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Original Article

Infantile urinary tract infection, presentations and outcomes in General Hospital, Tripoli, Libya: A Single-Center retrospective analytical cross-sectional study

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ABSTRACT:

Background: Urinary tract infection (UTI) is a common cause of fever and hospitalization in infants. Early diagnosis and management are vital to prevent short and long-term complications. We aimed to describe clinical features, laboratory and imaging findings, risk factors, and short-term outcomes among infants <1 year hospitalized with UTI.**Materials and Methods:** A Single-Center retrospective analytical cross-sectional study was conducted at the Pediatric Department of Al-Hadaba Al-Khadra General Hospital, Tripoli, Libya. Data including fifty (50) infants hospitalized with a confirmed diagnosis of UTI between January and October 2024. Data were extracted from medical records, including demographics, presentation, laboratory results, imaging, risk factors, and outcomes. All infants received broad-spectrum intravenous antibiotics adjusted according to culture sensitivity. Statistical analysis was performed using SPSS version 25. Descriptive statistics areused to summarize infants' characteristics. Associations were tested using Fisher's exact/Chi-square, and logistic regression was planned for independent predictors. $P < 0.05$ was significant. **Results:** Fifty infants were included. Fever (96%) and vomiting (68%), were the most frequent symptoms. Abnormal renal ultrasound was detected in (44%), and positive urine culture in (14%). Eight infants (16%) had identifiable risk factors: Spina bifida (2), antenatal hydronephrosis (1), renal hypoplasia (1), maternal antenatal UTI (2), prolonged rupture of membranes (2), and uncircumcised males (4). Prolonged stay occurred in (22%), recurrence in (24%), and sepsis in (8%). Abnormal ultrasound and positive culture were independent predictors of prolonged stay, while risk factors and abnormal imaging predicted recurrence.**Conclusion:** UTI in infants commonly presents with systemic symptoms and significant imaging abnormalities. Abnormal renal ultrasound is a key predictor of prolonged stay, recurrence, and complications, highlighting the need for early imaging and structured follow-up of high-risk infants to prevent renal damage.

Key words: Urinary tract infection, presentations and outcomes, hospitalization ,Tripoli, Libya

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INTRODUCTION:

Urinary tract infection (UTI) is one of the most common serious bacterial infections in infants and young children. In the first year of life, it is a leading cause of fever, bacteremia, and hospitalization [1, 2]. Male predominance is seen during the first three months of life, especially among uncircumcised boys, whereas beyond infancy, females predominate [3]. The reported prevalence of UTI in febrile infants varies between 5–7%, but it may reach 10% in infants under three months [4]. Early diagnosis and appropriate management are essential because renal parenchymal involvement during infancy can lead to long-term Sequelae such as renal scarring, hypertension, and chronic kidney disease (CKD) [5, 6]. Clinical manifestations are often nonspecific, including fever, irritability, poor feeding, vomiting, or failure to thrive, making diagnosis challenging without laboratory confirmation [7]. Infants with UTI are also at higher risk for systemic complications such as sepsis and meningitis due to immature immune defenses and difficulty in localizing infection [7]. Thus, prompt diagnosis and evaluation with urine culture and renal imaging are crucial to detect anatomical abnormalities and prevent recurrence. Congenital and perinatal risk factors such as vesicoureteral reflux, antenatal hydronephrosis, Spina bifida, and prolonged rupture of membranes predispose infants to infection [8]. Despite this, data on infant-specific risk factors and outcomes, particularly in resource-limited settings, remain scarce. The present study aims to describe the clinical characteristics, laboratory and imaging findings, and outcomes of infants under one year admitted with UTI, and to identify predictors of prolonged hospital stay, recurrence, and complications. Understanding the pattern of UTIin this age group will help optimize early recognition and management to reduce morbidity and long-term renal damage.

MATERIAL AND METHODS:

Study design: A Single-Center retrospective analytical cross-sectional study.

Setting: Pediatric Department of Al-Hadaba Al-Khadra General Hospital, Tripoli, Libya.

