

Urologic Considerations and Complications in Kidney Transplant Recipients



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Urologic considerations during the kidney transplantation process, starting with initial recipient evaluation and continuing through the post-transplant, long-term follow-up, are critical for minimizing urologic complications and improving graft survival. Appropriate, targeted, preoperative urologic evaluation of the recipient allows for an optimized urinary tract to accept the graft, whereas post-transplant urologic follow-up and monitoring decrease the risk of graft lost secondary to a urologic cause, particularly in patients with a urologic reason for their kidney failure and in those patients with concomitant urologic diagnoses. Urologic complications comprise the second most common adverse post-transplant event, occurring in 2.5% to 14% of patients and are associated with high morbidity, graft loss, and mortality. Early and late urologic complications, including hematuria, hematoma, lymphocele, urine leak, ureteral stricture, nephrolithiasis, and vesicoureteral reflux, and their causes and treatment options are explored. A multidisciplinary team approach to kidney transplantation, including transplant surgery, urology, and nephrology, optimizes outcomes and graft survival. Although the current role of the urologist in kidney transplantation varies greatly by institution, appropriate consultation, participation, and monitoring in select patients is essential.

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INTRODUCTION

Knowledge of the anatomy, physiology, and anomalies of the urinary tract are of paramount importance in kidney transplantation. Understanding the etiology of the recipient's kidney failure, particularly when there was a urologic cause, is extremely important for graft survival.

Urologic complications comprise the second most common adverse post-transplant anatomic event, behind postoperative vascular etiologies, and are associated with high morbidity, graft loss, and mortality.¹⁻⁵ The overall reported rate of urologic complication post-transplant is 2.5% to 14%, depending on the series.^{1,6} Urologists have been involved in kidney transplantation from the genesis of this complex operation, yet their current role varies tremendously by institution.^{4,7}

The authors seek to explore important urologic considerations in kidney transplantation and associated complications, highlighting ways to optimize urologic and graft survival outcomes.

PRE-TRANSPLANT RECIPIENT UROLOGIC EVALUATION

The initial evaluation of the transplant recipient does not always include a full urologic assessment but is aimed at ruling out potential sources of infection and malignancy, screening for noncompliance, and decreasing the risks of operative morbidity, mortality, and graft failure. According to Cairns and colleagues,⁸ "urological requirements for successful renal transplantation are: the absence of uri-

nary tract infections (UTIs) and calculi, a functional lower urinary tract, and the exclusion of urinary tract malignancy. The goal of the urologist is to rid the urinary tract of infection and calculi and to optimize the condition of the lower urinary tract, which should be sterile, continent, and compliant, before implantation of the donor kidney." This holds true for the most part today, although patients with a history of ileal conduit, continent urinary diversion, or those on chronic clean intermittent catheterization can be transplanted successfully.^{9,10}

Appropriate preoperative urologic workup of the transplant recipient, particularly in the patient with a urologic cause for kidney failure, in the child with congenital anomalies of the kidney and urinary tract, and in the patient with concomitant urologic diagnoses, is critical for graft longevity.¹¹ Tailored evaluation of the recipient's bladder may include uroflowmetry to measure urine flow rate, measurement of postvoid residual volumes to assess ability to empty the bladder, and urodynamics that allows evaluation of bladder capacity, intravesical pressures, bladder compliance, bladder sensation, and ability to empty. Additional evaluation may include computed tomography (CT) of the abdomen and pelvis, which may detect nephrolithiasis and kidney masses and voiding cystourethrography to evaluate for vesicoureteral reflux (VUR).

Evaluation of bladder emptying should be performed in patients with a history of bladder outlet obstruction, which may result from congenital causes, such as posterior urethral valves, an enlarged prostate, urethral stricture disease, and/or neurogenic bladder. Incomplete emptying from obstruction related to benign prostatic hyperplasia (BPH) or urethral stricture needs to be addressed before transplantation. BPH may be successfully treated with alpha-blockers and 5-alpha reductase inhibitors or it may require surgical treatment with transurethral resection of the prostate, laser vaporization of the prostate, or simple prostatectomy.¹² Of note, treatment of BPH is guided by the presence and severity of lower urinary tract symptoms, which may worsen as urine volume is restored after kidney transplant in the oliguric/anuric ESRD patient.¹²

