Surgery Illustrated

Renal transplant–recipient surgery

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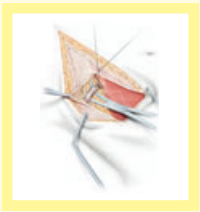
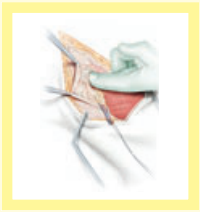
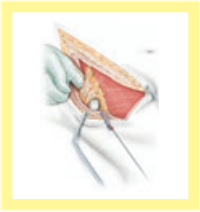
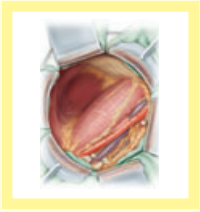
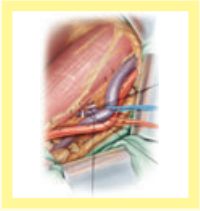










INDICATIONS

Kidney transplantation is indicated in patients with end-stage renal disease. The contraindications are considered to be active infection, active malignancy, a high risk of perioperative mortality, noncompliance, or unsuitable anatomy for technical success.

SPECIFIC EQUIPMENT

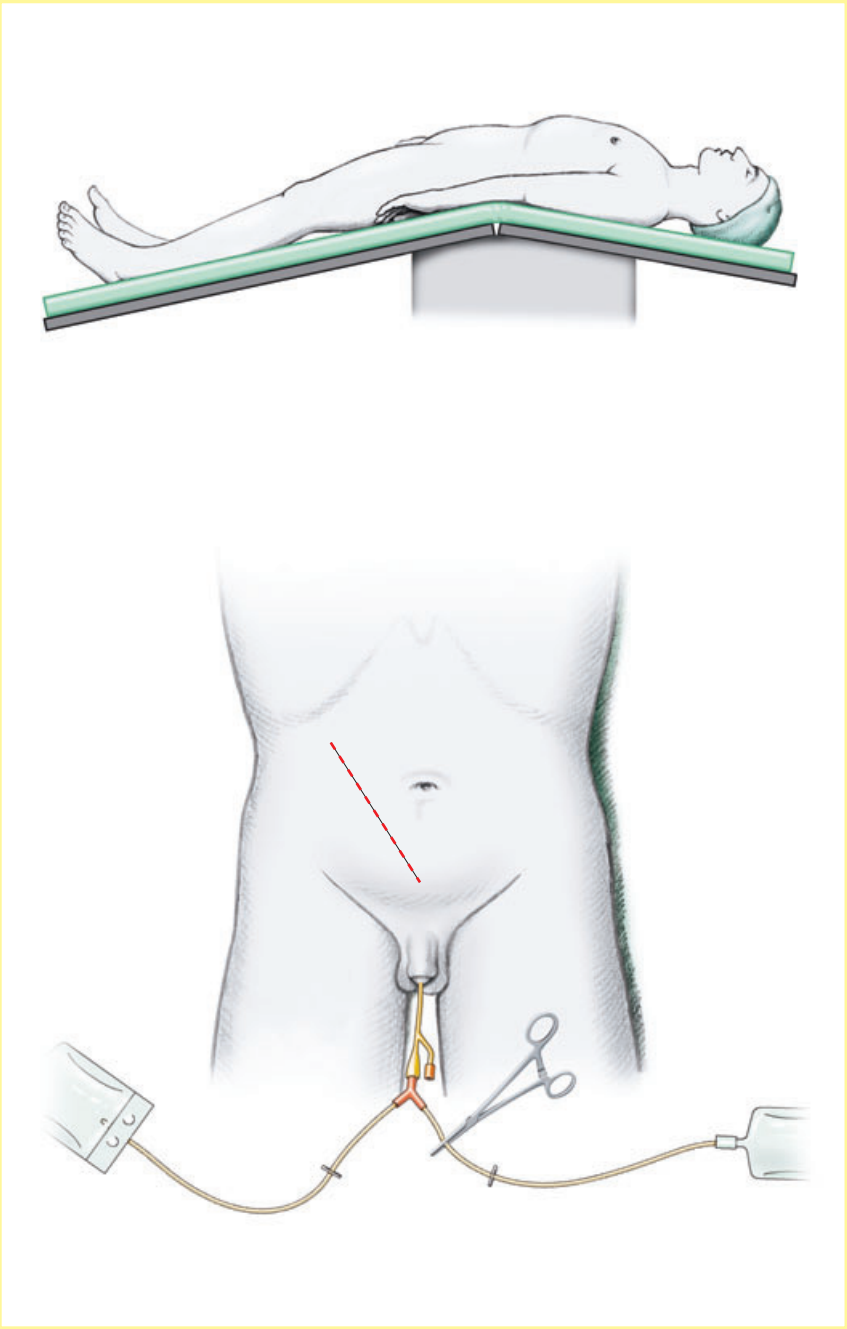
- Basic laparotomy set.
- Bookwalter table-fixed retractor.
- 5- and 6-mm vascular punches.
- Headlight.
- Magnification (optional).
- Morse-Andrews suction tube.
- DeBakey 'Atraugrip' vascular tissue forceps.
- Lahey/Sweet gall bladder duct forceps, 19 cm.
- Thin vascular needle holders.
- A variety of vascular clamps.
- Rumel tourniquets.
- Large, medium and small clips with applicators.
- 5/0 and 6/0 monofilament vascular sutures.
- 5/0 synthetic monofilament absorbable sutures.
- Haemostats with suture boots.
- Soft suction drain (two if the patient is obese).
- Y-connector system for bladder irrigation and drainage.
- Foley catheter that will comfortably fit the urethra after calibration with bougies-a-boule.
- 5 F × 12 cm double-pigtail stent (optional).
- Sequential calf-compression devices.
- Triple-lumen central venous catheter.
- List of medications for the anaesthetist to administer during the case.

