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RECURRENT URINARY TRACT INFECTION IN CHILDREN ATTENDING MOSUL GOVERNORATE

[*1]Dr. Mohammad Hilal Al-Badrany, [2]Dr. Lara Samuel Oshana

[1]M.B.Ch.B/ F.I.C.H.S (Pediatrics).
[2]M.B.Ch.B/ F.I.C.H.S (Family Medicine).

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***Corresponding Author: Dr. Mohammad Hilal Al-Badrany**

M.B.Ch.B/ F.I.C.H.S (Pediatrics).

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ABSTRACT

Background: Recurrent urinary tract infection is an important health problem among children and may be associated with repeated morbidity, underlying urinary tract abnormalities, and risk of renal complications. It is commonly encountered in both primary health care and pediatric practice. **Objectives:** To assess recurrent urinary tract infection among children attending selected primary health care centers and pediatric consultation clinic in Nineveh Governorate and to identify associated demographic, clinical, and radiological factors. **Methods:** A cross-sectional study was conducted among children attending Baghdada Primary Health Care Centers and the Pediatric Consultation Clinic at Mosul General Hospital, Nineveh Governorate, Iraq, during the period from June 2025 to March 2026. The study included children from infancy up to 14 years of age with recurrent urinary tract infection. Data were collected using a specially designed questionnaire including demographic characteristics, clinical presentation, risk factors, laboratory findings, and imaging results. Statistical analysis was performed using appropriate tests, and a p-value of less than 0.05 was considered statistically significant. **Results:** The study included 54 children with recurrent urinary tract infection and 100 children with first attack urinary tract infection. Recurrent UTI was most common among children aged 1–4 years (33.4%) and was slightly more frequent among females (51.0%). Significant associations were found between recurrent UTI and low socioeconomic status (51.0%, p=0.002), type of feeding (p=0.001), and positive family history of renal problems (27.0%, p=0.002). Constipation was reported in 27.0% of recurrent cases. Fever was the most common symptom (43.0%), followed by diarrhea and vomiting (42.5%), lower abdominal pain (29.6%), and dysuria (28.3%). Ultrasound showed hydronephrosis in 41.0% of recurrent cases, while micturating cystourethrography showed vesicoureteric reflux in 20.9%. **Conclusions:** Recurrent urinary tract infection in children is associated with socioeconomic, familial, clinical, and radiological factors. Early diagnosis, proper urine testing, culture-guided treatment, management of constipation and voiding problems, parental education, and referral of complicated cases are recommended to reduce recurrence and prevent renal complications.

KEYWORDS: Children; Recurrent UTI; Pediatrics; Family medicine; Nineveh.

1-INTRODUCTION

Urinary tract infection (UTI) is one of the most common bacterial infections in childhood and remains an important cause of sickness in pediatric and family medicine practice. It may affect the lower urinary tract, presenting as cystitis with dysuria, frequency, urgency, suprapubic pain, or new-onset urinary incontinence, or the upper urinary tract, presenting as febrile UTI or pyelonephritis with fever, flank pain, vomiting, abdominal pain, or systemic illness. In infants and young children, symptoms are often nonspecific, including fever, irritability, poor feeding, vomiting, lethargy, or failure to thrive, which may delay diagnosis if UTI is not considered in the differential diagnosis. Recent reviews emphasize that pediatric UTI requires careful clinical assessment, appropriate urine sampling, urinalysis, and urine culture confirmation because misdiagnosis may lead either to missed infection or unnecessary antibiotic exposure.[1-2]

Recurrent urinary tract infection (RUTI) in children is clinically significant because repeated infections may be

associated with renal scarring, hypertension, impaired renal growth, and, rarely, chronic kidney disease, especially when infections are febrile, treatment is delayed, or underlying urinary tract abnormalities are present. Recurrent UTI is commonly defined as two or more episodes of upper UTI, one episode of upper UTI plus one or more episodes of lower UTI, or three or more episodes of lower UTI; other recent European guidance defines recurrence as at least three UTI episodes within 12 months or at least two episodes within 6 months. These definitions are useful in clinical practice because they identify children who need closer follow-up, assessment of modifiable risk factors, and selective imaging.[2-3]

