RECIPIENT OPERATION

The usual responsibilities of the anesthesia and the surgical teams are depicted in Table 40-7.

Table 40-7. Usual Responsibilities of Anesthesia and Surgical Teams during Renal Transplantation

Anesthesiology	*Surgery*
Anesthetic induction	Patient position
Central venous access	Bladder catheterization
Administration of antibiotics	Preliminary skin preparation
Administration of immunosuppressants	Surgical exposure of operative site
Administration of heparin	Renal revascularization
Assurance of conditions for diuresis	Urinary tract reconstruction
	Wound closure

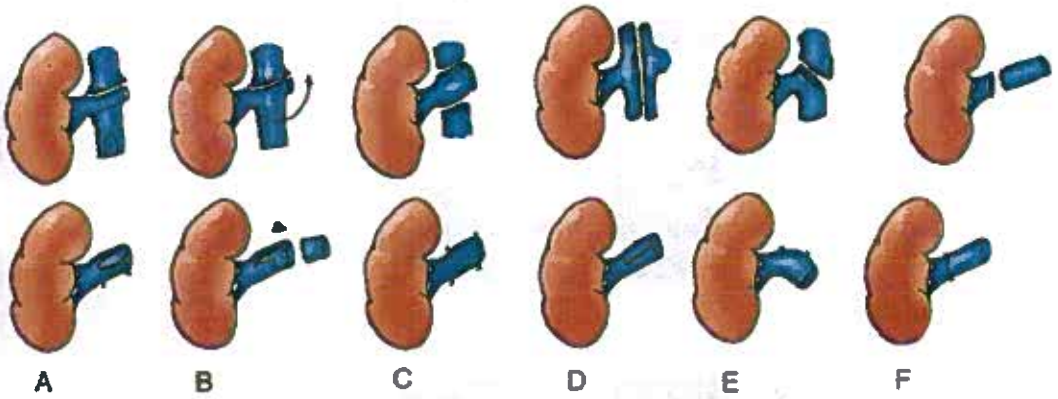

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Figure 40-5 A to G, Methods of extending the right renal vein include modifications of the interior vena cava and a free graft of donor external iliac vein. The first two methods are valuable when the cephalad portion of the right renal vein has been compromised by the separation of the liver graft from the kidney grafts. (A and B from Barry JM, Lemmers MJ: Patch and flap techniques to repair right renal vein defects caused by cadaver liver retrieval for transplantation. J Urol 1995;153:1803; C from Barry JM, Fuchs EF: Right renal vein extension in deceased kidney transplantation. Arch Surg 1978;113:300; D and F from Barry JM, Hefty TR, Sasaki T: Clam-shell technique for right renal vein extension in cadaver kidney transplantation. J Urol 1988;140:1479; E from Corry RJ, Kelley SE: Technic for lengthening the right renal vein of cadaver donor kidneys. Am J Surg 1978;135:867.)

