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Original Article

Clinical profile of pediatric patients with vesicoureteral reflux

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Abstract

Background: Vesicoureteral reflux (VUR), a common pediatric urologic anomaly, predisposes children to recurrent urinary tract infections and renal scarring. Clinical presentation data from resource-limited South Asian settings remain sparse.

Objective: To describe the clinical profile of pediatric patients with vesicoureteral reflux at a tertiary care hospital in Bangladesh.

Methods: This prospective cohort study was conducted at Bangladesh Medical University, Dhaka, Bangladesh, from January 2024 to December 2025. Eighty-seven children aged <12 years with confirmed VUR on voiding cystourethrography were enrolled using purposive sampling. Data on age, sex, presenting symptoms, history of febrile UTI, and associated anomalies were collected. Data were analyzed using SPSS version 23.0.

Results: Of 87 patients, 70.1% were female (median age 18 months). Febrile UTI was the most common presentation (74.7%), followed by antenatal hydronephrosis (20.7%). Bilateral reflux occurred in 56.3%. Among 136 refluxing ureters, grade III VUR was most frequent (36.0%), and moderate-to-high-grade reflux (III–V) accounted for 74.2%. Renal scarring was present in 47.1%, significantly associated with high-grade reflux ($p<0.001$).

Conclusion: Febrile UTI in young females is the dominant presentation of pediatric VUR in Bangladesh. High-grade reflux and renal scarring are alarmingly common, underscoring the urgent need for early diagnosis after febrile UTI in infants and young children.

Keywords: Antenatal hydronephrosis, Children, Clinical profile, Febrile UTI, Renal scarring, Vesicoureteral reflux.

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1. Introduction

Vesicoureteral reflux (VUR) is defined as the retrograde flow of urine from the bladder into the ureter and occasionally the renal collecting system.1 This abnormal flow results from a functional or anatomic incompetence of the ureterovesical junction, which normally acts as a one-way valve preventing urinary backflow.2 VUR is one of the most commonly diagnosed urologic abnormalities in the pediatric population, with an estimated prevalence of 0.4–1.8% among asymptomatic children and 30–50% among those presenting with febrile urinary tract infections (UTIs).3,4The clinical significance of VUR lies in its strong association with acute pyelonephritis and subsequent renal scarring, also termed reflux nephropathy.5 Renal scarring can lead to long-term complications including hypertension, proteinuria, chronic kidney disease, and in severe cases, end-stage renal failure.6 Despite advances in prenatal ultrasonography, a substantial proportion of children with VUR remain undiagnosed

until they present with their first febrile UTI, which may already be complicated by early renal parenchymal damage.7The natural history of VUR is characterized by a tendency toward spontaneous resolution, particularly for low-grade reflux (grades I–II). However, higher-grade reflux (grades III–V) is less likely to resolve spontaneously and carries a greater risk of breakthrough UTIs and progressive renal injury.8 Current management strategies range from continuous antibiotic prophylaxis to endoscopic injection of bulking agents and open ureteral reimplantation, with treatment decisions guided by reflux grade, laterality, patient age, bladder bowel dysfunction, and parental preferences.9Geographic and demographic variations in the clinical presentation of VUR have been reported in the literature. Studies from high-income countries have consistently identified younger age at diagnosis, female predominance, and febrile UTI as the most common mode of presentation.10 However, data from low- and middle-income countries, particularly South Asian nations, remain limited. Bangladesh, with a population exceeding 170 million, has a high burden of childhood infectious diseases, yet no prospective cohort study has systematically characterized the clinical profile of pediatric VUR patients in this setting.11Several factors may influence VUR presentation in resource-limited settings, including delayed access to pediatric nephrology and urology services, limited availability of voiding cystourethrography (VCUG) and di-mercapto-succinic acid (DMSA) scintigraphy, and competing health priorities that divert attention from non-emergent congenital anomalies.12Additionally, cultural practices, antibiotic stewardship patterns, and referral pathways may differ substantially from those described in Western cohorts.Understanding the local clinical profile of VUR is essential for developing evidence-based screening protocols, optimizing diagnostic algorithms, and guiding targeted interventions in Bangladesh and similar settings. Therefore, this prospective cohort study was designed to describe the clinical presentation, demographic characteristics, and reflux grading patterns among children diagnosed with VUR at a tertiary care hospital in Dhaka, Bangladesh.

Methodology

This prospective cohort study was conducted at Bangladesh Medical University, Dhaka, Bangladesh, from January 2024 to December 2025. All children aged <12 years referred to the Department of Pediatric Nephrology with suspected vesicoureteral reflux (VUR) were screened for enrollment. A total of 87 patients who met the eligibility criteria were included using purposive sampling.

Inclusion criteria: Children of either sex aged 0 months to 12 years with a newly confirmed diagnosis of VUR on voiding cystourethrography (VCUG) were included. Diagnosis was established following the International Reflux Study Committee criteria.