Several risk factors contribute to recurrent UTI in children. These include young age, female gender after infancy, uncircumcised male infants, previous febrile UTI, vesicoureteral reflux, congenital anomalies of the kidney and urinary tract, obstructive uropathy, neurogenic bladder, bladder and bowel dysfunction, constipation, poor hydration, infrequent voiding, incomplete bladder emptying, poor perineal hygiene, and previous inappropriate or incomplete antibiotic treatment. Escherichia coli remains the predominant causative organism in pediatric UTI, although recurrent infections, prior antibiotic exposure, urinary tract anomalies, and healthcare contact may increase the likelihood of non-E. coli organisms and antimicrobial resistance. Therefore, urine culture and local antimicrobial susceptibility patterns are essential for guiding empirical and definitive therapy.[1-4]

The diagnosis of recurrent UTI depends on a combination of compatible clinical features, evidence of pyuria or bacteriuria on urinalysis, and significant bacterial growth on urine culture from an appropriately collected specimen. NICE guidance recommends urine testing in babies, children, and young people with symptoms and signs that increase the likelihood of UTI, and also advises considering urine testing in unwell children when UTI is clinically suspected even if classical symptoms are absent. The method of urine collection should be appropriate for age and toilet-training status, because contaminated samples may lead to false-positive diagnosis and unnecessary treatment. Current guidance also recommends avoiding treatment of asymptomatic bacteriuria, as unnecessary antibiotics may contribute to antimicrobial resistance without clinical benefit.[2-5]

Imaging and further evaluation are important components of the assessment of recurrent UTI but should be used selectively. Renal and bladder ultrasound is commonly recommended for children with recurrent UTI to detect structural abnormalities, hydronephrosis, bladder wall changes, post-void residual urine, or other urinary tract pathology. Additional investigations, such as dimercaptosuccinic acid renal scan or micturating cystourethrogram, may be considered in selected children, particularly those with atypical UTI, abnormal ultrasound findings, recurrent febrile infections, poor urine flow, non-E. coli infection, or suspected vesicoureteral reflux. Recent EAU/ESPU guidance supports a risk-based approach to diagnosis and management, aiming to identify children at higher risk of renal damage while avoiding unnecessary invasive investigations in low-risk cases.[3, 5]

Management of recurrent UTI requires both acute treatment and prevention of further episodes. Acute episodes should be treated promptly with appropriate antibiotics based on age, severity, site of infection, local resistance patterns, and culture results. Preventive management includes correction of constipation, treatment of bladder and bowel dysfunction, encouraging regular voiding, adequate fluid intake, avoidance of delayed micturition, hygiene education, and follow-up of children with recurrent or atypical infections. The role of continuous antibiotic prophylaxis remains selective and controversial. Recent systematic reviews suggest that prophylaxis may reduce symptomatic recurrence in some children, particularly those at higher risk, but benefits must be balanced against antimicrobial resistance and adverse effects. Non-antibiotic preventive strategies, including cranberry products, probiotics, and behavioral interventions, remain areas of ongoing research and may not be suitable as universal recommendations.[6,7]

The burden of recurrent UTI is particularly relevant to both pediatrics and family medicine because many children initially present to primary health care centers, family medicine clinics, emergency units, or pediatric outpatient clinics. Family physicians are often responsible for early recognition, urine testing, initial empirical therapy, interpretation of culture results, counseling families, identifying recurrence, managing constipation and voiding problems, and referring children who require pediatric or urologic evaluation. Pediatricians, in turn, play a central role in confirming diagnosis, evaluating recurrent or complicated cases, arranging imaging, managing children with urinary tract anomalies or renal involvement, and coordinating long-term follow-up. In Nineveh Governorate, where children may move between primary care and hospital-based services, studying recurrent UTI can provide valuable local data on clinical presentation, recurrence patterns, risk factors, microbiological profile, antibiotic sensitivity, imaging findings, and referral practices. Such information may help improve coordination between family medicine and pediatric services and support evidence-based local protocols for diagnosis, treatment, prevention, and follow-up.