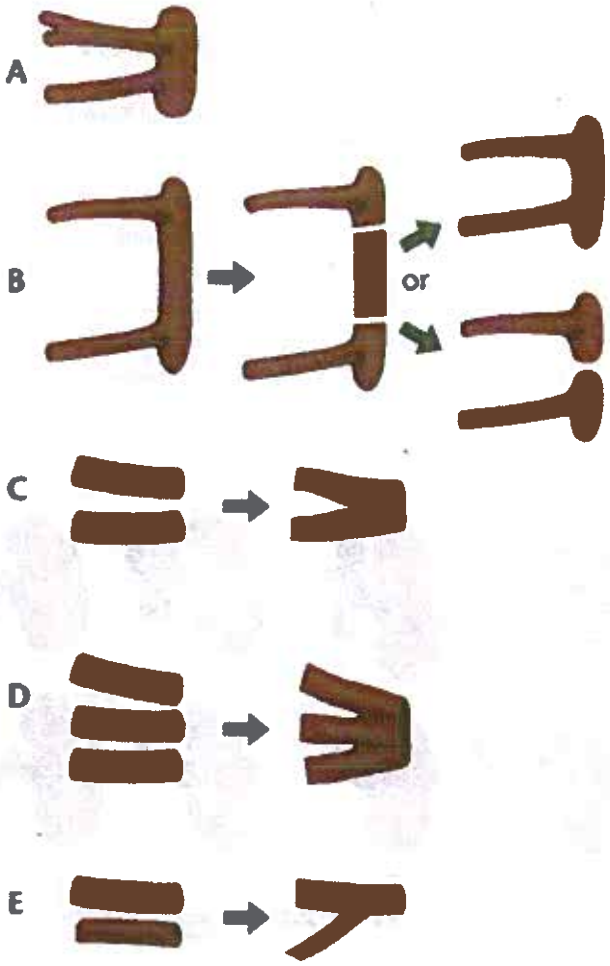

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Figure 40-6 Preparation of the kidney transplant with multiple renal arteries. A and B, Use of aortic patches when the kidney is from a deceased donor. C and D, Pair of pants or three-legged pair of pants is used when an aortic patch is not available, such as when the kidney is from a living donor. E, Anastomosis of segmental renal artery to main renal artery. The segmental renal artery can also be anastomosed to the inferior epigastric artery using an end-to-end technique. (A to E from Barry JM: Technical aspects of renal transplantation. In Schrier RW [ed]: Atlas of Diseases of the Kidney. Philadelphia, Current Medicine, 1998, p 14.4.)

A prophylactic antibiotic is administered just before surgery and continued postoperatively until the results of intraoperative cultures are known. Immunosuppression is started just before or during surgery in the deceased kidney graft recipient and, in some programs, in the week before transplantation in the living donor kidney transplant recipient.

After the induction of anesthesia and the placement of a triple-lumen central venous catheter, the genitalia and skin are prepared, and a Foley catheter is placed in the bladder or bladder substitute. **It is helpful to have the catheter attached to a three-way drainage system that allows intraoperative filling and draining of the bladder, especially in a small recipient or in an individual who has a small, defunctionalized bladder.** The bladder or bladder substitute is rinsed with a broad-spectrum antibiotic solution, such as neomycin-polymyxin B.

and gravity filled. The catheter tubing is clamped until it is time to do the ureteroneocystostomy. A self-retaining ring retractor attached to the operating table that has been flexed and rotated toward the surgeon allows the operation to be performed by a surgeon and one assistant (Fig. 40-7). To prevent spinal injury, patients with significant back disease, such as ankylosing spondylitis, should be placed in a comfortable, padded position before anesthetic induction and table flexion should be avoided. Antibiotic irrigation is used liberally during the procedure. Central venous pressure is maintained between 5 and 15 cm H_2O with intravenous fluids. If fluid administration alone cannot maintain the mean arterial pressure at greater than 60 mm Hg and the systolic blood pressure greater than 90 mm Hg, respectively, a dopamine or dobutamine infusion is started.

In adults and children who weigh more than 20 kg, a first kidney graft is usually placed extraperitoneally in the contralateral iliac fossa by way of a rectus-preserving Gibson incision. This allows the renal pelvis and ureter to be the most medial structures in case subsequent urinary tract surgery is necessary on the kidney graft. Common exceptions to this principle are the obese recipient in whom it is easier to place a kidney graft in the right iliac fossa because of the more superficial iliac veins and the simultaneous pancreas and kidney transplant recipient in whom it is common to place the left kidney with its longer renal vein in the left iliac fossa. **If there is some doubt about whether there will be enough room in the left pelvis of a small patient for a large kidney, placement of the kidney on the right side will allow access to a wider choice of arteries and veins for vascular reconstruction.** In small children, this is accomplished by extension of the Gibson incision to the right costal margin or by a midline abdominal incision. In men, the spermatic cord is preserved and retracted medially. In women, the round ligament is divided between ligatures. The recipient's target blood vessels are dissected. When the renal vein is short, it is helpful to completely mobilize the external and common iliac veins by dividing the gluteal and internal iliac veins between ligatures or large clips. These branches can be retracted anteriorly with a loop of heavy silk. Lymphatic vessels are divided between ligatures to prevent the development of postoperative lymphocele. **The surgeon must be careful not to mistake the genitofemoral nerve, which sometimes crosses the external iliac artery, for a lymphatic vessel.**

