

Urinary Diversion in Renal Transplantation



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KEYWORDS

• Renal transplantation • Urinary diversion • Bladder augmentation

KEY POINTS

- Renal transplantation in patients with urinary diversion is feasible with comparable long-term graft function despite higher overall rates of infectious complications.
- Careful preoperative assessment of patients should be done before proceeding with transplant.
- Knowledge of the unique surgical challenges of this specific cohort of patients is mandatory to achieve favorable outcomes.

INTRODUCTION

Patients with anatomically and/or functionally abnormal lower urinary tracts present a unique challenge for the renal transplant surgeon. In a subset of these patients, the native bladder may be suitable for transplantation. In others, intestinal reconstruction or diversion may have been already performed or be required at the time of presentation. For the latter group, questions of timing of surgery and type of diversion must be addressed (**Box 1**).

Kelly and colleagues¹ were the first to report the feasibility of transplantation in patients with an ileal diversion in 1966, providing hope for a desperate group of patients. At that time, an intact natural or reconstructed lower urinary tract was considered mandatory to be eligible for transplantation because of fear of recurrent infection and urosepsis in immunocompromised patients. Reports followed over the years describing renal transplantation after other types of urinary diversion. Tunner and colleagues² reported the first transplantation in patients with a colon conduit in 1971, and more recently, renal transplantation has been described in patients with more complex continent diversions.^{1,3,4}

Approximately 6% of patients receiving a kidney transplant in the United States have end-stage renal

disease (ESRD) attributable to lower urinary tract abnormalities.⁵ Among pediatric patients, 24.1% of ESRD cases are attributed to congenital abnormalities of the kidney and urinary tract (CAKUT) as of 2016.⁶ The most common causes of CAKUT are posterior urethral valves, vesicoureteral reflux, and neurogenic bladder, including spina bifida. Bladder exstrophy complex, prune-belly syndrome, and other rare syndromes comprise the rest. In transplant patients with hostile bladders, possible nonnative urinary systems include bladder augmentation with gastric, intestinal, or ureteric segments, continent cutaneous diversions, and ileal and colonic conduits. Orthotopic continent reservoirs are more likely to be performed well after transplantation in older patients with development of bladder cancer after transplant.⁷ Rates of renal transplantation into patients with supravescical diversion range from 0.4% to 2.3%.^{8,9} Rates of transplantation into a prior bladder augmentation is similarly rare with overall rates of ~1%.¹⁰

The original fear of uroseptic complications in those with intestinal diversion and reconstruction has not been entirely alleviated. In 1997, Alfrey and colleagues¹¹ cautioned against bladder augmentation before renal transplantation citing

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Box 1**Options for urinary anastomosis in kidney transplantation with abnormal lower urinary tract**

- Intestinal conduits
 - Uretero intestinal
 - Uretero ureteral
- Augmentation
 - Uretero intestinal
 - Uretero vesical
 - Uretero ureteral
- Cutaneous ureterostomies
 - Uretero ureteral
- Donor cutaneous ureterostomy

increased risk of recurrent urinary tract infection (UTI), sepsis, graft loss, and death. Most recent reports, however, are at odds with this view, and there is a strong body of evidence to support transplantation in these individuals and those with diversions.^{1-5,8-10,12} Although there does seem to be a high incidence of infection in these patients after transplant, with complication rates of UTI and pyelonephritis of 24% and 13%, respectively, this has not been proven to translate into poorer patient or graft survival.^{5,13-15}

WORKUP FOR PATIENTS WITH URINARY DIVERSION

It is critical to determine which patients will need staged or simultaneous surgical urinary reconstruction to achieve a mechanism for unobstructed low-pressure elimination. It is critical to determine which patients will need staged or simultaneous surgical urinary reconstruction to achieve a mechanism for unobstructed low-pressure elimination. This distinction is particularly important in patients who developed ESRD secondary to a lower urinary tract abnormality, which is more common in the pediatric population.¹⁶

A thorough history is paramount to establish a clear timeline of lower urinary tract dysfunction in relation to development of ESRD. Low urine outputs in ESRD patients can lead to a defunctionalized bladder due to the absence of bladder cycling.

Errando and colleagues¹⁷ thought that bladders that cycle less than 300 mL daily are defunctionalized. The ability of these bladders to recover was first shown by Tanagho¹⁸ and MacGregor and colleagues,¹⁹ who went on to demonstrate gradual improvement in these bladders. They were even

able to reverse the diversion in some patients with overall good long-term outcomes. They emphasized the importance of distinguishing defunctionalized bladder (usable bladders) and those with pathologic contracture owing to extensive mural fibrosis or multiple bladder surgeries (nonusable bladders). This important distinction has been corroborated by other researchers.^{19,20} Serrano and colleagues²¹ reported using the native bladders of 5 male patients who had prior ileal conduit diversion for small bladder capacities and uninhibited detrusor contractions. After bladder rehabilitation and renal transplantation, the mean bladder capacity was increased 10 times with resolution of the uninhibited detrusor contractions.

Imaging

Some investigators recommended voiding cystourethrogram (VCUG) as a part of the standard workup^{22,23} for adult transplant candidates; however, the necessity of routine VCUG is debatable. Glazier and colleagues²⁴ questioned the cost-effectiveness of routine VCUG in transplant candidates when they retrospectively reviewed 517 VCUGs in pretransplant patients. Only 13 (2.5%) patients were found to have abnormal imaging, and of those, only 3 (0.6%) required pretransplant surgical intervention. A positive urologic history was common in all the 13 patients. Performing VCUG and urodynamic study (UDS) only in patients with LUTS, defunctionalized bladder, and extensive urologic history demonstrated abnormal findings in 45% of the patients, significantly improving the yield of those studies.¹⁷

Routine VCUG has been described in the pediatric pretransplant population²⁵ owing to their previously mentioned higher rate of lower urinary tract abnormalities. These patients usually have had a VCUG study during workup for their original disease. Careful review of those images is required. Requesting repeat studies on patients with images more than 1 year old is reasonable because the underlying abnormality is usually dynamic.²⁶

The authors suggest that a reasonable strategy would be to obtain a VCUG in only those adult patients with a compelling urologic history while maintaining a lower threshold for pediatric patients, especially when their cause of ESRD is poorly characterized.

Imaging with a loopogram may also be warranted in patients with a preexisting ileal conduit, especially in those with low or no urine output. A loopogram is prudent in this scenario in order to exclude conduit abnormality, such as stomal stenosis or contracture. In their limited series of 6

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