Period: from January to October 2024

Inclusion: All infants (< 12 months) admitted with clinical and laboratory evidence of UTI were included. Infants with incomplete records or alternative diagnoses were excluded.

Data collection: Data were extracted from hospital records, including demographics, clinical features, laboratory findings, imaging results, treatment given, risk factors, clinical outcomes, and referral/follow-up.

Demographic data: age, sex.

Clinical features: specific and non-specific symptoms of UTI.

Laboratory findings: urine microscopy (WBC/hpf), urine culture results, C – **-C**reactive protein, and total leukocyte count.

Imaging results: renal ultrasound findings and presence of vesicoureteral reflux (VUR) if evaluated by Micturating cystourethrogram (MCU).Risk factors recorded were Spina bifida, antenatal hydronephrosis, renal hypoplasia, maternal antenatal (UTI), maternal prolonged rupture of membranes (PROM), and uncircumcised males.Treatment: All infants received empirical broad-spectrum intravenous antibiotics (typically third-generation cephalosporins ± aminoglycosides), adjusted per culture results.

Duration of treatment: ranged from (7) to (14) days, followed by oral antibiotics in selected cases.

Outcomes Definitions:

- Prolonged hospital stay: more than 7 days.
- Recurrence: infants with a previous documented UTI under nephrology follow-up.
- Complications: short-term events such as sepsis.

Statistical analysis: Data were analyzed using SPSS version 25. Descriptive statistics are used to summarize infants' characteristics. Associations were tested using Fisher's exact/Chi-square; logistic regression was planned for independent predictors. A p-value <0.05 was considered statistically significant.Ethical Considerations: As this was a retrospective review of anonymized medical records, the requirement for individual informed consent was waived. Confidentiality of patient data was strictly maintained throughout data handling and analysis.

RESULTS:

Infants under one year (n = 50)

Descriptive analysis

Demographics: Table 1

Of the 50 hospitalized infants with urinary tract infection, 56% were males. Pyelonephritis was diagnosed in 62% infants.

Clinical Presentation: Table 1; Figure 1

Fever was almost universal (96%, mostly high-grade). Common associated features included vomiting (68%), poor feeding (52%), lethargy (48%), and change in urine color (30%). Urinary symptoms were less frequent but hematuria was reported in 6% of hospitalized infants. Non-specific gastrointestinal symptoms such as diarrhea (16%) were recorded in older infants near 12 months of age.

Laboratory and Imaging Findings:Table 2; **F**igure 2
Leukocyturia ≥ 25 WBC/hpf was found in 62%, while nearly all had leukocytosis (96%) and positive C-reactive protein (100%). Urine culture grew a pathogen in seven infants (14%)—predominantly *Escherichia coli*. Abnormal renal ultrasound was documented in 44%**,** mainly showing increased cortical echogenicity and mild hydronephrosis.

Risk factors: Table 3
Six specific risk factors: uncircumcision in (8%), Spina bifida in (4%), maternal antenatal UTI in (4%), maternal prolonged rupture of membranes in (4%), antenatal hydronephrosis (2%), and renal hypoplasia (2%).

Clinical outcomes: Table 4:
A prolonged hospital stay (>7 days) occurred in 22%. Past medical history of UTI (recurrence) was reported in 24%. Complications (sepsis) developed in (8%); all aged less than three (3) months.

Treatment and hospital course:
All infants were managed with intravenous broad-spectrum antibiotics, which led to clinical improvement in all patients before discharge. None required escalation to carbapenems or developed antibiotic resistance during hospitalization.