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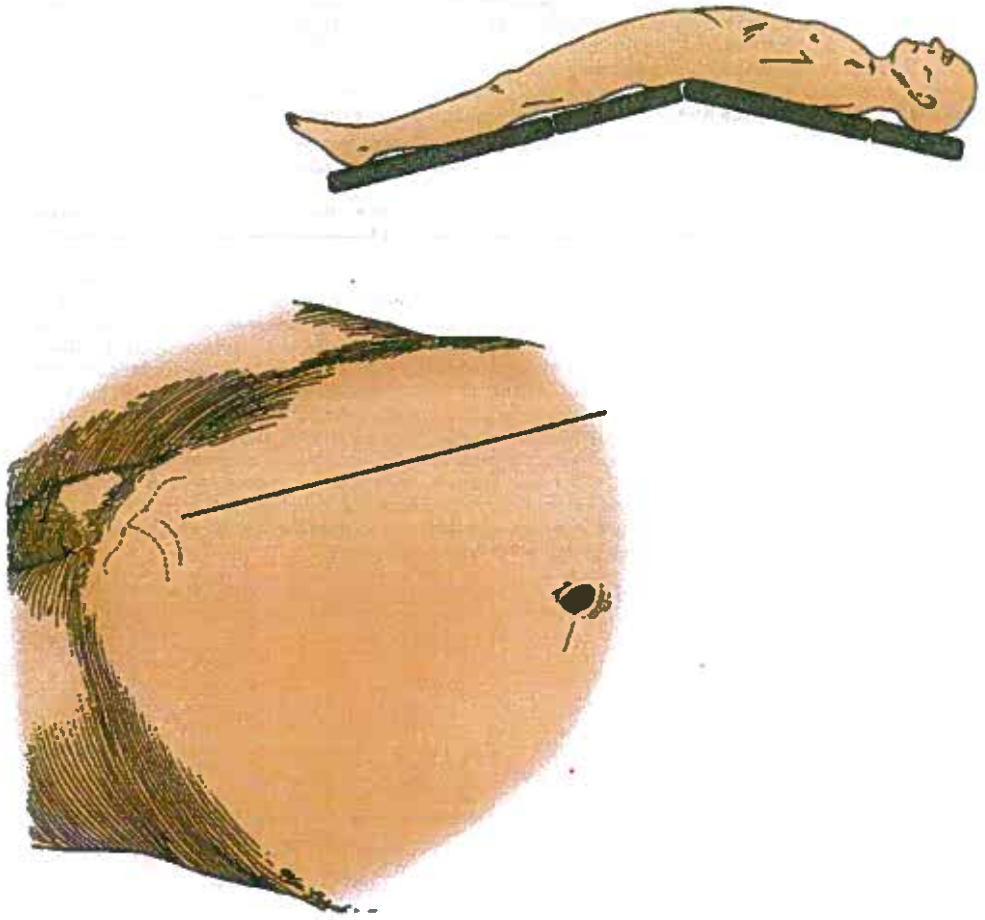

Figure 40-7 Patient position for kidney transplantation into right iliac fossa. Table flexion opens the iliac fossa and retropubic space, just as for radical cystectomy or open prostatectomy. Rotation of the table toward the surgeon, who stands on the patient's left side, assists in performance of the lateral aspects of the vascular anastomoses. (From Montie JE: Technique of radical cystectomy in the male. In Marshall FF [ed]: Textbook of Operative Urology. Philadelphia, WB Saunders, 1996, p 399.)