Exclusion criteria: Patients with secondary VUR due to neurogenic bladder, posterior urethral valves, bladder exstrophy, or prior surgical or endoscopic treatment for VUR were excluded. Children with incomplete medical records or those lost to follow-up before VCUG confirmation were also excluded.

Study procedure: All participants underwent detailed clinical history taking and physical examination. VCUG was performed using standard protocols to grade VUR (I–V) [13]. Renal parenchymal scarring was assessed using technetium-99m di-mercapto-succinic acid (DMSA) scintigraphy. Demographic data, presenting symptoms, age at diagnosis, sex, laterality, reflux grade, and associated congenital anomalies were recorded using a structured case report form.

Data analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Categorical variables were presented as frequencies and percentages. Continuous variables were expressed as median with interquartile range due to non-normal distribution. No reference citations were required for this section.

Result

A total of 87 pediatric patients with confirmed vesicoureteral reflux (VUR) were enrolled. The median age at diagnosis was 18 months (interquartile range 8–36 months, range 1 month to 11 years). Female patients predominated (70.1%) compared to males (29.9%), yielding a female-to-male ratio of 2.3:1. Infants aged under 12 months constituted 48.3% of the cohort, while children aged 1–5 years accounted for 37.9%, and those aged over 5–12 years comprised 13.8%.Febrile urinary tract infection was the most common mode of presentation, observed in 74.7% of patients. Antenatal hydronephrosis detected on prenatal ultrasound was the second most frequent presentation (20.7%). Failure to thrive without documented fever was the presenting feature in 4.6%. Among children presenting with febrile UTI, the median age was 14 months (IQR 6–28 months), whereas those with antenatal hydronephrosis had a significantly younger median age at diagnosis of 2 months (IQR 1–4 months). Recurrent febrile UTIs before diagnosis were documented in 28.7% of patients.Bilateral reflux was observed in 56.3% of patients, while unilateral reflux occurred in 43.7%. Among unilateral cases, left-sided reflux was more common (60.5%) than right-sided reflux (39.5%). A total of 136 refluxing ureters were analyzed. Grade III VUR was the most frequently encountered grade (36.0%), followed by grade IV (27.2%), grade II

(19.9%), grade V (11.0%), and grade I (5.9%). Moderate-to-high-grade reflux (grades III–V) accounted for 74.2% of all refluxing ureters.Renal scarring on DMSA scan was present in 47.1% of patients. Scarring was significantly more common in patients with high-grade reflux (grades IV–V) compared to those with low-grade reflux (grades I–II) ($p<0.001$). Congenital anomalies of the kidney and urinary tract (CAKUT) were identified in 13.8%, including duplex collecting system (8.0% of the total cohort), renal dysplasia (3.4%), and hypoplastic kidney (2.3%).

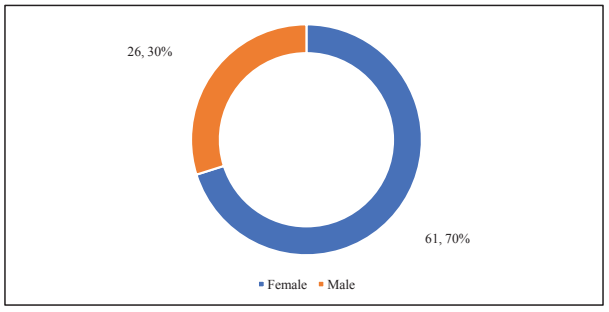


Figure 1: Sex distribution of pediatric VUR patients (N=87)

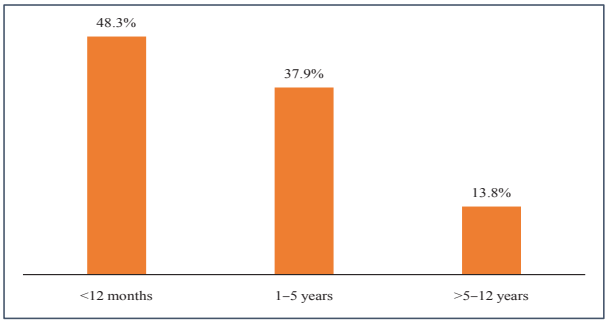


Figure 2: Age distribution of participants

Table 1: Presenting clinical features by age group

Presenting feature	<12 months (n=42)	1–5 years (n=33)	>5–12 years (n=12)	Total (N=87)
Febrile UTI	26 (61.9%)	28 (84.8%)	11 (91.7%)	65 (74.7%)
Antenatal hydronephrosis	16 (38.1%)	2 (6.1%)	0 (0.0%)	18 (20.7%)
Failure to thrive	0 (0.0%)	3 (9.1%)	1 (8.3%)	4 (4.6%)

Table 2: Laterality and distribution of refluxing ureters

Parameter	Category	n	%
Laterality (patients, N=87)	Bilateral	49	56.3
	Unilateral	38	43.7
Side of unilateral reflux (n=38)	Left	23	60.5
	Right	15	39.5

