Guest Editorial

Renal transplantation in 2016

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Kidney transplantation is the best treatment for end-stage renal disease (ESRD) in patients selected to exclude active infection, active malignancy, high risk of perioperative mortality, unsuitable anatomy for technical success, and noncompliance for social, financial, or mental health reasons. Living renal donors must be protected from morbidity, mortality, and exploitation. In the US, a transplant system has evolved around a systematic team approach to a health care problem that has included the process of continued quality improvement. It has provided results that were only imagined 40 years ago. This issue of the journal contains review articles on the current status of renal transplantation and advances in recent years.

LIVING RENAL DONOR SELECTION

The generally accepted contraindications for living renal donation include reduced renal function, coercion, children below legal adulthood, hypertension, renal disease, malignant or infectious disease transmissible to a recipient, diabetes mellitus, significant cardiopulmonary disease, and significant urolithiasis.[1] The risk of 90-day mortality is 3.1/10,000 for living donor nephrectomy, and this is significantly less than for laparoscopic nondonor nephrectomy (260/10,000), and laparoscopic cholecystectomy (18/10,000).[2] The risks of developing -ESRD in living renal donors, healthy nonrenal donors, and unscreened nondonors have been calculated to be 90, 14, and 326/10,000 cases, respectively.[3] The ESRD risk is small for well-screened donors, and it can be calculated for individuals by using an online risk tool (http://www.transplantmodels.com/esrdrisk).[4]

Donor imaging is used to assess the renal size, relative function, anatomic abnormalities, associated pathologies and vascular variations. When available, a computerized axial tomography scan with and without intravenous contrast with three-dimensional reconstruction is the best modality. An important principle is to leave the better kidney with the donor. Hydronephrosis and pyelonephritis are reported to be significantly more common in right than left kidneys of pregnant women.[5] For that reason, when the kidneys are otherwise equal, right donor nephrectomy is probably best for a female donor with child-bearing potential.

RECIPIENT PREPARATION

This process has been an example of interdisciplinary medicine for decades.[6] The goals for the evaluation of a renal transplant candidate are (1) to determine if any of the following contraindications exist: Unsuitable anatomy for technical success, high risk for perioperative mortality, active infection, active malignancy, or noncompliance; (2) to determine the risk of recurrent renal disease that could cause loss of a transplanted kidney (for example, rapidly progressive focal segmental glomerulosclerosis, oxalosis, atypical hemolytic uremic syndrome, or membranoproliferative glomerulonephritis); and (3) to identify immunologic risk factors (for example, donor-recipient ABO blood group incompatibility, positive donor-recipient lymphocytotoxic crossmatch, high panel reactive antibody level, complete human leukocyte antibody mismatch between donor and recipient, African race, youth, early immunologic loss of another transplant, and systemic lupus erythematosus) to aid in the selection of induction and maintenance immunosuppression. In addition to the transplant surgeon and transplant nephrologist, input from the following services is routinely sought: Dentistry (for oral infections and cancer), pharmacy (for drug identification, appropriate dosing, and drug interactions), optometry (for glaucoma and cataracts), nurse transplant coordination (for patient compliance), nutrition (for nonprescribed, over-the-counter medications and supplements) social service (for mental health, identification of support persons, and compliance), and financial counseling (to assure funds for the transplantation process, chronic immunosuppression, and follow-up). The two most common specialty consultants are infectious disease and cardiology. A Charlson comorbidity score that includes age is simple to calculate for a patient and can be used to help select an ESRD management option.[7] Two substances associated with transitional cell carcinoma are cyclophosphamide, a treatment for some glomerulopathies, and aristolochic acid, an herbal supplement that has also been identified as a cause of nephropathy in Asia and Central Europe.[8]

The purpose of the pretransplant urinary tract evaluation is to answer the questions set forth in Table 1. Urinary tract functional assessment by history is difficult in the anuric patient, and one has to rely on a patient's recollection of his or her preanuric voiding symptoms. Ultrasound assessment is routinely done for postvoid residual urine and upper tract abnormalities. Generally accepted indications for nephrectomy are hypertension uncontrolled with medications, recurrent pyelonephritis, persistent anti-glomerular basement membrane antibodies, staghorn calculi, proteinuria with hypoalbuminemia, solid renal mass, and polycystic kidneys complicated by any of the preceding or with any of the following: Kidneys too large to allow renal transplantation, early satiety, chronic renal pain, or recurrent hemorrhage. Table 2 provides guidelines used at our center for waiting times to transplantation for common urologic cancers.