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Urodynamic evaluation should be considered in patients with voiding dysfunction, neurogenic bladder, or a suspected noncompliant bladder, as can be seen in patients with a history of bladder outlet obstruction (eg, posterior urethral valves). This test determines intravesical pressures, functional bladder capacity, and sensation of the bladder. Intravesical pressures of greater than 40 cm of water are typically used to define “high-pressure” or poorly compliant bladders on urodynamic evaluation.¹³ Noncompliant, high-pressure bladders are typically treated with anticholinergic medications to relax the detrusor but may require bladder augmentation to decrease intravesical pressures and increase capacity. The indications and surgical approaches for bladder augmentation are covered elsewhere in this edition, but of particular concern in kidney transplant recipients is the risk for injury to the transplanted graft by backpressure transmitted from a noncompliant, high-pressure bladder. In patients with a history of a complex urological reconstruction, such as bladder augmentation or neobladder, a reconstructive urologist familiar with the anatomy should be consulted before the transplant operation and should be available during the operation.¹⁴

Urodynamic evaluation may also reveal nonobstructive causes of incomplete emptying, such as detrusor hypoactivity. In these patients, clean intermittent catheterization may be required to provide adequate drainage of the bladder.

Patients with a history of VUR who have recurrent lower UTIs or who have had pyelonephritis may need pre-transplant native nephroureterectomies to lower the risk of post-transplant UTI before immunosuppression.¹⁵ Other indications for native nephrectomy include solid kidney tumors, upper tract urothelial tumors, hypertension refractory to medical therapy, severe, intractable nephrotic syndrome, cystic kidney disease causing loss of abdominal domain, pain or anorexia, and high volume stone disease not amenable to endoscopic treatment.

The Israel Penn Transplant Tumor Registry is the world’s premier repository of information on patients who have developed malignancies after organ transplant and has standardized the incidence of post-transplant malignancy to 1.18 compared with the general population.¹⁶ Risk factors include a history of previous malignancy, older age, tobacco use, malignancy in the donor, and immunosuppressive medications. Thus, the urologic evaluation of kidney transplant patients should include screening for urologic malignancies including prostate cancer and renal cell carcinoma. Pre-transplant screening for prostate cancer should follow the American Urologic Association’s screening recommendations for all men.¹⁷ Specifically,

men older than 40 years with a life expectancy of at least 10 to 15 years should be screened for prostate cancer with a prostate-specific antigen and digital rectal examination.¹⁷

There is an increasing incidence of renal cell carcinoma (RCC) in the ESRD population with acquired cystic disease of the kidney (100-fold).¹⁸⁻²⁰ As discussed earlier, native nephrectomy is typically indicated if a solid or complex cystic kidney mass is present. However, emerging minimally invasive techniques, including radiofrequency ablation and cryoablation, are gaining acceptance in the management of kidney masses in this patient population.²¹ The use of minimally invasive treatments of RCC may be particularly applicable in ESRD patients, where RCC is associated with more favorable clinical and histologic features and oncologic outcomes than in patients with normal kidney function.²²

UROLOGIC CONSIDERATIONS IN DONOR/KIDNEY SELECTION

Living and deceased donors are both viable options for the patient in need of kidney transplantation. In living dona-

tion, the donor has nothing to gain from nephrectomy besides altruistic fulfillment. Thus, the transplant team must ensure the lowest complication rate and the highest chance of normal kidney function after donor nephrectomy. Knowledge of the renal vascular anatomy, ureteral anatomy (eg, presence of duplication anomalies), and presence of nephrolithiasis in the kidney to be transplanted are important, allowing optimal surgical planning.²³ Kidney and ureteral duplication anomalies

require careful ureteral dissection, both intracorporeally and on the backbench, as preservation of the vascular supply to both ureters during implantation into the recipient’s bladder is essential to decrease the risk of ureteral ischemia which can lead to stricture disease. The presence of stones in the graft requires backbench pyeloscopy or pyelotomy with stone retrieval before transplantation.

A thorough urologic evaluation of the potential living donor typically begins with a kidney ultrasound to screen for obvious anomalies that would not allow for kidney donation, such as unilateral renal agenesis. CT angiography of the abdomen and pelvis, both with and without contrast, allows for assessment of the vascular anatomy, anatomy of the collecting system, and screening for nephrolithiasis. There is an emerging role of magnetic resonance imaging angiography in pre-donation imaging, although recent studies have not demonstrated clear superiority of magnetic resonance imaging over CT angiography.²⁴⁻²⁶

CLINICAL SUMMARY

- Urologic complications comprise the second most common adverse event after kidney transplantation.
- Pre-transplant targeted urologic evaluation allows for optimization of the urinary tract accepting the graft.
- The role of the urologist in kidney transplantation varies greatly by institution, yet it is ideal for the urologist knowledgeable of complex congenital genitourinary reconstructive anatomy to be involved in the operative management.
- Appropriate post-transplant urologic consultation and follow-up is important to optimize post-transplant outcomes.

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