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Prognostic value of serum creatinine levels in children with posterior urethral valves treated by primary valve ablation

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Abstract *Purpose:* We evaluated the prognostic value of serum creatinine level at presentation and nadir creatinine during follow up for future renal function (RF) in children with posterior urethral valves (PUV).
Materials and methods: Between 1987 and 2004, 120 cases of PUV were treated initially at our hospital with valve ablation. Initial assessment included serum creatinine measurement, urine analysis and culture, renal ultrasonography and voiding cystourethrography. After valve ablation, renal ultrasound and serum creatinine measurement were repeated and thereafter during visits until the end of follow up.
Results: Follow up ranged from 2 to 12 years (mean = 4.4). Renal insufficiency (RI) developed at the end of follow up in 44 patients (36.5%). The mean initial and nadir serum creatinine in the RI group was higher than in the normal RF group ($P < 0.05$). With a cut-off value of 1 mg/dl for initial and nadir serum creatinine, the incidence of RI was significantly different ($P < 0.05$).
Conclusion: Our data confirm the high prognostic value of nadir serum creatinine after relief of valvular obstruction. Further, the serum creatinine level before valve ablation correlates significantly with long-term RF in children with PUV.

Introduction

PUVs represent the most severe obstructive uropathy in children and cause renal failure in 25–30% of cases before adolescence [1]. The main issues in treatment of urethral valves concern very young infants. In these patients, the potential for recovering renal function (RF) is believed to be significant.

Lines of management depend on general condition of the patient, RF at presentation and the available hospital facilities. Although valve ablation is the treatment of choice for patients with PUV, debate continues as to the role of urinary diversion [2,3].

The prognosis for children with urethral valves is improving and current management is gradually rewriting

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the historical data. Many factors have been associated with final renal outcome, such as age at presentation, presence of VUR, renal parenchymal echogenicity on initial ultrasound, serum creatinine and creatinine clearance at first year of life [4–8].

The aim of our study was to evaluate the prognostic value of serum creatinine levels in children with PUV treated by primary valve ablation.

Materials and methods

A retrospective study including all children with postnatally detected PUV who were treated by primary valve ablation in the Mansoura Urology and Nephrology Center between 1987 and 2004 was carried out. There were 120 boys with a mean age of 2 years (range from 1 month to 15 years). The charts of all patients were reviewed, and clinical records and all radiological and laboratory findings were analyzed.

The preoperative evaluation included history, clinical examination, urinalysis, and urine culture. Serum creatinine was measured in all patients at presentation and at time of valve ablation. Published, age-specific, serum creatinine levels were used for comparison [9] and the mean values were compared between groups. Creatinine clearance (eGFR) was calculated from the Schwartz formula [10]. Renal ultrasonography and VCUG were carried out in all patients. Primary valve ablation was performed in all patients regardless of serum creatinine level or upper tract configuration.

Patients were followed up every 3–6 months with clinical examination, urinalysis and culture, serum creatinine, and ultrasonography. VCUG was also obtained 3–6 months after valve ablation in all patients and when necessary thereafter.

Binary and logistic regression analysis was utilized. Values were expressed as means ± standard deviation (SD) unless otherwise reported. SPSS® for Windows 10 software was used for all analyses. Associations between categorical variables were examined by Mann–Whitney test. The Kaplan–Meier method was used to identify the rate of development of end-stage renal disease (ESRD). All statistical tests were two sided. A *P*-value of 0.05 or less was considered statistically significant.

Long-term renal outcome was defined as favorable when RF was either normal (GFR $\geq$ 90 ml/min/1.73 m^2) or moderately impaired (GFR from 60 to 89 ml/min/1.73 m^2), and poor when the patient had either chronic renal failure (CRF) or ESRD [11,12]. CRF was defined as a stage where GFR was 59 ml/min/1.73 m^2 or less according to the guidelines of the National Kidney Foundation [12]. ESRD was defined as a requirement for dialysis or renal transplantation.

Table 1 Comparison between patients with normal renal function and patients with renal insufficiency as regards serum creatinine and creatinine clearance.

	Normal RF group ($N = 76$)	RI group ($N = 44$)	*P*
Mean initial serum Cr	0.8 mg/dl	1.7 mg/dl	<0.001
Mean nadir serum Cr	0.55 mg/dl	1 mg/dl	<0.001
Mean initial Cr clearance (eGFR)	117 ml/min	34 ml/min	<0.001

Results

Follow-up duration ranged from 2 to 12 years (mean ± SD = 4.4 ± 2.6). Renal insufficiency (RI) developed at the end of follow up in 44 patients (36.5%) with ESRD in 18.

Serum creatinine on admission ranged from 0.2 to 12.3 mg/dl (mean ± SD = 1 ± 1.3). After valve ablation serum creatinine dropped in all patients by varying degrees and nadir serum creatinine ranged from 0.2 to 3 mg/dl (mean ± SD = 0.74 ± 0.5). Final serum creatinine ranged from 0.3 to 12 mg/dl (mean ± SD = 1.5 ± 2).

On comparing the serum creatinine in the RI group with the group of normal RF using Mann–Whitney test, we found that the serum creatinine on admission ranged from 0.2 to 12.3 mg/dl (mean ± SD = 1.7 ± 1.9) in the RI group, while in the normal RF group it ranged from 0.2 to 3 mg/dl (mean ± SD = 0.8 ± 0.5), and the difference was statistically significant ($P < 0.001$) (Table 1).

When initial serum creatinine before valve ablation was below 1 mg/dl RI developed in 22% (17/77), while RI developed in 27 out of 43 boys (63%) who presented with serum creatinine above 1 mg/dl (Fig. 1).

Nadir serum creatinine was the most statistically significant predictor for the final renal outcome ($P < 0.001$). When the nadir creatinine was below 1 mg/dl, the incidence of RI was markedly reduced (24%) in comparison to a nadir creatinine above 1 mg/dl (84%) (Fig. 2). Also, nadir serum creatinine showed a statistically significant difference between the two groups: it ranged from 0.2 to 3 mg/dl (mean ± SD = 1 ± 0.6) in the RI group and from 0.2 to

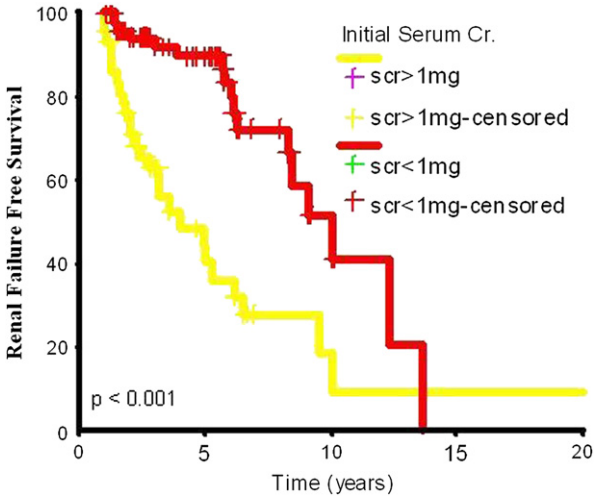

Figure 1 Kaplan–Meier plot showing incidence of chronic renal failure stratifying by serum creatinine at presentation. Red line = serum Cr at presentation ≤ 1 mg/dl; yellow line = serum Cr at presentation > 1 mg/dl. Log-rank test: $P < 0.001$ (for interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).