Novel Strategy for Temporary Decompression of the Lower Urinary Tract in Neonates Using a Ureteral Stent

Frank J. Penna,* Paul Bowlin, Fahad Alyami, Darius J. Bägli, Martin A. Koyle and Armando J. Lorenzo

Division of Pediatric Urology, Hospital for Sick Children and University of Toronto, Toronto, Ontario, Canada

Abbreviations and Acronyms

PUV = posterior urethral valves

VCUG = voiding cystourethrogram

Accepted for publication April 15, 2015.

Study received institutional review board approval.

* Correspondence: Division of Pediatric Urology, Hospital for Sick Children, 555 University Ave., Toronto, Ontario, Canada M5G 1X8 (telephone: 416-813-6465; FAX: 416-813-6461; e-mail: frank.penna@sickkids.ca).

Purpose: In children with congenital obstructive uropathy, including posterior urethral valves, lower urinary tract decompression is recommended pending definitive surgical intervention. Current options, which are limited to a feeding tube or Foley catheter, pose unappreciated constraints in luminal diameter and are associated with potential problems. We assess the impact of luminal diameter on the current draining options and present a novel alternative method, repurposing a widely available stent that optimizes drainage.

Materials and Methods: We retrospectively reviewed patients diagnosed with posterior urethral valves between January 2013 and December 2014. In all patients a 6Fr 12 cm Double-J® ureteral stent was advanced over a guidewire in a retrograde fashion into the bladder. Luminal flow and cross-sectional areas were also assessed for each of 3 tubes for urinary drainage, ie 6Fr Double-J stent, 5Fr feeding tube and 6Fr Foley catheter.

Results: A total of 30 patients underwent uneventful bedside Double-J stent placement. Mean ± SD age at valve ablation was 28.5 ± 16.6 days. Mean ± SD peak serum creatinine was 2.23 ± 0.97 mg/dl after birth and 0.56 ± 0.22 mg/dl at the procedure. Urine output after stent placement was excellent in all patients. The Foley catheter and feeding tube drained approximately 18 and 6 times more slowly, respectively, and exhibited half the calculated cross-sectional luminal area compared to the Double-J stent.

Conclusions: Use of Double-J stents in neonates with posterior urethral valves is a safe and effective alternative method for lower urinary tract decompression that optimizes the flow/lumen relationship compared to conventional drainage options.

Key Words: infant, newborn; stents; ureter; urinary bladder neck obstruction

VARIOUS conditions in pediatrics require appropriate lower urinary tract decompression. The indications range from routine postoperative catheter drainage to congenital obstructive uropathological conditions such as posterior urethral valves. In the early neonatal period placement of a Foley (balloon) catheter or feeding tube is routinely performed to promote uninterrupted urine flow and bladder decompression, and to facilitate stabilization of renal function and electrolyte abnormalities, depending on the severity of intrinsic renal damage.[1]

Lower urinary tract decompression with a feeding tube is the standard of care in children with obstructive uropathy and is recommended as a temporizing measure until definitive treatment can be performed (ie valve ablation, ureterocele puncture, vesicostomy, ureterostomy). While insertion of a feeding tube or Foley

0022-5347/15/1944-1086/0
THE JOURNAL OF UROLOGY®

http://dx.doi.org/10.1016/j.juro.2015.04.102
Vol. 194, 1086-1090, October 2015
Printed in U.S.A.

catheter is the current standard of care in neonates and small children, there are limitations to their use. The Foley catheter relies on an inflatable balloon to remain in the bladder and prevent distal migration. Use of a Foley catheter in patients with PUV has been discouraged, as it is thought to cause ureteral obstruction and anuria due to compression of the trigone by the balloon.[2,3] The Foley catheter also carries a risk of traumatic injury during placement or removal by inadvertent deployment of the balloon in the urethra or dislodgment by forceful traction. It is also limited by the smallest size available (6Fr, or 8Fr if open ended). The 8Fr catheter is softer and curls easily, whereas the 6Fr catheter typically has an indwelling wire for stability.

