Pediatric Posterior Urethral Disruption With Resultant Iatrogenic Dilutional Hyponatremia

S Sparks, J Zepp, S Zaslau, H Farivar-Mohseni, W Tarry

Citation

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Abstract

This report addresses a case of iatrogenic dilutional hyponatremia in a pediatric male trauma victim with a Grade III posterior urethral disruption. Suprapubic catheter placement was undertaken soon after the patient arrived at the Emergency Department. Primary realignment (urethral stenting with a catheter) was undertaken by way of a combined transurethral/percutaneous transvesical approach. Postoperatively, the patient developed a pseudo-transurethral resection (TUR) syndrome, which included dilutional hyponatremia (nadir serum Na 121 meq/L), hypotension (blood pressure was 100/60 mmHg), and heart rate 115 beats/minute although without evidence of cognitive change. The pathophysiology likely involved fluid absorption through open posterior urethral veins. With gentle administration of hypertonic saline, the patient's hyponatremia subsequently resolved.

INTRODUCTION

Posterior urethral injuries occur most commonly with major blunt trauma with associated pelvic fracture.[1] Lower genitourinary injury has been reported to occur in 6 of 212 (3%) patients with pelvic fractures.[2] The classic triad, present in approximately 50% of urethral injuries, consists of blood at the meatus, inability to urinate, and a palpably full bladder.[3]

The purpose of this Case Report is to present an unusual case of dilutional hyponatremia. This type of postoperative complication is seen more commonly in adult men who have undergone transurethral resection of the prostate, but this Case Report suggests an additional subset of patients who may develop a similar problem. This patient's prognosis was improved significantly with placement of the urethral stent. Special attention should be given to this complication, as hyponatremia can be corrected simply when recognized early, but could pose a serious dilemma if overlooked.

CASE PRESENTATION AND MANAGEMENT

A previously healthy, 12-year-old Caucasian male arrived at the Emergency Department (ED) as a victim of a pedestrian versus motor vehicle accident. He sustained multiple pelvic fractures, as well as a Grade III posterior urethral disruption.

Retrograde urethrogram confirmed the posterior urethral injury. Primary realignment (urethral stenting with a catheter) was undertaken with the under visual and fluoroscopic guidance.

The urethral cystoscope could not navigate to the bladder, so a cystogram was performed. Approximately 30 mL of methylene blue showed extravasation into the urethra, although a definitive passage could not be identified. A suprapubic cystoscope via a second suprapubic incision and was used to traverse the bladder neck in an attempt to find the urethral scope. This blind search was unsuccessful, so a Polack catheter was placed into the suprapubic cystoscope and guided through the bladder neck. A grasper was placed through the urethral cystoscope to retrieve the Polack catheter, and a subsequent sensor wire assured cystostomy drainage across the urethral disruption with a 16-Fr Council tip catheter. The suprapubic catheter was subsequently clamped two days postoperatively, and removed on post-procedure day 3. Throughout the duration of the cystotomy procedure, approximately 8 liters of glycine irrigant was instilled in total by way of the urethral and suprapubic cystoscopes. Postoperatively, the patient developed a pseudo-transurethral resection (TUR) syndrome, which included dilutional hyponatremia (nadir serum Na 121 from 136 preoperatively), hypotension (blood pressure: 90/60 from 126/86 preoperatively), and heart rate 115 beats/minute although without evidence of cognitive change. With gentle administration of normal saline and furosemide, the patient's hyponatremia subsequently resolved. The patient was discharged home with the urethral catheter, and had a normal retrograde urethrogram on POD #14. His catheter was

removed. He is currently voiding well with a good force of stream. His serum sodium at postoperative follow up was 136 meq/L.

