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Management of calculus anuria in children: Experience of 54 cases☆

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Abstract *Objective:* To evaluate the outcome of different treatment plans for calculus anuria in children.
Patients and methods: Patients were subdivided into three groups, A, B and C. Group A included patients who were critically ill, had serum creatinine ≥ 3.5 mg/dl, blood urea ≥ 100 mg/dl, serum potassium ≥ 7 meq/l and/or blood pH ≤ 7.1; and they were treated initially by peritoneal dialysis. Patients in groups B and C were stable with serum creatinine < 3.5 mg/dl, blood urea < 100 mg/dl, serum potassium level < 7 meq/l and blood pH > 7.1. In group B, the obstructing stone could not be localized, and they were treated either by percutaneous nephrostomy or JJ stent. In group C, stone level was confidently determined and patients were treated by open surgery.
Results: Fifty-four patients were included. All patients regained normal serum creatinine levels within 72—120 h. Overall complication rate in groups A and C was 26% and 13%, respectively. In group B, overall complication rate was 66% for percutaneous nephrostomy and 50% for internal stent.
Conclusions: Urinary diversion in children is associated with a high complication rate while dialysis is highly effective in children. Formal surgery in compensated children is associated with a low complication rate with good outcome and early recovery.

Introduction

Acute renal failure due to calculus disease is a urological emergency. Management in the form of urinary diversion (percutaneous nephrostomy), acute peritoneal dialysis, hemodialysis and definitive surgical treatment can save the patient from developing chronic renal failure. In children, it

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is a catastrophic, life-threatening event with significantly increased morbidity and mortality rates. Post-renal acute renal failure (5% of acute renal failure cases) requires immediate treatment. Most children regain normal kidney function if the condition is reversed promptly [1].

There are many problems during management of anuria in children. Children are at greater risk of acute renal failure complications (sepsis and electrolyte imbalance). Stone location is difficult to determine accurately, especially if the stone is present in the ureter. Lastly, the risk of de-compensation from anesthesia during intervention is high.

We report our experience in the management of calculus anuria in children to identify the optimal time of interference, and the indication and complications of each treatment line (dialysis, surgery and urinary drainage).

Patients and methods

We reviewed the charts of children who were treated for calculus anuria in our urology and pediatric nephrology departments in the period from December 2004 to June 2007. Patients were initially evaluated in the nephrology subunit of the pediatric department. Every child was subjected first to a general examination to exclude signs of acidosis, sepsis or fluid retention. A venous blood sample was taken to determine levels of serum electrolytes, serum creatinine and blood urea. An arterial blood sample was taken to determine the level of blood gases. Abdominal ultrasound and plain urinary tract imaging were done to determine degree and level of obstruction. Patients were subdivided into three groups, A, B and C, according to the clinical findings and type of treatment. The treatment decision was based on the patient's general condition, basic metabolic panel and stone localization. Group A included patients who were critically ill, had serum creatinine $\geq$ 3.5 mg/dl, blood urea nitrogen $\geq$ 100 mg/dl, serum potassium $\geq$ 7 meq/l and/or blood pH $\leq$ 7.1. This group was treated initially by peritoneal dialysis, followed by our standard protocol of management, in which open surgery or drainage would be chosen according to the stone level determined. Patients in groups B and C were stable with serum creatinine $<$ 3.5 mg/dl, blood urea nitrogen $<$ 100 mg/dl, serum potassium level $<$ 7 meq/l and blood pH $>$ 7.1. In group B, the obstructing stone could not be localized and patients were treated either by percutaneous nephrostomy or JJ stent. If the decision was percutaneous nephrostomy then we chose the side to operate according to the priority of infection and the more dilated pelvis. In group C, stone level was confidently determined and patients were treated by open surgery, choosing the side where there were fewer stones. Follow-up tools included urine output and basic metabolic panel. Complications were recorded for each treatment line. Time for blood chemistry to return to normal was also recorded.

Results

Fifty-four patients were included. Age ranged from 1 to 8 years. Nineteen patients (35.2%) fell in the group A category, 12 patients (22.2%) were group B and 23 patients (42.6%) were group C. All children had bilateral urinary stones.

Group A (dialysis group)

All children regained normal blood urea, serum creatinine (Fig. 1) and electrolyte levels within 48 h (after one run of dialysis). Eight children (42%) in this group were relieved of anuria during dialysis due to either stone expulsion (through urethra or to the bladder) or dis-impaction.

The overall complication rate was 26% (Table 1). Hypokalemia was recorded in three children (15%) and sepsis in two children (10%). Both conditions were managed by replacement therapy and antibiotics.

Children with persistent anuria after dialysis (11) were managed by open pyelolithotomy in eight, internal stenting in two and percutaneous nephrostomy in one.

Group B (urinary drainage group)

As regards patients treated with percutaneous nephrostomy, serum creatinine improved within 3 days (Fig. 1). The overall complication rate was 66% (Table 1). Major complications were slipped tube in two (33%) patients, febrile UTI in two (33%) patients and primary hemorrhage in one (16%) patient. Minor complications were leakage around the tube in two (33%) patients, mild hematuria in one (16%) patient and transient tube obstruction in three (50%) patients.

In patients treated with internal stenting, the creatinine level improved within 3 days (Fig. 1). The overall complication rate was 50% (Table 1). The major complication was febrile UTI in two (33%) patients. A minor complication was a difficult introduction in two (33%) patients. Immediate relief of anuria occurred in four children while in the other two children anuria was relieved after 24—48 h.

Group C (open surgery group)

Pyelolithotomy was done in 16 patients (69.5%) and ureterolithotomy in seven patients. Serum creatinine improved rapidly within 3 days (Fig. 1).

The overall complication rate was 13% (Table 1). Secondary hemorrhage occurred in one child (4%) and was managed conservatively by blood transfusion and parental antibiotics. Other complications were minor: persistent leakage in two (8%) patients (stopped spontaneously within 6 days), low-grade fever in two (8%) patients and wound infection in two (8%) patients.

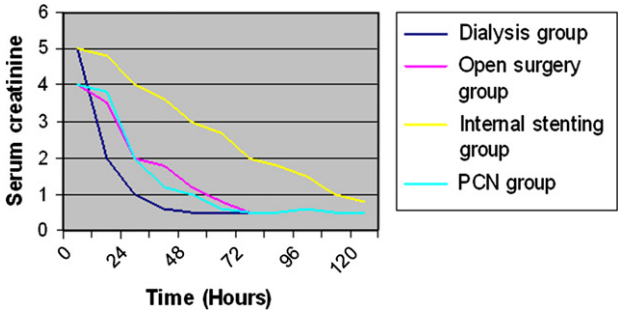

Figure 1 Graph showing drop in serum creatinine level over time for each treatment line.