TECHNIQUES AND COMPLICATIONS OF VASCULAR ANASTOMOSES

The standard technique for kidney transplantation into an adult, including instruments, instructions for the anesthetist, and postoperative management of tubes and drains have been previously described.[9] If a transplant candidate has had femoral lines placed in the past, Doppler flow studies of iliac vessels will prevent a surprise during the kidney transplant operation. To prevent renal artery stenosis, a few things are worthy of emphasis: (1) To prevent a kink in the renal artery, follow the "Best Fit" principle to select the recipient artery and vein for the vascular anastomoses, (2) do the arterial anastomosis first because it's the smaller of the two and the kidney transplant is not fixed in position as it is when the venous anastomosis has already been done, (3) if there are two separate renal arteries, do a pair-of-pants renal artery reconstruction whenever possible because flow is proportional to the fourth power of the radius, (4) do not put a knot inside the lumen of a vascular anastomosis, it's a nidus for clot, (5) do not injure the intima of a vessel by touching it with an instrument, (6) if the internal iliac artery is to be used, place the vascular clamps on the common and external iliac arteries, and not on the proximal internal iliac artery, so that if a delayed vascular clamp injury occurs, it can be easily managed with a "straight shot" transluminal angioplasty of the common or external iliac artery, (7) do a circular punch arteriotomy in the recipient artery if an end-to-side anastomosis will be done because a slit can close with hypotension, a circular hole cannot, (8) if a renal artery stenosis is highly probable, selective renal arteriography and transluminal angioplasty with or without a stent can be done with one visit for both diagnosis and treatment.

Table 1: Urinary tract evaluation

Does the bladder or its substitute fill?
Does the bladder or its substitute empty?
Is the patient dry?
Is cancer present?
Could the kidneys make the patient sick?
Are the kidneys too large?

Table 2: Waiting times for kidney transplant listing following genitourinary cancer treatment

Cancer	Stage/risk	Grade	Waiting time (years)
Kidney	T1aN0M0	Any	None
	T1bN0M0	Fuhrman 1-2	None
	T1b	Fuhrman 3-4	2
	≥T2	Any	2
Prostate	Low risk	Gleason ≤6	None
	Intermediate risk	Gleason 7	None
	High risk	Gleason ≥8	2
TCC*	≤T1, focal	Low, with negative re-resection and F/U† cytology	None
	≤T1	High (include CIS‡)	2
	≥T2	Any	2

*TCC=Transitional cell carcinoma, †F/U=Follow-up, ‡CIS=Carcinoma *in situ*

TECHNIQUES AND COMPLICATIONS OF URINARY TRACT RECONSTRUCTION

If possible, place the kidney transplant into the opposite iliac fossa of a recipient. This places the renal pelvis and proximal ureter medial and superficial to the renal vein and artery so that a subsequent repair of an obstructed or necrotic renal transplant ureter can be done with minimal risk of kidney transplant vascular injury. If an anuric patient had a normal bladder before urine production ceased, bladder cycling before transplantation is unnecessary because the bladder will gradually resume its normal volume within 6 weeks of transplantation. An abnormal pretransplant urinalysis can be ignored if the recipient is afebrile and has no symptoms of urinary tract infection. A three-way bladder irrigation and drainage system allow the bladder to be irrigated with an antibiotic solution at the time of transplantation, and for the anesthetist to fill and drain the bladder during the case to assist in the identification of a small, defunctionalized bladder or a bladder in a scarred pelvis. For children, the size of bladder catheter is determined by urethral calibration. Antireflux ureteroneocystostomy of surgeon's choice is the most common method for urinary tract reconstruction. Opinions vary about antibiotic prophylaxis and the management of tubes and drains after kidney transplantation. A guideline that has evolved over decades is presented in Table 3.

The management of urinary tract complications after kidney transplantation is dealt in another article in this issue of the journal. When faced with a problem in a kidney transplant recipient, it is helpful to answer the following questions: (1) What would I do if this patient did not have a kidney

Table 3: Management of tubes and drains after a kidney transplant

Foley catheter	Remove on POD* 3-5, start CIC† as needed
Ureteral stent	Remove in ~ 4 weeks
Drain (s)	Remove when <50 ml‡/24 h
Antibiotics	For 3 months (usually trimethoprim/sulfa)
Retention	Tamsulosin for men >50 years old
	Clean, intermittent catheterization if necessary

*POD=Postoperative day, †CIC=Clean, intermittent catheterization, ‡ml=Milliliters

transplant (2) will the treatment plan be influenced by the location of the kidney transplant (3) will the treatment plan be influenced by immunosuppression (4) will the treatment plan make the patient's lifetime better (or longer)?

TRANSPLANTATION INTO THE ABNORMAL BLADDER

A patient with an upper urinary tract diversion for vesicoureteral reflux usually has a defunctionalized bladder that will turn out to be satisfactory for urinary tract reconstruction.[10] If intermittent catheterization will be necessary after kidney transplantation, teach the technique to the patient and/or caretaker well in advance of the operation. An augmentation into a urinary system that makes urine is preferable to an augmentation into a dry system because mucus from a gastrointestinal system patch can be diluted by urine and rinsed out when the bladder is emptied. An augmented dry bladder will require periodic irrigations to clear mucus before transplantation.

STATUS OF ROBOTIC-ASSISTED RENAL TRANSPLANTATION

IDEAL, an acronym for Idea, Development, Exploration, Assessment, and long-term study,[11] has been applied to the assessment of robotic-assisted renal transplantation.[12] Investigators are approaching the fourth step. It is now possible to compare open and robotic-assisted kidney transplant techniques for the following variables: Learning curve, surgeon anxiety, recipient morbidity, kidney transplant quality, hospital expense, and marketing.

I would like to thank the authors of the articles included in this issue for their contributions and hope the readers of the journal benefit from them.

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