2-PATIENTS AND METHODS

An official administrative approval was obtained from the Directorate of Health in Mosul before conducting the present study. Verbal informed consent was obtained from the parents or caregivers of all included children after explaining the aim and procedures of the study, and

confidentiality of the collected data was maintained throughout the research.

This cross-sectional study was conducted among children attending the Pediatric Consultation Clinic at Mosul General Hospital and Baghdada Primary Health Care Centers in Nineveh Governorate, Iraq, during the period from June 2025 to March 2026. The study involved both primary health care and hospital-based pediatric services to assess recurrent urinary tract infection among children from pediatric and family medicine perspectives.

The study population included children from infancy up to 14 years of age, of both sexes, who attended the selected centers during the study period and had a history suggestive of recurrent urinary tract infection. Children were included if they had recurrent UTI with available clinical and laboratory information and consent from their parents or caregivers, while children with a first episode of UTI only, incomplete data, and refusal to participate were excluded.

Data were collected using a specially designed questionnaire that included demographic information such as age, sex, residence, and health care setting, in addition to clinical data including presenting symptoms, duration of illness, number of previous UTI episodes, fever, dysuria, frequency, urgency, abdominal pain, flank pain, vomiting, poor feeding, urinary incontinence, constipation, delayed voiding, previous antibiotic use, previous hospital admission, family history of UTI, circumcision status in boys, history of congenital urinary tract anomalies, and symptoms suggestive of bladder or bowel dysfunction. All children were clinically assessed by general and abdominal examination, including evaluation of temperature, hydration status, systemic illness, suprapubic tenderness, renal angle tenderness, palpable bladder, abdominal masses, and signs of constipation. Urine samples were collected according to the child's age and toilet-training status, using clean-catch midstream urine in toilet-trained children and appropriate collection methods in younger children.

General urine examination was performed to detect pus cells, red blood cells, bacteria, nitrite, leukocyte esterase, protein, and other relevant findings, while urine culture and sensitivity were requested when clinically indicated, particularly in children with recurrent symptoms, fever, previous antibiotic exposure, or suspected complicated infection. Significant bacterial growth, isolated organisms, and antibiotic sensitivity patterns were recorded when available. Imaging findings, especially renal and urinary tract ultrasound, were recorded when available or requested to assess kidney size, hydronephrosis, urinary tract dilatation, bladder wall thickness, post-void residual urine, stones, or congenital anomalies, while other investigations such as voiding cystourethrogram or renal scan were documented if previously performed or clinically indicated. The main studied variables included age, sex, residence, number of UTI episodes, presenting symptoms, fever, constipation, urinary symptoms, previous antibiotic use, urine examination findings, urine culture results, isolated organisms, antibiotic sensitivity pattern, ultrasound findings, and associated risk factors.

Data were reviewed, coded, and entered into a computerized database, and statistical analysis was performed using appropriate statistical software; categorical variables were presented as frequencies and percentages, while continuous variables were presented as mean and standard deviation or median and range according to data distribution. Associations between selected demographic and clinical variables were assessed using the chi-square test or Fisher's exact test when appropriate, and a p-value of less than 0.05 was considered statistically significant.

3-RESULTS

The most common age group affected was 1–4 years (toddlers) in recurrent UTI, while less than 1 year was more common in those with first attack UTI, as shown in Table 1 below.

Age (years)	Cases of recurrent UTI		Cases of 1st attack UTI		P-value
	No.	%	No.	%	
<1	10	18.6	32	32.0	0.213
1–4	18	33.4	27	27.0	
5–6	11	20.3	23	23.0	
≥7	15	27.7	18	18.0	
Total	54	100.0	100	100.0	

Slight increase in number of females in recurrent UTI, while females predominated in first attack UTI, as shown in Table 2 below.

Gender	Cases of recurrent UTI		Cases of 1st attack UTI		P-value
	No.	%	No.	%	
Male	26	49.0	36	36.0	0.142
Female	28	51.0	64	64.0	
Total	54	100.0	100	100.0	

In those with low socioeconomic state, there was an increase in the risk of UTI recurrence (51%), as shown in Table 3 below.

