RESEARCH PAPER

Five-Year Vesicoureteric Reflux Outcomes in Young Children: A prospective analysis at tertiary care.

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Abstract

Background: Vesicoureteral reflux (VUR) is a common childhood urological problem, yet long-term outcome data from Indian paediatric cohorts are limited. Most published studies describe short follow-up periods or focus only on surgical interventions. Parents and clinicians often face uncertainty regarding real long-term success rates of reflux resolution across different grades. This study aimed to address this knowledge gap by presenting five-year radiological outcomes of children with VUR managed through a combination of conservative treatment, endoscopic injections, and ureteric reimplantation.

Methods: Children diagnosed with primary VUR were prospectively followed for five years. Clinical data, reflux grades, imaging findings and treatment outcomes were recorded. Resolution rates were analysed across VUR grade groups (I–II, III, and IV–V), and outcomes of endoscopic and surgical interventions were assessed separately.

Results: Of the 38 children who completed the full follow-up, 24 showed complete radiologic resolution (63.1%). Children with lower-grade reflux had the highest natural improvement: 90.9% in grade I–II and 80% in grade III. In contrast, 35.2% resolution was seen in children with grade IV–V, indicating more aggressive disease biology. Endoscopic intervention showed encouraging success, with a single injection curing 60% and a second injection increasing the cure rate to 70%. Surgical reimplantation produced excellent outcomes, resolving reflux in 83.3% of operated children.

Conclusion: This study provides important long-term Indian data showing that most children with low-to-moderate grade VUR naturally improve without surgery. It highlights how step-wise endoscopic therapy is safe and effective, and surgery remains highly successful when needed. The long five-year follow-up makes this study unique, practical, and relevant to day-to-day paediatric urology decision making.

Keywords: Vesicoureteic reflux, Recurrent UTI, Ureteric reimplantation, Pediatric Urology

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1.Introduction

Vesicoureteral reflux (VUR) is the retrograde flow of urine from the bladder into the ureter and kidney. The goals of management are to prevent recurrent febrile urinary tract infections (UTIs), avoid renal scarring, preserve kidney function, and minimize treatment morbidity.[1]

Recent trials emphasize tailored management for children: low-grade VUR often resolves spontaneously, whereas selected children with recurrent febrile UTIs, scarring, or high-grade VUR may benefit from intervention (endoscopic injection or ureteral reimplantation) or selective antibiotic prophylaxis. The RIVUR randomized trial showed that trimethoprim–sulfamethoxazole prophylaxis reduced recurrent UTIs in children with VUR, particularly in those with bladder-bowel dysfunction. [2]

Recent guideline updates from European societies and reviews underline an individualized, risk-stratified approach and report contemporary data on spontaneous resolution, the role of prophylaxis, and outcomes after endoscopic or open/robotic surgery. [3,4]

In many centers, clinicians still face practical questions: how many children with newly diagnosed VUR will have recurrent infections over 5 years; how often does VUR resolve with conservative care; what proportion require endoscopic injection or reimplantation; and which organisms cause recurrent infections in this population? We present a single-center prospective cohort of 44 children with primary VUR followed for five years to address these outcomes and relate them to recent evidence.

2.Methods

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2.1. Study design and setting
This was a prospective observational cohort study carried out at a tertiary pediatric center. Children with newly diagnosed primary VUR between January 2015 and December 2017 were enrolled and followed for five years. The institutional ethics committee approved the study and written informed consent was obtained from parents.

2.2. Inclusion and exclusion criteria
Inclusion: children aged 1 month to 12 years with primary VUR proven on micturating cystourethrogram (MCUG). Exclusion: neurogenic bladder, posterior urethral valves, transplant recipients, or secondary VUR from anatomic obstruction.

2.3. Baseline assessment
At diagnosis we recorded age, sex, presenting features (febrile UTI vs antenatal hydronephrosis vs family screening), VUR grade (I to V, using International Reflux Study grading), laterality, and initial DMSA renal scan where available to document baseline renal defects.