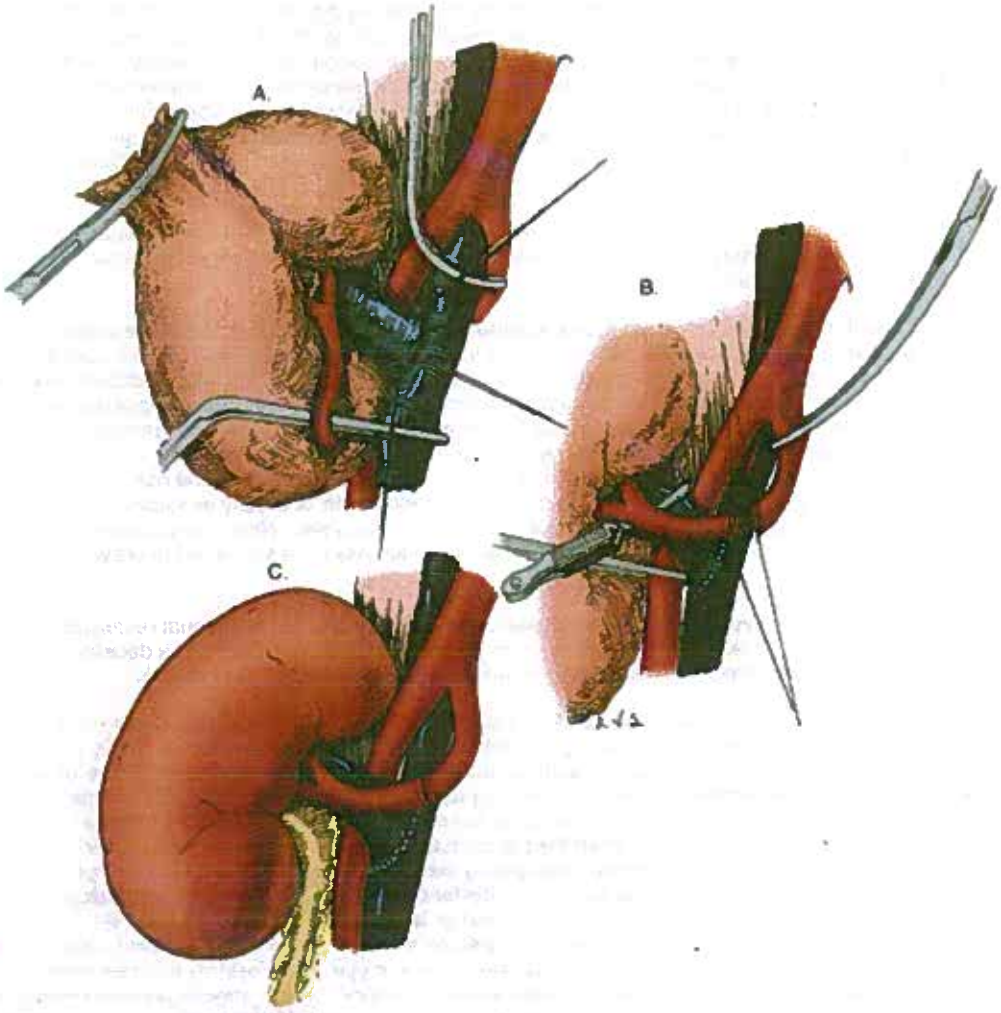

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Figure 40-8 A, The renal vein is anastomosed to the external iliac vein, usually medial to the external iliac artery. When the recipient has a tortuous iliac artery, the venous anastomosis is best performed lateral to the bowed external iliac artery. B, In the absence of significant recipient arteriosclerosis, the renal artery is commonly anastomosed to the internal iliac artery with 5-0 or 6-0 monofilament, nonabsorbable sutures. Many prefer to perform the renal artery anastomosis before the venous anastomosis. If significant internal iliac arteriosclerosis is present or the contralateral renal artery has been used in a previous renal transplant in a man, the external or common iliac arteries become the target vessels for renal artery anastomosis. C, The completed venous and arterial anastomoses. (A to C from Salvatierra O Jr: Renal transplantation. In Glenn JF [ed]: Urologic Surgery, 4th ed. Philadelphia, JB Lippincott, 1991, pp 243-251.)

Before temporary vascular occlusion, heparin, 30 units/kg, is commonly given intravenously to the recipient. During the vascular anastomosis, an infusion of mannitol® is begun to act as a free-radical scavenger and as an osmotic diuretic. Infusion of an electrolyte solution provides intraoperative volume expansion. The addition of an albumin infusion has been found to be helpful in promoting early renal function in the deceased donor kidney transplant (Dawidson et al, 1994). It is a common practice to keep the kidney transplant cool by wrapping it in a sponge containing crushed saline ice, by dripping an ice-cold electrolyte solution on it, or by placing it in a plastic

bag or glove filled with slush. The renal artery is usually anastomosed to the end of the internal iliac artery or to the side of the external iliac artery (Fig. 40-8). Other possible locations for the arterial anastomosis are dictated by the clinical situation, and they include the common iliac artery, the aorta, the splenic artery, and the native renal artery. Moderate arteriosclerosis of the internal iliac artery can be managed by endarterectomy. In the event of significant arteriosclerosis of that vessel, the renal artery is anastomosed end to side to the external iliac artery or to the common iliac artery. **A vascular punch is useful for creating a round hole in a rigid or arteriosclerotic vessel and in the common iliac artery or aorta of a child to prevent renal artery coaptation and thrombosis if hypotension occurs.**

When the pelvic vessels are unsuitable for renal revascularization, orthotopic renal transplantation with anastomosis of the renal artery to the splenic artery or native renal artery and venous reconstruction with the renal vein or inferior vena cava can be done (Gil-Vernet et al, 1989).