Table 1. Descriptive analysis of Demographic and clinical presentation

Variable	Interpretation	Percentage (%)	Frequency (n)
Male sex	28	56	Male predominance, typical in first year of life
Pyelonephritis	31	62	Most infants had upper UTI rather than lower
Fever (high grade)	48	96	Common presenting symptom
Vomiting	34	68	Reflects systemic inflammatory response
Poor feeding	26	52	Nonspecific but frequent symptom
Lethargy	24	48	Indicates moderate–severe illness
Change in urine color	15	30	Observed in one-third
Diarrhea	8	16	Nonspecific, may delay diagnosis
Hematuria	3	6	May indicate severe inflammation

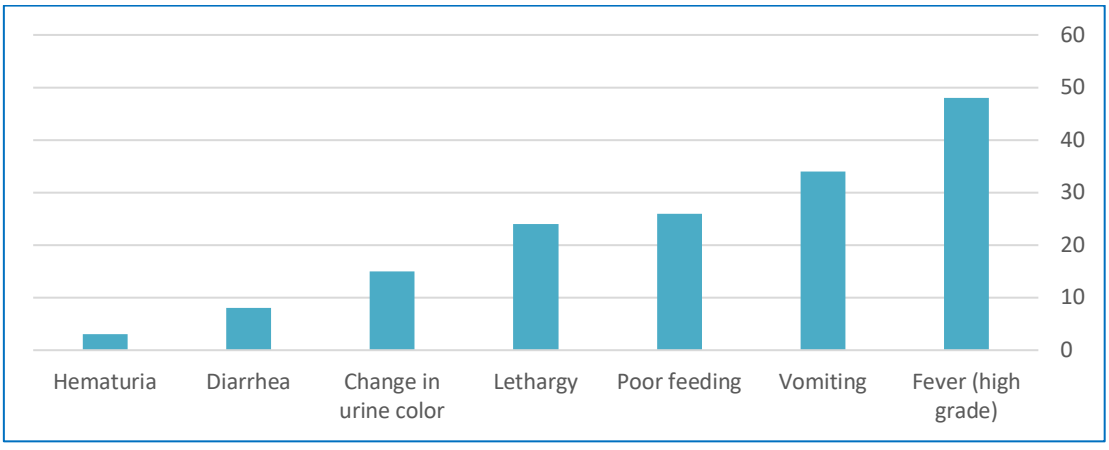

Figure 1: Clinical symptoms among infant with UTI

Table 2. Descriptive analysis of Laboratory and imaging findings

Parameter	Frequency (%)	Interpretation
Leukocyturia ≥25 WBC/hpf	**31 (62%)**	**Suggestive of true infection**
Leukocyturia ≥ 10- < 25 WBC/hpf	**19 (38%)**	
Leukocytosis (>12×10⁹/L)	**48 (96%)**	**Reflects systemic inflammation**
Positive urine culture	**7 (14%)**	**Likely underestimated due to preadmission antibiotics**
Abnormal renal ultrasound	**22 (44%)**	**Indicates high rate of structural involvement**

Interpretation: *Nearly half of infants had abnormal renal ultrasound findings, emphasizing the importance of early imaging even after the first UTI episode.*

Table 3. Descriptive analysis of Risk factors

Variable	Frequency (%)	Interpretation
Antenatal hydronephrosis	1 (2%)	Congenital renal structural abnormalities
Renal hypoplasia	1 (2%)	Congenital renal structural abnormalities
Spina bifida	2 (4%)	Neurogenic bladder (delay bladder empty)
Maternal antenatal UTI	2 (4%)	Maternal–neonatal transmission risks of infection
Prolonged rupture of membranes	2 (4%)	Maternal–neonatal transmission risks of infection
Uncircumcised males	4 (8%)	Increased risk of periurethral bacterial colonization
≥ 1 risk factor present	8 (16%)	
Past history of UTI	12(24%)	Suggests recurrence tendency
Uncircumcised males	4 (8%)	Increased risk of periurethral bacterial colonization

Table 4. Descriptive analysis of clinical outcomes

Outcome	Frequency (%)	Interpretation
Prolonged hospital stay (>7 days)	11 (22%)	Related to systemic illness or abnormal imaging
Past history of UTI (recurrence)	12 (24%)	Common within the first year
Complications (sepsis)	4 (8%)	Occurred only in infants <3 months