Social state	Cases of recurrent UTI		Cases of 1st attack UTI		P-value
	No.	%	No.	%	
Low	28	51.0	24	24.0	**0.002**
Medium	17	31.5	54	54.0	
High	9	17.5	22	22.0	
Total	54	100.0	100	100.0	

Urinary tract infection was less common in breast-fed babies than in bottle-fed and mixed-fed ones, as shown in Table 4 below.

Type of feeding	Cases of recurrent UTI		Cases of 1st attack UTI		P-value
	No.	%	No.	%	
Breast	2	3.7	18	18.0	**0.001**
Bottle	8	14.8	38	38.0	
Mixed	25	46.3	22	22.0	
Weaned	19	35.2	22	22.0	
Total	54	100.0	100	100.0	

Those with family history of renal problems had more liability for recurrent infection, as shown in Table 5 below.

Family history	Cases of recurrent UTI		Cases of 1st attack UTI		P-value
	No.	%	No.	%	
Positive	14	27.0	8	8.0	0.002
Negative	40	73.0	92	92.0	
Total	54	100.0	100	100.0	

Some patients gave a history of constipation. It was found that 14 patients (27%) had constipation and 40 patients (73%) did not have constipation in cases of recurrent urinary tract infection, while 8 patients (8%) only had constipation in those with first attack urinary tract infection and 92 patients (92%) did not have constipation. Recurrent urinary tract infection was more common in those with low weight, as shown in Table 6 below.

Weight in centile	Cases of recurrent UTI		Cases of 1st attack UTI		P-value
	No.	%	No.	%	
<25	26	48.2	38	38.0	0.348
25–75	22	40.7	53	53.0	
≥75	6	11.0	9	9.0	
Total	54	100.0	100	100.0	

Fever was the most common presenting feature (43%), followed by diarrhea and vomiting (42.5%), then other signs and symptoms, as shown in Table 7 below.

Signs and symptoms	Cases of recurrent UTI No.	%
Fever	24	43.0
Diarrhea and vomiting	23	42.5
Lower abdominal pain	16	29.6
Dysuria	15	28.3
Frequency	12	22.2
Failure to thrive	6	11.1
Urgency	2	3.7
Nocturnal enuresis	1	1.9

Hydronephrosis was the most common ultrasound finding (41%) in those with recurrent UTI, while the finding was normal in 77% of cases with first attack urinary tract infection, as shown in Table 8 below.

Ultrasound finding	Cases of recurrent UTI		Cases of 1st attack UTI	
	No.	%	No.	%
Hydronephrosis	23	41.0	14	14.0
Congenital anomaly of the kidney	5	9.0	4	4.0
Stone	6	10.0	5	5.0
Normal	22	37.2	77	77.0

On MCU, vesicoureteric reflux was the most common abnormal finding (20.9%), followed by bladder abnormality in 14.8%, as shown in Table 9 below.

MCU finding	Cases of recurrent UTI No.	%
Vesicoureteric reflux	9	20.9
Abnormal bladder	8	14.8
Posterior urethral valve	1	2.3
Normal	25	46.0

The IVU showed that hydronephrosis was the most common finding (40.6%) and, to a lesser extent, other abnormalities, as shown in Table 10 below (done for 37 patients only).

IVU finding	Cases of recurrent UTI No.	%
Hydronephrosis	17	40.6
Duplicated urinary system	2	5.4
Single kidney	2	5.4
Stone	3	8.2
Pelviureteric junction obstruction	1	2.8
Normal	12	30.2

4- DISCUSSION

The present study showed that recurrent urinary tract infection (UTI) was most frequent among children aged 1–4 years, while first attack UTI was more frequent among infants below 1 year of age, with no statistically significant difference between the two groups. This finding may be explained by the fact that infants are more likely to present with a first febrile UTI because of immature host defense mechanisms and nonspecific clinical manifestations, whereas toddlers and preschool children may develop recurrent episodes due to toilet training problems, delayed voiding, constipation, bladder and bowel dysfunction, and incomplete bladder emptying. Recent pediatric reviews reported that recurrent UTI is common in childhood and may occur in more than 30% of children after an initial episode, especially when predisposing factors are present. Comparable findings were reported by Barola et al. and Marsh and Watson, who emphasized that recurrent UTI in children is influenced by age, urinary tract abnormalities, voiding behavior, and bowel dysfunction.[8, 1]