2.4. Management strategy
Management followed a risk-stratified protocol aligned with contemporary guideline recommendations: children with low-grade VUR (grades I–II) and no renal scarring were offered conservative management with parental education, prompt treatment of UTI, and consideration of antibiotic prophylaxis in selected cases (recurrent febrile UTI or bladder-bowel dysfunction). Children with grade III disease were considered for either prophylaxis or endoscopic injection depending on clinical course and parental preference. Children with persistent high-grade VUR (IV–V), recurrent febrile UTIs despite prophylaxis, or progressive scarring were offered surgical correction (endoscopic injection of dextranomer/hyaluronic acid (Dx/HA) or ureteral reimplantation , open or laparoscopi depending on anatomy and surgeon/parent choice. These principles follow guideline and recent randomized/observational data. [1–4]

2.5. Follow-up
Children were followed at 3 months, 6 months, then every 6–12 months clinically for five years. At each visit we documented interval UTIs (culture-proven), hospital admissions, febrile episodes, any surgical procedures, and blood pressure. MCUG was repeated selectively after intervention or at 12–24 months if clinically indicated. DMSA scans were repeated at 12 months and at the end of follow up if clinically indicated.

2.6. Outcomes and definitions
Primary outcomes: (1) recurrent UTI during five years (≥1 culture-proven febrile UTI after enrolling in the study), (2) radiologic resolution of VUR, (3) new or progressive renal cortical scarring on DMSA, and (4) need for surgical intervention (endoscopic injection or ureteral reimplantation). Secondary outcomes: organisms isolated from urine cultures in recurrent infections, antibiotic resistance patterns, surgical complications, and loss to follow-up.

2.7. Statistical analysis
Descriptive statistics (means, medians, proportions) were used. Resolution rates were compared between grades and management groups using chi-square tests; $p < 0.05$ was considered significant.

3.Results
3.1. Cohort and follow-up
Forty-four children were enrolled. During the five-year follow up 6 children (13.6%) were lost to follow-up, leaving 38 children with complete 5-year data available for outcome analysis. Mean age at diagnosis was 3.8 years (range 0.4–11.5); 32 (72.7%) were female and 12 (27.3%) male.

3.2. VUR severity and initial presentation
Distribution by grade (44 children at baseline): Grade I–II: 14 children (31.8%); Grade III: 12 children (27.3%); Grade IV–V: 18 children (40.9%). Presentation: 30 children (68.2%) presented with febrile UTI, 8 (18.2%) were detected after antenatal hydronephrosis, and 6 (13.6%) by family screening.

3.3. Initial DMSA
Baseline DMSA was available in 38 children; 8/44 (18.2%) had cortical defects consistent with renal scarring at diagnosis.

3.4. Management received
Table 1: Management Strategies Used in Study Participants (n = 44)

Management Strategy	Number of Children (n)	Percentage (%)	Clinical Notes
Conservative management (parental education + prompt UTI treatment ± prophylaxis)	20	45.4%	13 were VUR grade I–II; 7 were grade III with parental preference for observation
Continuous antibiotic prophylaxis (TMP-SMX or Nitrofurantoin)	25	56.8%	Used as first-line for recurrent UTIs or post-diagnosis; some patient strategies changed over time
Endoscopic injection	10	22.7%	Mostly grades II–III; some grade IV children after counselling
Ureteral reimplantation surgery (open or minimally invasive)	6	13.6%	Mainly grade IV–V disease, bilateral involvement, or failure of endoscopic therapy

Radiologic outcomes (38 children with complete follow-up)
Among the 38 children who completed 5-year follow-up:
Overall radiologic resolution (no VUR on follow-up cystogram occurred in 24/38 children (63.1%).

Table 2: Radiological resolution Among Children with Vesicoureteral Reflux (n = 38 Completed Follow-up)

Resolution by initial VUR grade	Number of Children (n)	Percentage (%)
Grade I–II	**10/11**	**90.9% (Mostly resolved without surgery)**
Grade III	**8/10**	**80%**
Grade IV–V	**6/17**	**35.2%**

Table 2: Radiological resolution Among Children with Vesicoureteral Reflux (n = 38 Completed Follow-up

Grades I–III demonstrated significantly higher resolution than grade IV–V

- Endoscopic injection outcomes (10 children): single injection cured VUR radiologically in 6 (60%); a second injection (in 1 child) increased the cumulative cure to 7/10 (70%).
- Ureteral reimplantation outcomes (6 children): radiologic cure was achieved in 5/6 (83.3%) after surgery; one child had persistent low-grade reflux.

3.5. Recurrent urinary tract infections and organisms

During five years, 12 of the 38 children (31.5%) experienced at least one culture-proven recurrent febrile UTI after enrolment. Analysing by management:

- Conservative group: 8 of conservatively managed children who completed follow-up had recurrent UTIs.
- Endoscopic group: 3 had recurrent UTIs (some before and some after injection).
- Reimplantation group: 1 had recurrent febrile UTI after surgery.