SPECIFIC PATIENT PREPARATION

- The patient should take nothing by mouth, except for medications approved by the anaesthetist, within 5 h of the surgery.
- Shampoo and shower within 12 h of surgery.
- No bowel preparation is necessary.
- Treat UTI if present.
- Antibiotic administration within 30 min of procedure.
- Calf sequential compression devices to prevent deep venous thrombosis.
- Place triple lumen central venous access.

SPECIFIC PATIENT POSITIONING

Reverse Trendelenburg for central venous line placement; after placing the central venous line, an extended supine position with a break in the table just above the iliac crest.



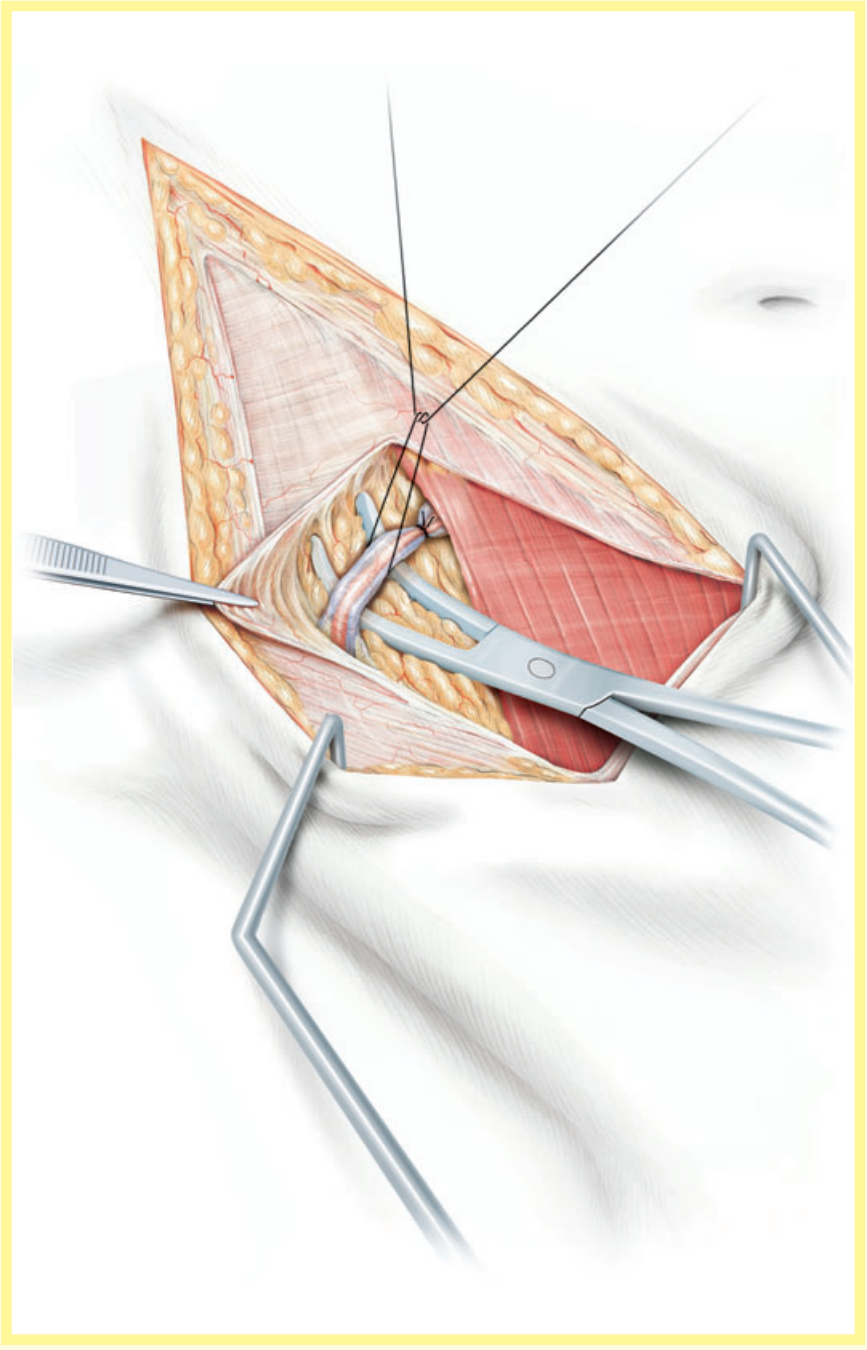
SURGICAL STEPS

Figure 1

The patient is supine, slightly hyperextended and the sequential calf-compression devices applied (not shown); the Foley catheter is attached to a Y-connector that is connected to an irrigation/drainage system so the bladder can be rinsed with an antibiotic solution and 50 mL left indwelling, and so the anaesthetist can fill and drain the bladder during surgery. The patient is prepared and draped for a Rutherford Morison incision. In a small child, this incision can be extended to the costal margin.

Figures 2 and 3

A 20-cm extraperitoneal Rutherford Morison incision is made. The anterior rectus sheath, not the rectus muscle, is cut, and the inferior epigastric vessels are divided between heavy silk ligatures. A long stump of the inferior epigastric artery is preserved if it will be necessary to make a separate anastomosis to a lower pole segmental renal artery.