Regarding gender distribution, the current study found a slight female predominance among recurrent UTI cases, although the association was not statistically significant. This is consistent with the known epidemiology of pediatric UTI, where females become more commonly affected after infancy because of the shorter urethra and easier ascending bacterial colonization. However, the lack of statistical significance in this study may be related to the sample size and the inclusion of younger male children, in whom UTI may also be common, especially if uncircumcised or if urinary tract anomalies are present. Recent reviews continue to identify female sex as an important risk factor for UTI after infancy, while male infants remain an important high-risk group during the first year of life. Similar observations were described by Maringhini et al. and Marsh and Watson.[1,3]

Socioeconomic status showed a significant association with recurrent UTI, as more than half of recurrent cases were from low socioeconomic status. This finding may reflect the effect of overcrowding, poor hygiene, delayed medical consultation, limited access to health services, incomplete treatment, inadequate follow-up, and higher risk of recurrence due to untreated constipation or voiding problems. In family medicine practice, socioeconomic conditions may influence both exposure to infection and the ability of families to complete investigations, urine culture, imaging, and follow-up visits. Recent guidance emphasizes that effective management of pediatric UTI requires timely diagnosis, appropriate urine testing, culture-based treatment, and follow-up, which may be more difficult in disadvantaged families. This agrees with the practical approach recommended by NICE and the EAU/ESPU pediatric UTI guidance, which stress accurate diagnosis, selective

imaging, and risk-based follow-up.[3, 9]

The present study demonstrated a significant association between type of feeding and recurrent UTI, with recurrent infection being less frequent among breast-fed children and more frequent among mixed-fed and weaned children. Breastfeeding may provide protection through immunological factors, improved gut microbiota, and reduction of bacterial colonization by uropathogens. Although feeding type is not always included as a major independent predictor in recent guidelines, breastfeeding has been discussed in pediatric literature as a potentially protective factor against early childhood infections, including UTI. The higher recurrence among mixed-fed and weaned children in the current study may also be related to age distribution, hygiene practices, bottle preparation, and socioeconomic factors. This result is in agreement with recent pediatric UTI literature that supports the role of host, environmental, and behavioral factors in recurrence.[1, 3]

A positive family history of renal problems was significantly more frequent among children with recurrent UTI than those with first attack UTI. This finding is clinically important because family history may suggest inherited or familial predisposition to vesicoureteral reflux, congenital anomalies of the kidney and urinary tract, or recurrent renal disease. NICE guidance recommends considering micturating cystourethrogram in selected children when there is ultrasound dilatation, poor urine flow, non-E. coli infection, or family history of vesicoureteral reflux. Therefore, family history should be routinely assessed in children with recurrent UTI, especially when associated with febrile episodes or abnormal imaging findings. This is consistent with NICE recommendations and the 2025 EAU/ESPU pediatric UTI guidance.[3, 9]

Although recurrent UTI was more frequent among children with weight below the 25th centile, the association was not statistically significant. Low weight may be a consequence of repeated infections, poor appetite, chronic illness, malnutrition, or underlying renal and urinary tract disease. Conversely, children with recurrent febrile UTI may experience poor growth if diagnosis or treatment is delayed. However, the absence of statistical significance in the current study suggests that weight alone may not be an independent predictor of recurrence and should be interpreted together with other clinical and socioeconomic factors. A recent study among young children with recurrent UTI investigated growth patterns and clinical risk factors, supporting the importance of monitoring growth in children with recurrent infections, especially infants and younger children.[10]

Fever was the most common presenting feature among recurrent UTI cases, followed by diarrhea and vomiting, lower abdominal pain, dysuria, and frequency. This pattern reflects the wide clinical spectrum of pediatric UTI, where younger children may present with nonspecific systemic or gastrointestinal symptoms, while older children are more likely to report local urinary symptoms. The high frequency of fever in the present study suggests that many recurrent cases may have involved upper urinary tract infection or febrile UTI, which requires prompt diagnosis and treatment to reduce the risk of renal scarring. NICE recommends urine testing in children with symptoms and signs that increase the likelihood of UTI and also advises considering urine testing in unwell children when UTI is suspected even without classical urinary symptoms. Similar clinical presentations were described in recent pediatric reviews and clinical guidelines.[1, 8, 9]