Interpretation: Young infants (<3 months) are particularly at risk for sepsis and prolonged hospital stay

Association analysis; bivariate analysis Table 5
Association between risk factors, clinical presentations, and clinical outcomes (tested using Fisher/Chi-square)

- Prolonged stay was significantly associated with abnormal renal ultrasound (p = 0.021), positive urine culture (p = 0.034), poor feeding (p = 0.012), and vomiting (p = 0.018),
- Past medical history of UTI (recurrence) was associated with abnormal ultrasound (p = 0.030) and **the**presence of risk factors (p = 0.041).
- Complications (sepsis) occurred only in infants < 3 months and were associated with male sex (p = 0.047), poor feeding (p = 0.022), lethargy (p = 0.031), and abnormal ultrasound (p = 0.040).

Table 5. Association analysis between clinical presentations, risk factors and outcomes

Outcome	Associated variable	p-value	Interpretation
Prolonged stay	Poor feeding	0.012*	**Reflects systemic toxicity**
	Vomiting	0.018*	**Reflects systemic toxicity**
	Abnormal ultrasound	0.021*	**Structural abnormalities prolong recovery**
	Positive culture	0.034*	**Confirms bacterial etiology and severity**
Recurrence	**Abnormal ultrasound**	0.030*	**Indicates underlying defect**
	Spina bifida	0.048 *	**Neurogenic bladder (delay bladder empty)**
	Uncircumcised male	0.049 *	**Increased risk of periurethral bacterial colonization**
	Any risk factor (≥ 1)	0.041 *	**Structural or congenital causes contribute**
Complications (sepsis)	Male sex	0.047*	**Higher risk in male infants**
	Poor feeding	0.022*	**Reflects systemic toxicity**
	Lethargy	0.031*	**Reflects systemic toxicity**
	Abnormal ultrasound	0.040 *	**Suggests renal parenchymal involvement**

* Significant ($p < 0.05$)
Interpretation: Abnormal ultrasound consistently correlated with all adverse outcomes — a strong indicator for closer follow-up.

Independent Predictors for Adverse Outcomes

In multivariable logistic regression (limited by sample size): **Table 6**

- For prolonged stay, abnormal ultrasound (OR ≈ 3.5, p = 0.032) and positive urine culture (OR ≈ 2.8, p = 0.041) remained significant independent predictors.
- For recurrence, abnormal ultrasound (OR ≈ 3.2, p = 0.039) and presence of risk factors (OR ≈ 2.9, p = 0.048) were independent predictors.
- Regression for **complications** was not stable due to only four events; descriptive trends suggest ahigher risk among male infants with abnormal ultrasound and systemic symptoms.

Table 6. Multivariable logistic regression analysis

Outcome	Variable	Odds ratio (95% CI)	p-value	Interpretation
Prolonged stay	**Abnormal ultrasound**	3.5 (1.2–10.1)	0.032	**Independent predictor**
	Positive urine culture	2.8 (1.1–7.5)	0.041	**Strong infection predictor**
Recurrence	**Abnormal ultrasound**	3.2 (1.0–9.9)	0.039	**Indicates underlying malformation**
	Risk factors (any)	2.9 (1.0–8.6)	0.048	**Suggests structural predisposition**

Interpretation: Imaging abnormalities remained the dominant predictor of poor outcomes

DISCUSSION:

Demography and Clinical characteristics**:** In our study of which focuses on hospitalized infants under one year with urinary tract infection, male predominance wasobserved, especially among infants younger than three months, whichsupports previous evidence that uncircumcised male infants

are at increased risk due to periurethral colonization. The incidence of UTI is highest in the infant period for all children, then decreases markedly among boys after infancy [1]

Clinical characteristics: High-grade Fever, vomiting, poor feeding, and lethargy were the most common presenting features. These findings are consistent with previous studies showing that infant UTI often presents with **systemic or non-specific systemic symptoms**, reflecting both immature host defenses and difficulty in verbalizing urinary discomfort at this age. On the other hand, systemic or non-specific systemic symptoms make early recognition of infantile urinary tract infection challenging [2_5].

