# Vesicoureteral Reflux in Conjunction With Posterior Urethral Valves

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**Purpose:** We evaluated the link between primary kidney function and vesicoureteral reflux in patients with posterior urethral valves. We also analyzed the timing of the resolution of reflux after release of urethral obstruction.

**Materials and Methods:** We retrospectively analyzed records and x-ray results for 200 patients with posterior urethral valves treated at our institution between 1953 and 2003. Of these patients 197 were evaluated for vesicoureteral reflux.

**Results:** Bilateral vesicoureteral reflux was present in 73 patients (37%) and unilateral reflux in 54 (27%). Of 99 cases of posterior urethral valves diagnosed postnatally the diagnosis was made at a younger age when reflux was present ($p < 0.001$). Patients with reflux (especially bilateral) had significantly higher serum creatinine levels at presentation and 6 and 12 months postoperatively compared to patients without reflux. In unilateral cases the split functions of refluxing kidneys were significantly decreased. Reflux resolved spontaneously at a median of 1.28 years (range 0.04 to 15.16) after treatment of posterior urethral valves, resolving more rapidly in patients with unilateral disease. Among 200 poorly functioning kidneys 35 with reflux (18%) were removed.

**Conclusions:** In patients with posterior urethral valves vesicoureteral reflux is often associated with poorly functioning kidneys. Accordingly patients with bilateral reflux have decreased overall kidney function. Reflux resolves in half of ureters within 2 years after valve ablation. Reflux resolves more rapidly in unilateral cases.

**Key Words:** child, kidney, urethra, vesico-ureteral reflux

**Abbreviations and Acronyms**

ESRD = end-stage renal disease
PUV = posterior urethral valves
UTI = urinary tract infection
VCUG = voiding cystourethrogram
VUR = vesicoureteral reflux

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Posterior urethral valves are accompanied by vesicoureteral reflux at a rate of 26% to 72%.[1] The association of reflux and renal function in boys with posterior urethral valves is controversial. Although bilateral reflux appears to be associated with kidney failure, unilateral reflux with an ipsilateral nonfunctioning kidney has been suggested to protect contralateral kidney function.[2–9] However, some recent studies have not shown such a protective effect.[10–12]

Valve ablation is commonly followed by nephrectomy in cases of unilateral VUR and nonfunctioning kidney.[10] Previously early ureterovesical reconstruction was proposed in cases involving gross dilatation of the upper urinary tract.[13–15] Although a conservative expectant attitude following release of the distal obstruction is now more common,[16–18] few studies exist concerning spontaneous resolution of VUR after urethral valve ablation. VUR has been reported to resolve spontaneously in 27% to 79% of refluxing ureters at 2 weeks to more than 1 year following valve ablation.[2,18–22]

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Although renal failure is more common in patients with bilateral reflux, it is unclear if this finding is related to congenital renal dysplasia or acquired damage. Also, the regression of VUR during long-term followup and the need for surgery have not been explored extensively. We evaluated the association of primary kidney function and VUR in patients with PUV. We also assessed the rate and timing of spontaneous resolution of VUR after valve ablation.

## PATIENTS AND METHODS

We retrospectively reviewed the database of the Hospital for Children and Adolescents for cases of PUV between 1953 and 2003. A total of 200 cases were identified, of which 28 were diagnosed prenatally, 87 after urinary tract infection and 33 due to neonatal problems. In 39 patients symptoms leading to diagnosis were heterogeneous. PUV diagnosis was based on VCUG, urethral endoscopy or open surgery findings (early cases). Data sufficient to confirm VUR were available in 197 patients. Of these patients 127 (64%) had reflux on x-ray or radionuclide cystography. Primary kidney function was analyzed by measuring maximal serum creatinine values at presentation, 6 and 12 months, and 5 to 7 years after valve ablation. Renal split function was assessed on scintigraphy at presentation. We noted patients diagnosed with ESRD who were younger than 16 years. We compared patients with vs without VUR, and those with unilateral vs bilateral VUR.

VUR management and resolution were analyzed for the entire series. Spontaneous resolution of VUR was analyzed in detail in patients born between 1980 and 2003 and initially treated at our institution.