Ultrasound findings in the present study showed that hydronephrosis was the most common abnormality among children with recurrent UTI, while normal ultrasound findings were more frequent among first attack cases. This finding supports the importance of imaging in recurrent UTI to detect structural abnormalities, urinary tract dilatation, stones, and congenital anomalies. Current NICE guidance recommends ultrasound within 6 weeks for children with recurrent UTI and further evaluation according to age, clinical features, and imaging results. The EAU/ESPU guidance also supports a risk-based diagnostic approach to identify children who are more likely to have renal damage or urinary tract abnormalities while avoiding unnecessary invasive tests in low-risk children. The high rate of hydronephrosis in the present study is therefore clinically relevant and supports selective imaging in recurrent cases.[3, 9]

Micturating cystourethrography in the current study showed that vesicoureteric reflux was the most common abnormal finding, followed by bladder abnormality and posterior urethral valve. Vesicoureteric reflux is a well-recognized risk factor for recurrent febrile UTI and renal scarring, especially when associated with bladder and bowel dysfunction or high-grade reflux. Recent evidence suggests that children with both vesicoureteral reflux and bladder bowel dysfunction have the highest risk of recurrence and may benefit most from targeted management. NICE does not recommend routine micturating cystourethrogram for all children after UTI but advises considering it in selected cases with ultrasound dilatation, poor urine flow, non-*E. coli* infection, or family history of vesicoureteral reflux. This supports the selective use of MCU in the present study population.[9, 11]

Intravenous urography findings showed that hydronephrosis was the most common abnormality, followed by stones, duplicated urinary system, single kidney, and pelviureteric junction obstruction. Although intravenous urography is now less commonly used in many settings because ultrasound, DMSA scan, and other imaging modalities are preferred, the findings still indicate that recurrent UTI may be associated with

underlying structural abnormalities. Stones and obstructive lesions can predispose to urinary stasis and repeated infection, while congenital anomalies may require long-term follow-up or specialist referral. Recent pediatric guidance emphasizes selective imaging and specialist assessment for children with recurrent or atypical UTI, especially when obstruction, urinary tract dilatation, or congenital abnormality is suspected.[3, 9]

This study should be interpreted in light of several limitations. The cross-sectional design allowed description of the clinical and epidemiological profile of recurrent urinary tract infection among children, but it did not allow follow-up of patients over time or determination of direct cause-and-effect relationships. In addition, the study was limited to children attending the Pediatric Consultation Clinic at Mosul General Hospital and Baghdada Primary Health Care Centers; therefore, the results may not fully represent all children with recurrent UTI in Nineveh Governorate, especially those managed in private clinics or other hospitals. Another limitation was that some data depended on information provided by parents or caregivers, including previous UTI episodes, feeding pattern, constipation, family history, and prior antibiotic use, which may be affected by inaccurate recall. Moreover, urine culture and imaging investigations were not performed uniformly for all participants, as some tests were requested according to clinical indication and availability, which may have led to underestimation of some microbiological or structural abnormalities. Finally, the relatively small number of recurrent UTI cases may reduce the strength of some statistical comparisons, and further larger prospective studies are needed to evaluate recurrence patterns, renal complications, and preventive strategies more accurately.

5- CONCLUSION AND RECOMMENDATION

The present study concluded that recurrent urinary tract infection in children is an important problem in both primary health care and pediatric practice in Nineveh Governorate. It was more common among children aged 1–4 years, slightly higher in females, and significantly associated with low socioeconomic status, type of feeding, and positive family history of renal problems. Fever was the most common presenting symptom, and hydronephrosis and vesicoureteric reflux were the main radiological abnormalities. Early diagnosis, urine culture when indicated, appropriate antibiotic use, management of constipation and voiding problems, parental health education, and referral of complicated or recurrent cases are recommended. Larger prospective studies are needed to evaluate recurrence, antibiotic resistance, and long-term renal outcomes.

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