It is usually preferable to do the renal artery anastomosis first because it is the more critical of the two vascular anastomoses, the kidney is not tethered by the venous anastomosis, and venous occlusion can be delayed until after the renal artery anastomosis. This results in decreased iliac venous occlusion time and reduces the risk of iliofemoral venous thrombosis. In cases in which the renal vein is short and exposure is limited, it may be preferable to perform the venous anastomosis first. A man undergoing repeat renal transplantation with the prior transplant anastomosed to the contralateral internal iliac artery should not have the ipsilateral internal iliac artery used. This is to preserve blood supply to the corpora cavernosa and reduce the risk of iatrogenic impotence (Gittes and Waters, 1979). The renal vein, with or without an extension, is usually anastomosed end to side to the external iliac vein or to the junction of the external and common iliac veins. When transplanting an adult kidney into the right retroperitoneum of a small child, the renal vein often has to be shortened to prevent redundancy with anastomosis to the inferior vena cava.

Furosemide is commonly infused just before release of the vascular clamps. After renal revascularization, injection of verapamil, a calcium channel blocker, into the renal arterial circulation of the deceased donor kidney graft has been shown to protect the kidney from reperfusion injury (Dawidson et al, 1994).

Urinary tract reconstruction is usually by antireflux ureteroneocystostomy, of which there are several techniques (Politano and Leadbetter, 1958; MacKinnon et al, 1968; Konnak et al, 1975; Texter et al, 1976; Barry, 1983). **Most surgeons prefer an extravesical rather than the transvesical approach for ureteroneocystostomy because it is faster, a separate cystotomy is not required, and less ureteral length is necessary, thus ensuring a distal ureteral blood supply** (Figs. 40-9 and 40-10). Figure 40-9C demonstrates a rapid technique that can be used with or without a stent when the patient has a very small bladder or the procedure must be quickly completed. **If a prior augmentation cystoplasty had been done, the transplant surgeon will need to know the blood supply of the patch so as not to interfere with it at the time of transplantation.** Indications for ureteroureterostomy and pyeloureterostomy are short or ischemic allograft ureters, very limited bladder capacity, or the surgeon's preference. Double-pigtail ureteral stents are used when there is concern about the ureteroneocystostomy technique, or when ureteroureterostomy or pyeloureterostomy has been performed. The routine use of a ureteral stent for all cases has been shown to reduce the incidence of ureteral complications (Pleass et al, 1995; Mangus and Haag, 2004). Long-term results of renal transplantation into the valve bladder and other abnormalities of the lower urinary tract have been very satisfactory (Luke et al, 2003; Mendizabel et al, 2005).

When a patient with an intestinal conduit undergoes renal transplantation (Surange et al, 2003), the kidney graft should be placed in such a way that it does not interfere with the flat surface at the stoma site and contribute to a poor fit of the urinary appliance and subsequent urinary leakage. The technique of ureteral implantation into an intestinal pouch is the same as that for ureteroneocystostomy. The pouch is irrigated free of mucus with an antibiotic solution, and the best site for the ureteral implantation is chosen with the pouch filled. Intraoperative identification of the conduit and subsequent ureteral anastomosis can be facilitated by cannulation of the stoma with a 14-French Foley catheter and inflating the balloon with 3 to 4 mL of sterile water or staining the conduit with methylene blue®. To avoid a kink in the allograft ureter, the kidney transplant can be placed upside down in the iliac fossa so that the ureter is pointing cephalad. The ureteral anastomosis is usually protected with a stent that is left in place for several weeks.

It is common practice to send swab culture specimens from the surface of the deceased donor kidney transplant and from the urinary bladder. It is unnecessary to do so from the surface of a living donor kidney unless there has been a break in sterile technique in the retrieval, perfusion, or transportation of the kidney.

When both kidneys from a deceased donor with marginal renal function are transplanted into the same recipient,

one kidney can be transplanted into each iliac fossa by way of a vertical midline incision or by way of separate Gibson's incisions, or both kidneys can be placed in the right retroperitoneum, one on top of the other (Masson and Hefty, 1998). This technique can also be used for simultaneous kidney and pancreas transplantation (Fridell et al, 2004). The first transplant can be anastomosed to the inferior vena cava and common iliac artery, and the second can be anastomosed to the external iliac vein and external or internal iliac artery.

The uncomplicated renal transplantation can be closed by a variety of running or interrupted suture techniques without drains unless anticoagulation is planned. If the rectus-retracting approach has been used, it is not necessary to place any sutures in the rectus muscle; one simply closes the anterior rectus sheath after the external oblique, internal oblique, and transversus abdominis muscles and their fascial layers have been closed in the cephalad aspect of the wound. **A closed suction drain is recommended in the subcutaneous tissue of an obese patient.** A running absorbable subcuticular suture eliminates the need for subsequent suture or clip removal.