Mann-Whitney test was used to compare serum creatinine values, kidney split function and patient age when analyzing 2 groups, and Kruskal-Wallis test was used when analyzing 3. Fisher's exact test was used to compare groups with poor renal function and ESRD (StatView®, version 5.0.1). A p value of less than 0.05 was considered significant.

## RESULTS

VUR was detected in 127 patients (64%). Laterality was bilateral in 73 patients (37%) and unilateral in 54 (27%). Reflux was grade I in 4 ureters (2%), grade II in 4 (2%), grade III in 16 (8%), grade IV in 47 (24%) and grade V in 116 (59%). Unilateral VUR was right in 31 patients (57%) and left in 23 (43%). Median age at diagnosis of PUV was 0.3 years (range 0 to 25.5). Of 99 patients diagnosed with PUV postnatally the diagnosis was made at a younger age in those with reflux (median 0.3 years, range 0 to 14.6) than without reflux (2.9 years, 0 to 25.5, $p < 0.001$). Of 28 patients with a prenatal diagnosis of PUV reflux was detected in 17 (61%). Of PUV cases diagnosed postnatally urinary tract infection was a presenting symptom in 31 of 59 without VUR (53%) and in 66 of 110 with VUR (60%, $p = 0.42$).

Patients with VUR (especially bilateral) had significantly higher serum creatinine levels than those without VUR (table 1). At scintigraphy a poorly functioning kidney on the refluxing side with split function less than 10% was detected in 22 of 73 patients (30%). In comparison only 2 of 35 patients (6%) without VUR had a poorly functioning kidney on scintigraphy ($p = 0.006$). In unilateral cases the median split function was 31% (range 0% to 58%) on the refluxing side and 69% (42% to 100%) on the contralateral side ($p < 0.001$). Patients with bilateral VUR more often had reduced kidney split function on 1 side than those without VUR. Also, ESRD developed significantly more often in patients with bilateral VUR compared to those with unilateral or no VUR.

Early in the series 11 refluxing ureters in 10 patients were operated before or at valve ablation. Of these patients 4 underwent nephrectomy elsewhere before valve ablation at our hospital, 5 underwent correction of primary unilateral VUR and 1 underwent correction of bilateral VUR.

Data were available for 141 refluxing ureters following valve ablation and 49 were lost to followup. VUR resolved spontaneously in 88 ureters (62%), following antireflux surgery in 29 (21%) and after nephrectomy in 24 (17%).

Indications for operative treatment of VUR changed considerably during the study. Almost all ureterovesical surgery was done early in the series or performed elsewhere. Nephrectomy was performed in cases of nonfunctioning or marginally functioning kidneys, where severe VUR usually also persisted. Unilateral nephrectomy was performed in 35 patients (18%) with ipsilateral severe reflux and nonfunctioning kidney (right side in 18, left in 17). However, in 11 of these cases VUR had resolved before nephrectomy. A total of 20 nephrectomies were performed in patients with unilateral VUR (37%) and 15 in those with bilateral VUR (21%). Nephrectomy was also performed in 3 of 70 patients (4%) without VUR.

**Table 1.** *Serum creatinine levels at presentation and after resection of PUV*

| | No VUR | Unilat VUR | Bilat VUR |
|---|---|---|---|
| Mean μmol/l serum creatinine (range): | | | |
| At diagnosis | 66 (19–374) | 97 (21–433)* | 130 (14–593)* |
| 6 Mos postop | 43 (19–229) | 43 (22–504) | 58 (20–573)* |
| 12 Mos postop | 43 (19–284) | 46 (22–455) | 57 (28–292)* |
| 5–7 Yrs postop† | 54 (34–477) | 60 (29–583) | 66 (43–592) |
| No. ESRD before 16 yrs (%) | 3 (4) | 4 (7) | 18 (25)‡ |
| % Split renal function on worse kidney primarily (range) | 45 (0–50) | 31 (0–49)* | 29 (0–50)* |

* Significantly different from patients with no VUR.
† Patients with ESRD were excluded.
‡ Significantly different from patients with unilateral or no VUR.