > Klebsiella > Enterobacter > Proteus spp. > Enterococci [Abujilban, S. K et.al (2016)].

Current imaging protocols for pediatric UTIs have evolved significantly. While most children traditionally underwent imaging after their first UTI, contemporary guidelines from NICE, AAP, and ISPN now recommend imaging only when it directly informs management strategies to reduce risks of recurrence or renal damage [Williams, G. J., et.al(2012). In our cohort, 70% underwent ultrasonography, with 23% showing cystitis-related findings. Treatment analysis revealed cefotaxim as the most frequently prescribed antibiotic (44%), followed by gentamycin (30%), ceftriaxone (14%), penicillin (6%), and cloxacillin (3%). Recommendations Based on our study findings, we propose the following evidence-based recommendations:

Implementation of Routine Screening Protocols: Establish regular urinary tract infection screening programs for pediatric populations, with particular emphasis on high-risk groups Focus on early detection through standardized diagnostic algorithms to enable prompt therapeutic intervention

Comprehensive Hygiene Education Initiatives :Develop targeted awareness campaigns in school and clinical settings Emphasize proper perineal hygiene techniques and urinary habits Incorporate parent/caregiver education programs in pediatric healthcare visits

Antimicrobial Stewardship Implementation: Institutionalize antibiotic stewardship programs across healthcare facilities Promote culture-guided antibiotic therapy to combat rising antimicrobial resistance Establish treatment guidelines based on local antimicrobial susceptibility patterns

Future Research Directions: Investigate long-term renal outcomes in pediatric UTI patients Explore genetic predispositions and environmental determinants of infection susceptibility Conduct multicenter studies to validate findings across diverse populations

5 Conclusions

Our study demonstrates several key findings regarding urinary tract infections in the pediatric population: Epidemiological Patterns: Significant female predominance (77.4% vs 22.6% in males)Highest incidence in children aged 3-4 years (46%), followed by 5-8 years (40%) Clinical Presentation: Dysuria emerged as the most common symptom (18%) Other frequent manifestations included suprapubic pain (17.2%), vomiting (17.2%), and fever (15.2%) Microbiological Profile: Escherichia coli was the predominant etiological agent across all age groups and clinical presentations This pattern persisted regardless of patient risk factors Therapeutic Approach: Cefotaxime was the most frequently employed empirical antibiotic (44%) Gentamicin (30%) and ceftriaxone (14%) comprised the secondary treatment options.

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Conflict of interest: None declared

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