As an alternative, feeding tubes have been used. While conveniently smaller than pediatric Foley catheters (3.5Fr and 5Fr) and widely available, these tubes were not originally designed or intended for urinary drainage. They are relatively stiff and can traumatize the urethra, facilitating the creation of false passages. They can also be difficult to secure in a proper position and are prone to tent the bladder wall, coil or become dislodged. Dislodgement may necessitate reinsertion by a specialist, particularly in the setting of urethral trauma. Besides migration, entanglement and creation of a knot, although rare, may preclude removal and require cystoscopic retrieval.[4]

Occasionally urethral trauma with false passage creation is encountered and significant enough to compromise easy access to the bladder. Although in many instances it is possible to catheterize by a gentle second blind attempt, direct visualization with cystoscopic guidance is sometimes required, where a urethral catheter may need to be placed over a wire to facilitate entry into the bladder. This circumstance requires a larger diameter open-ended Foley catheter (8Fr or larger), which may be too large for neonates.

We have encountered some of these specific limitations of the Foley catheter and feeding tube at our institution (fig. 1). Discouraged with available options, we sought to explore alternative methods for lower urinary tract drainage in infants and small children with suspected lower urinary tract obstruction. During evaluation of a small newborn with obstructive uropathy in the neonatal intensive care unit in 2012 multiple previous catheter placement attempts made it difficult to negotiate a Foley catheter or feeding tube into the bladder. Due to the unstable condition of the patient, which precluded safe transfer for cystoscopy or vesicostomy, we advanced an angled Glidewire® at the bedside, checked its intravesical position with ultrasound and—after failing to slide an open-ended Foley catheter—easily advanced a hydrophilic Double-J stent, effectively

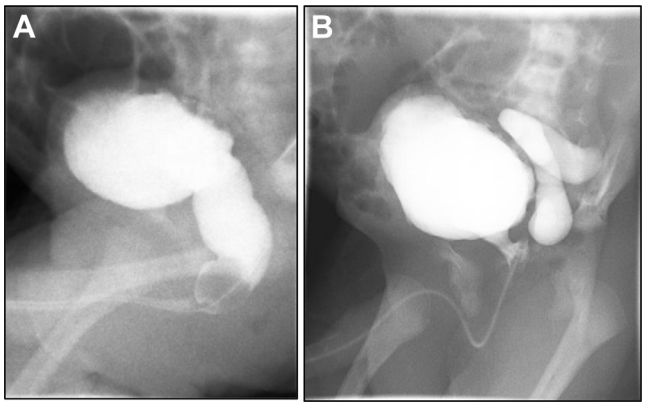

Figure 1. VCUG in patients with posterior urethral valves. *A,* migration of Foley balloon catheter into dilated posterior urethra. *B,* attempted insertion of feeding tube with difficulty negotiating bladder neck facilitates creation of false passage.

decompressing the lower tract. Based on this encouraging experience, we have favored this strategy in cases of suspected PUV and other conditions that require catheterization early in life.

The purpose of this study was to demonstrate that the Double-J stent provides a viable and conceptually attractive alternative to the current methods. In addition, we evaluated fluid dynamics between different catheters and propose modifications that could be implemented to create a catheter system addressing some of the encountered limitations.

MATERIALS AND METHODS

Following institutional review board approval we retrospectively reviewed our database of consecutive patients diagnosed with PUV (suspected in utero, with postnatal imaging confirming the presence of valves) between January 2013 and December 2014. These patients were treated with Double-J stenting across the urethra as the method of lower urinary tract decompression until definitive surgical treatment during inpatient admission. The distal end of the stent was maintained in a diaper, and urine output was estimated by diaper weight. All of the patients were maintained on antibiotic prophylaxis beginning at birth. Various parameters were reviewed, including age and serum creatinine at valve ablation, peak serum creatinine after birth and urine output, as well as complications.

Bedside Catheter Placement Technique

A 6Fr 12 cm Double-J stent was advanced over a guidewire and inserted with sterile lubricant in a retrograde fashion through the urethra into the bladder. Once a sufficient length of stent had been inserted, the guidewire was removed, thereby allowing the distal end of the stent to form an external curl outside the meatus. The internal proximal end of the stent spontaneously curled within the bladder, thereby providing a secure method for drainage compared to a feeding tube. In selected cases adequate positioning and deployment in the bladder lumen can be