Table 3: Distribution of VUR grades among refluxing ureters (n=136)

VUR grade	Number of ureters	%
I	8	5.9
II	27	19.9
III	49	36.0
IV	37	27.2
V	15	11.0

Table 4:Association between VUR grade and renal scarring on DMSA scan

VUR grade category	Renal scarring cases (n/N)	%
Low-grade (I–II)	5/26	19.2
Moderate-grade (III)	16/36	44.4
High-grade (IV–V)	20/25	80

Table 5: Congenital anomalies of the kidney and urinary tract (CAKUT) in VUR patients

Type of anomaly	n	% among CAKUT (n=12)	% of total cohort (N=87)
Duplex collecting system	7	58.3	8
Renal dysplasia	3	25	3.4
Hypoplastic kidney	2	16.7	2.3

Discussion

The present prospective cohort study provides, to our knowledge, the first systematic description of the clinical profile of pediatric vesicoureteral reflux (VUR) in Bangladesh. Among 87 children, we observed a female predominance (70.1%), a median age at diagnosis of 18 months, febrile urinary tract infection as the dominant presenting feature (74.7%), and a high proportion of moderate-to-high-grade reflux (grades III–V, 74.2% of refluxing ureters), with renal scarring present in nearly half of the patients at diagnosis.The female predominance observed in this cohort aligns closely with findings from multiple international studies.3,14 This sex disparity is well-recognized in VUR epidemiology and is attributed to the shorter urethral length in females and higher susceptibility to urinary tract infections.15 However, the female-to-male ratio of 2.3:1 in our study is lower than the 4:1–5:1 ratio reported from some European and North American cohorts.2,9 This discrepancy may reflect referral bias in our setting, where male infants with antenatal hydrone

phrosis are investigated more aggressively early in life, whereas females are often diagnosed only after recurrent febrile UTIs.16Febrile UTI was the presenting symptom in three-quarters of our patients, a frequency comparable to that reported in a large Indian cohort (72%) but higher than in a Korean study (58%).17,18 The relatively high prevalence of antenatal hydronephrosis (20.7%) as a presenting feature reflects increasing access to prenatal ultrasonography in Dhaka, although this remains lower than in high-income countries, where 30–40% of VUR cases are identified prenatally.7,19 The median age at diagnosis for antenatal hydronephrosis (2 months) in our study was substantially younger than for febrile UTI (14 months), confirming that prenatal screening enables earlier detection before infection-related renal injury occurs.20A notable finding was the predominance of bilateral reflux (56.3%) and moderate-to-high-grade disease (74.2% of ureters). Both figures exceed those reported in the Swedish reflux trial (bilateral 41%, grades III–IV 52%) and the RIVUR trial (bilateral 39%, grades III–IV 48%).5,6 Several explanations merit consideration. First, our tertiary referral center receives complex cases from across the country, introducing selection bias toward more severe phenotypes. Second, children with low-grade unilateral reflux and no UTIs may remain undiagnosed in resource-limited settings where VCUG is less readily available.12 Third, genetic and ethnic factors may influence VUR severity, though population-based comparative data are lacking.21Renal scarring at diagnosis was present in 47.1% of patients, strikingly higher than the 24–31% reported in contemporary European and North American cohorts.8,22 This finding is clinically concerning as scarring is a precursor to long-term complications, including hypertension and chronic kidney disease.6 The strong association between high-grade reflux and scarring (80% in grades IV–V versus 19.2% in grades I–II, $p<0.001$) confirms previously established relationships,11,23 However, the overall high scarring rate likely reflects delayed diagnosis, as 28.7% of our patients experienced recurrent febrile UTIs before VUR confirmation, suggesting missed opportunities for earlier intervention.24The prevalence of CAKUT (13.8%) in our cohort is consistent with the 12–18% range reported in VUR populations.2,17 The duplex collecting system was the most common anomaly, which is known to coexist with VUR due to shared embryologic origins affecting ureterovesical junction development.25

Limitations

This single-center prospective study used purposive sampling, which may limit generalizability. Selection bias toward severe cases is likely due to tertiary referral practices. The absence of long-term follow-up precludes assessment of hypertension and chronic kidney disease outcomes.

Conclusion

Febrile urinary tract infection in young females is the predominant clinical presentation of vesicoureteral reflux in this Bangladeshi cohort. Moderate-to-high-grade reflux accounts for three-quarters of affected ureters, with renal scarring present in nearly half of patients at diagnosis. These findings emphasize the need for early diagnosis strategies, including timely voiding cystourethrography after febrile urinary tract infection in infants and young children.

Recommendation

We recommend targeted voiding cystourethrography for infants and young children presenting with febrile urinary tract infection, particularly females. Strengthening prenatal ultrasound screening and establishing regional pediatric nephrology referral pathways in Bangladesh may facilitate earlier vesicoureteral reflux diagnosis and reduce renal scarring.

Ai Declaration

Artificial intelligence tools contributed marginally to manuscript preparation and development. All core scientific content was human-verified.

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