DISCUSSION

Posterior urethral injury occurs in a small percentage of pelvic fractures. The injuries are classified into three types: Type I: urethral stretch injury; Type II: urethral disruption proximal to the genitourinary tract; and Type III: urethral disruption both proximal and distal to the genitourinary diaphragm.[3] Partial and complete injury may be difficult to differentiate, but partial allows some passage of contrast through the prostatic urethra and into the bladder, whereas the complete injury shows extravasation at the injury site only.[3]

Known sequelae of the disruption include impotence, incontinence, stricture, and ejaculatory difficulties.[3] Impotence occurs in 13% to 30% of patients with pelvic fracture and urethral distraction injury when early catheter placement is the only treatment undertaken. This percentage increases to 48% to 72% in patients who require open repair.[3]

The overall rate of incontinence is approximately 2% to 4%.[3] Placement of a catheter across a urethral injury allows healing with mild stricture in a significant percentage (50%-65%).[3]

Tarman et al. reported their retrospective review of 8021 trauma patients during a 7-year period which showed 212 patients with pelvic fractures. Of these patients, only two (1%) had significant lower urinary tract injuries. One patient had a posterior urethral disruption and the other had an extraperitoneal bladder disruption. The patient with urethral disruption was managed with primary urethral realignment.[3]

Postoperative hyponatremia is believed to occur in approximately 4% of surgical patients. This is usually attributed to two factors: (1) infusion of excessive amounts of electrolyte-free water (5% dextrose in water or hypotonic saline), and (2) actions of antidiuretic hormone to prevent excretion of this electrolyte-free water.[4,5] The degree of central nervous system damage depends first on the absolute serum sodium concentration (NaS) and second on the rapidity with which NaS is lowered. The authors believe that in this case, the cause of hyponatremia was due to increased fluid absorption through open venous channels in the posterior urethra.

The most frequent cause of hyponatremia in pediatric patients is dilutional hyponatremia (syndrome of inappropriate secretion of antidiuretic hormone [SIADH], infusion-therapy). Patients reportedly become symptomatic, with sodium levels significantly less than 130 mEq/L; however, the effect is much worse when the level falls rapidly—especially in the elderly and children. Signs and symptoms include lethargy, nausea, vomiting, seizures, coma, and death.

The primary management goal of hyponatremia involves gradual correction by way of intravenous hypertonic saline at the rate of 1 mEq/L/hour increased to a target level of 125 mEq/L. An alternative strategy involves use of loop diuretics to decrease urinary concentrating ability.

The question arises in this case as to whether the complication of fluid overload in children who undergo TUR realignment of the urethra can be prevented. Tauzin-Fin reported that the uptake of 1000 mL of fluid corresponds to an acute decrease of 5 mmol/L-8 mmol/L of serum sodium concentration. They further reported that this is the volume above which absorption-related symptoms increase.[6] The authors of this Case Report believe physicians should monitor the amount of fluid instilled into the bladder carefully during these procedures, as it would be pertinent, particularly in children, to identify the volume fluid instilled during the procedure.

The second question regarding prevention of the TUR syndrome relates to use of a tracer to identify irrigation fluid absorption. Collins et al. studied 126 men who underwent TURP and were irrigated with 1% ethanol and 1.5% glycine. Their expired air was tested for ethanol every 20 minutes and again at the end of the procedure. Seventy-five percent of men absorbed the irrigation fluid and 4% developed clinical features of TUR syndrome. A weak correlation existed between breath-ethanol levels and serum glycine levels, which suggests ethanol can be used as a tracer to detect early absorption of irrigation fluids during TUR procedures.[7] Whereas this may not be the best tracer to use in children, it does suggest the case for the study of alternative, potentially safer irrigants.

CORRESPONDENCE TO

Stanley Zaslau, MD, FACS Division of Urology, Department of Surgery West Virginia University PO Box 9238 Morgantown, WV 26506 Phone: (304) 293-2706 Fax: (304) 293-2807 E-mail: szaslau@hsc.wvu.edu

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Author Information

Scott Sparks, MD
Senior Resident, Division of Urology, Department of Surgery, West Virginia University

John Zepp, DO
Intern, Lake Erie College of Osteopathic Medicine

Stanley Zaslau, MD
Associate Professor, Division of Urology, Department of Surgery, West Virginia University

Hesam Farivar-Mohseni, MD
Associate Professor, Division of Urology, Department of Surgery, West Virginia University

William F. Tarry, MD
Associate Professor, Division of Urology, Department of Surgery, West Virginia University