

# Advances in Pediatric Urinary Diversion



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## KEYWORDS

• Pediatric • Diversion • Techniques • Urinary • Bladder

## KEY POINTS

- Urinary diversion in pediatric patients is used for unique indications and utilizes distinct techniques.
- Pediatric patients who require or may require urinary diversion should be followed closely by a pediatric urologist with a wide breadth of knowledge of the various techniques for urinary diversion.
- Optimal management of pediatric patients requiring diversion should be tailored to individual patients.

## INTRODUCTION

Urinary diversion in pediatric patients is used for a distinct set of indications to address the unique surgical and technical challenges of this patient population. The management of spina bifida has evolved over the past century with the advent of clean intermittent catheterization and the judicious use of anticholinergic medicines; however, urinary diversion remains an important treatment modality for a certain subset of patients. The indications for and the various types of diversions as well as the relevant and emerging techniques are reviewed.

The primary indication for surgical invention and urinary diversion in pediatric patients is the preservation of renal function and prevention of upper tract deterioration secondary to a hostile lower urinary tract. In addition, reconstruction of the urinary tract to allow for urinary continence is particularly important with a significant effect on quality of life in these patients. A majority of patients requiring such techniques have a neurogenic bladder as a result of myelodysplasia.<sup>1</sup> Although there is an increased emphasis on optimizing bladder function via medical management and pharmacotherapy, several patients still require a form of urinary diversion, whether temporary or

permanent. In 1981, McGuire and colleagues<sup>2</sup> reported his findings linking detrusor leak point pressures greater than 40 cm H<sub>2</sub>O with increased risk of upper tract damage. Passive filling pressures greater than 40 cm H<sub>2</sub>O become clinically pathologic, leading to impaired ureteral drainage.<sup>3</sup> Elevated bladder pressure can produce hydronephrosis, which can result in an associated decrease in glomerular filtration rate (GFR). Moreover, elevated bladder pressures can cause secondary vesicoureteral reflux (VUR).<sup>1</sup>

Other indications for urinary diversion include temporizing newborns with severe VUR and febrile urinary tract infections (UTIs) as well as outlet obstruction secondary to conditions, including posterior urethral valves and bilateral ectopic ureters. Bladder exstrophy and other cloacal malformations require more complex urinary reconstruction.

## TYPES OF URINARY DIVERSION

Urinary diversion can be subdivided into 2 categories: continent and incontinent (**Table 1**). Continent urinary diversion seeks to maintain the continence mechanism using a continent catheterizable channel. Although intermittent catheterization and anticholinergic medications can obviate

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**Table 1**  
**Pediatric urinary diversion**

Continent	Incontinent
Mitrofanoff APV	Cutaneous
Monti procedure	vesicostomy
Continent catheterizable vesicostomy	Cutaneous ureterostomy
Button vesicostomy	Ileovesicostomy
Indiana pouch	Ileal conduit
Augmentation cystoplasty	
Ureterosigmoidostomy	

surgical repair in some cases, long-term urethral catheterization may be difficult for many patients. Orthopedic contractures, diminished manual dexterity, and other comorbidities can impede ease of routine catheterization and incontinent diversion may be the best alternative in these patients. Continent catheterizable channels allow an alternative route to drain the bladder with or without bladder augmentation or reconstruction of the bladder neck. Bladder augmentation and bladder neck reconstruction are important methods used in patients to improve not only continence but concerning urodynamic parameters that can subsequently affect the upper urinary tract.<sup>1</sup> Social circumstances precluding strict compliance to a catheterization regimen is a critical factor in selecting the best treatment option and urologists must take this into consideration.

## INCONTINENT URINARY DIVERSION

### *Cutaneous Vesicostomy*

#### **Background and indications**

Lapides and colleagues<sup>4</sup> first proposed the use of a cutaneous vesicostomy in the 1960s. Many infants with myelodysplasia and resultant neurogenic bladder were treated with a cutaneous vesicostomy as a temporizing measure to protect the upper urinary tracts from a hostile bladder. With the introduction of clean intermittent catheterization, the use of vesicostomies as a form of diversion has decreased significantly, yet there remains a subset of patients with specific indications requiring a urinary diversion.<sup>5</sup> Various indications include recurrent febrile UTIs, progressively worsening hydronephrosis with decreasing renal function, and outlet obstruction, such as posterior urethral valves when cystoscopy is not possible.<sup>6</sup>

#### **Technique**

The Blocksom technique of vesicostomy creation begins with a 2-cm midline transverse incision made approximately midway between the pubic

symphysis and the umbilicus.<sup>7</sup> The rectus muscles are separated and the bladder is exposed and secured with traction sutures. The peritoneum is mobilized cephalad to free the dome and posterior wall of the bladder and the urachus is ligated. The bladder is opened in the longitudinal axis and secured circumferentially to the skin. The posterior wall should be kept taut to prevent prolapse of the bladder through the incision.<sup>4</sup> Fig. 1 shows a vesicostomy performed at the time of bladder closure in an infant with cloacal exstrophy.

#### **Complications**

Complications related to cutaneous vesicostomy include stenosis, contact dermatitis, and mucosal prolapse (Fig. 2). Prudente and colleagues<sup>6</sup> evaluated 21 patients with a vesicostomy to determine long-term complications. Indications for the vesicostomy included posterior urethral valves and myelomeningocele. Renal function remained stable or improved in 95.2% and there was a decrease in the number of UTIs by 38.1% and VUR in 71.4%. As for complications, they reported stomal stenosis (38%), dermatitis (24%), and mucosal prolapse (29%). Fig. 2 demonstrates mucosal prolapse.

### **Cutaneous Ureterostomy**

#### **Background and indications**

Definitive surgical treatment of VUR and megaurter is indicated in the setting of recurrent febrile UTIs or upper tract deterioration. Failure of expectant management is particularly challenging in infants less than 1 year because surgical repair can be difficult. Ureteral reimplantation prior to 1 year of age has an increased rate of reoperation and revision.<sup>8</sup> For those patients less than 1 year of age, an end cutaneous ureterostomy can be used as a temporizing measure to allow the patient time to grow prior to definitive reimplantation.

#### **Technique**

Extraperitoneal exposure of the ureter can be carried out through an ipsilateral modified Gibson incision. The ureter is exposed and transected



Fig. 1. Vesicostomy.

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