  Organisms from urine cultures in recurrent infections (18 organisms reported):
- Escherichia coli: 12 (66%). This predominance is similar to reported pediatric UTI series where E. coli is the commonest pathogen.
- Klebsiella spp.: 4 (22.2%).
- Proteus mirabilis: 1 (5.5%).
- Enterococcus species:1 (5.5%).

  Antibiotic resistance: a rising proportion of cultures showed resistance to ampicillin and early-generation oral cephalosporins; most were sensitive to aminoglycosides and third-generation cephalosporins at our center.

3.6. Renal scarring and renal function

Among children with baseline normal DMSA 3 children developed new cortical defects at 12–24 months — 1 of these had recurrent febrile UTIs. No child progressed to stage ≥3 chronic kidney disease during the five years and no new sustained hypertension was documented.

3.7. Complications and adverse events

- Post-injection transient hematuria and dysuria occurred in 3/10 children and resolved within days.
- One child developed transient ureteric obstruction after injection requiring temporary stenting and subsequent reimplantation.
- Reimplantation complications included one wound infection and one urinary retention that resolved.

3.8 Loss to follow-up

6 children (13.6%) were lost; their baseline characteristics were similar to the whole cohort.

4. Discussion

This single-center prospective cohort of 44 children with primary VUR followed for five years provides a practical view of outcomes in a contemporary setting.
Key findings: (1) radiologic resolution occurred in 63.1% of children who completed follow-up; resolution was most likely in low-grade VUR and less likely in higher grades; (2) 31.5% had at least one recurrent febrile UTI over five years; (3) E. coli remained the predominant organism in recurrent infections (66% of isolates); and (4) endoscopic injection had an initial cure rate of 60% with cumulative success after repeat injection 70%, while ureteral reimplantation had a high cure rate (83.3%). These findings are generally concordant with the broader literature and guideline conclusions. [1–6,11]. International series and guideline summaries report high spontaneous resolution rates for grades I–II VUR and lower rates for higher grades; our cohort showed essentially universal resolution for low-grade disease in children who remained in follow up and lower rates for grade IV–V, consistent with published reviews. [3,4]
Antibiotic prophylaxis and RIVUR: The RIVUR randomized trial found that prophylaxis reduced recurrent UTIs in children with VUR, particularly in those with bladder-bowel dysfunction. Our prophylaxis group had fewer recurrent infections than some conservatively managed children, but cohort design and clinician selection bias limit direct comparison; randomized data should guide practice where equipoise exists. [2,9]
Endoscopic vs open repair: The success of Dx/HA injection observed here (single injection 60%, cumulative 70%) fits within ranges reported in meta-analyses and contemporary series, which vary by grade, surgeon experience, and patient factors. Open/robotic ureteral reimplantation remains highly successful with low rates of persistent VUR. [5–7,12]
Children with low-grade VUR (I–II) can usually be managed expectantly with education and prompt UTI treatment; many will have spontaneous resolution. [1,3].
Antibiotic prophylaxis reduces recurrent UTI risk in

selected patients (RIVUR evidence). Use prophylaxis selectively (recurrent febrile UTI, bladder-bowel dysfunction, or high-risk profiles) and consider local resistance patterns. [2,9]. Endoscopic injection is a minimally invasive option with reasonable short-term cure rates for low-to-moderate grades; plan for potential repeat injection and careful post-procedure surveillance. [5,6,12]. High-grade VUR or recurrent febrile UTIs despite optimized conservative care should prompt timely surgical referral. Reimplantation offers durable radiologic cure in most children. [1,7].

Limitations

This is a single-center observational cohort with some loss to follow-up (13.6%). Management was not randomized and reflects clinician/parent decisions, so treatment groups are prone to selection bias. Microbiology and antibiotic resistance patterns are center-specific and may vary by region. DMSA and MCUG follow-up were selective rather than universal, which could underestimate radiologic findings in some children.

5. Conclusion

In this prospective cohort of 44 children with primary VUR followed for five years, most low-grade cases resolved without surgery, recurrent febrile UTIs occurred in about one-third of children who completed follow up, E. coli remained the most common pathogen in recurrent infections, endoscopic injection provided good outcomes for selected children while reimplantation produced durable cure in most operated patients. These real-world results support guideline recommendations that management should be individualized by grade, clinical course, and infection risk. Continued attention to infection prevention, local antibiotic susceptibility, and careful follow-up remains essential.

During the preparation of this work the author(s) used ChatGPT in order to edit grammatical errors. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

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