Imaging findings: Early imaging is crucial to detect structural abnormalities that predispose to recurrent infections and renal scarring as along-term complication, and many prior studies have reported abnormal ultrasound in 30–45% of infants after the first UTI. In addition, renal ultrasonography should be repeated 4–6 weeks after the first febrile UTI for re-evaluation to avoid false positive studies [6_10]. Recent studies have reported that Technetium 99m-labeled dimercaptosuccinic acid (DMSA) scans have demonstrated a wide range of estimates (30-70%) for the prevalence of pyelonephritis in children with febrile UTI [11]. In our study, nearly half of the infants showed abnormal renal ultrasound findings, mainly increased echogenicity and hydronephrosis, which correspond to potential anatomical or functional urinary abnormalities. This supports previous study that have shown that abnormal ultrasound was a significant predictor of prolonged hospital stay, recurrence, and complications.

Laboratory findings: Leukocyturia and leukocytosis were nearly universal, reflecting systemic inflammatory response. However, urine culture positivity was lower (14%), possibly due to prior empirical antibiotic use before admission. This aligns with findings from developing countries where early antibiotic exposure often leads to sterile cultures despite clinical infection. *Escherichia coli* caused the majority of infections, in agreement with international data [12].

Risk factors: In our study, six specific risk factors were identified—Spina bifida, antenatal hydronephrosis, renal hypoplasia, maternal antenatal (UTI), prolonged rupture of membranes (PROM), and uncircumcision. Infants with these risks had higher recurrence rates, and abnormal ultrasound often mirrored underlying structural disease. The Spina bifida cases illustrate the impact of neurogenic bladder on recurrent infection, while antenatal (UTI) and (PROM) point to maternal–neonatal transmission risks [13-15].

Outcomes: Prolonged hospital stay associated with abnormal imaging and systemic symptoms, suggesting more severe infection or underlying renal involvement. Recurrences were similarly observed in about one-fourth of infants, consistent with previous reports showing recurrence rates of 20–30% in the first year after an initial UTI. This recurrence was more common among those infants with underlying risk factors such as uncircumcised male, vesicoureteral reflux (VUR), and bladder bowel dysfunction [13-15]. Complications (sepsis) occurred in (8%) of infants, all younger than three months, underscoring the high vulnerability of this age group to systemic spread; these results are consistent with previous reports showing bacteremia rates of 5–10% in febrile infants with UTI [16]. Predictors of poor outcome included abnormal imaging and positive culture, highlighting these as essential markers for closer follow-up.
In our study, younger age, abnormal ultrasound, and positive urine culture were the strongest predictors of adverse outcomes, emphasizing the need for early imaging and aggressive therapy in high-risk cases.

Treatment and hospital course: The choice of empirical antibiotics is guided by local resistance patterns **of***Escherichia coli*, the most common cause of UTI [17]. E. coli producing extended-spectrum beta-lactamases (ESBL) are becoming more common and have been associated with preexisting neurological disease, recent hospitalization (within one month), and exposure to antimicrobials within the preceding three months [18].

Strengths and limitations

This study provides real-world data from a general hospital setting in a resource-limited country. It is among the few to focus specifically on infants under one year. However, the retrospective design and small sample size limit statistical power, particularly for rare outcomes such as sepsis. Long-term follow-up imaging (e.g., DMSA scans) was not available to confirm renal scarring.

CONCLUSION:

UTI in infancy remains a diagnostic and therapeutic challenge. Infants often present with non-specific

systemic symptoms such as fever, vomiting, and poor feeding rather than localized symptoms, and a substantial proportion have underlying anatomical abnormalities. renal ultrasound and positive urine culture are consistent predictors of prolonged hospitalization, recurrence, and complications (sepsis). Our results highlighting the importance of early renal ultrasound and aggressive management in this age group, particularly males and those less than 3 months old, are essential during the first episode of febrile urinary tract infection, to reduce morbidity and prevent renal damage.

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