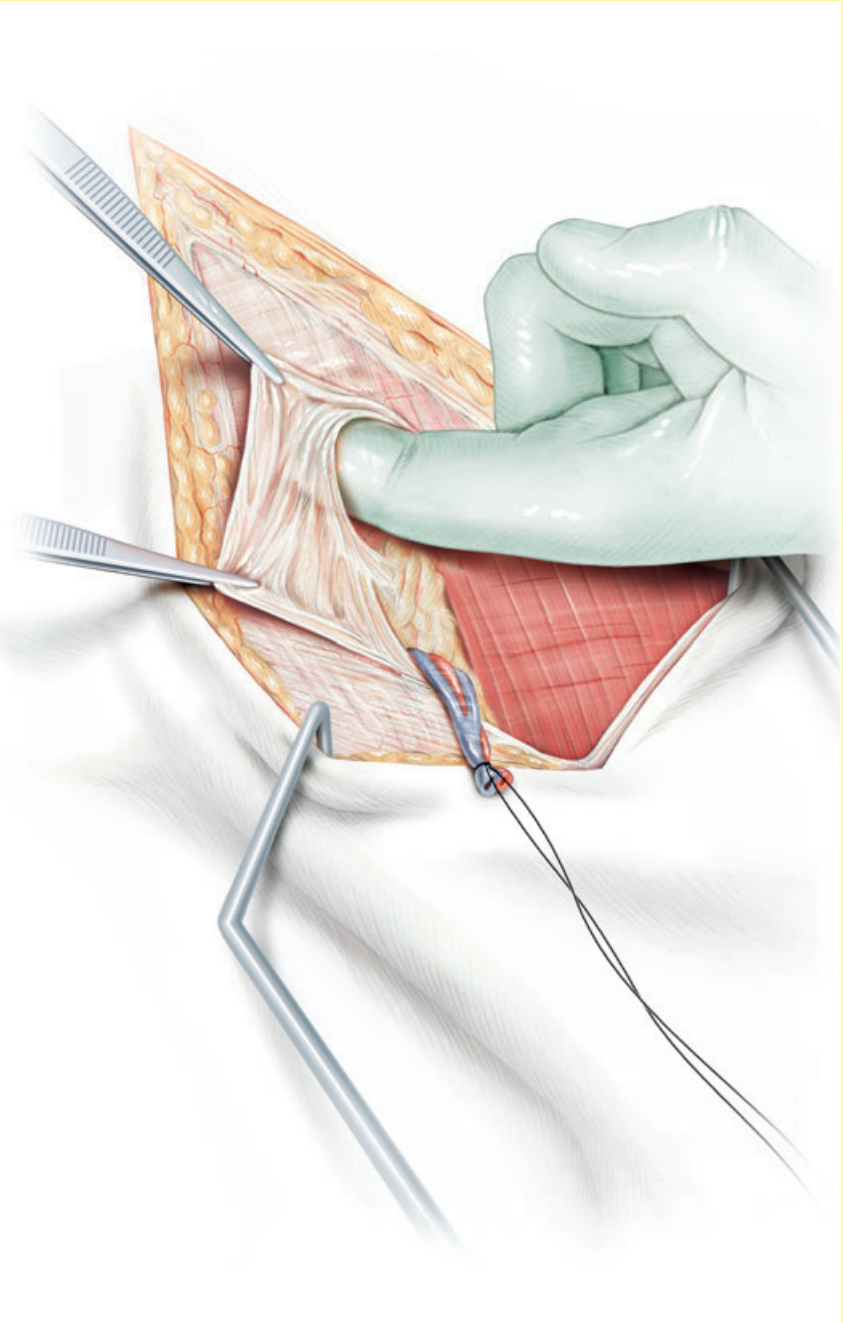
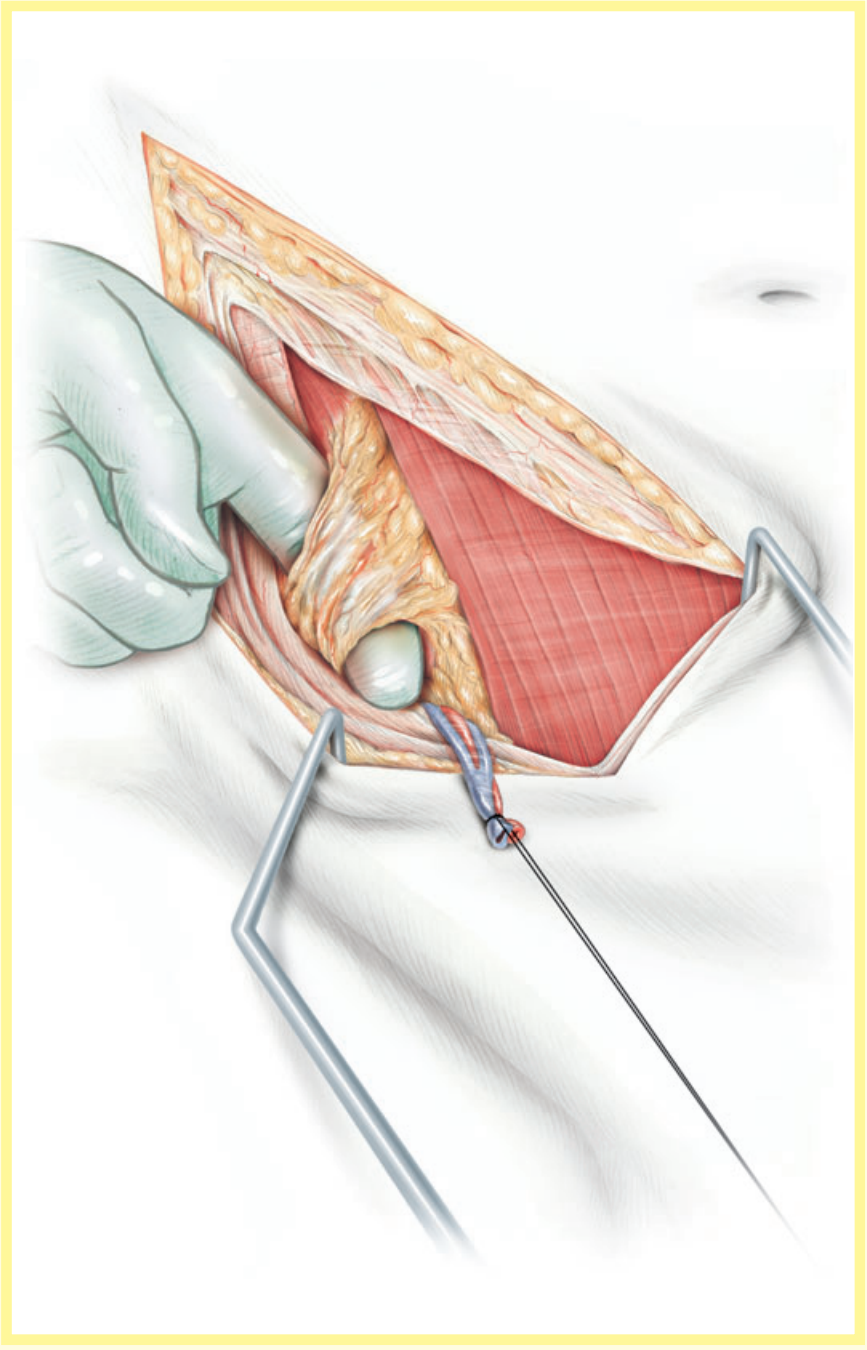


Figure 4

The spermatic cord is preserved and retracted medially. In women, the round ligament is divided between heavy silk ligatures. The iliac fossa and retroperitoneal space are developed until the lateral surface of the bladder and the ipsilateral sacral promontory are exposed. The Bookwalter retractor is placed.



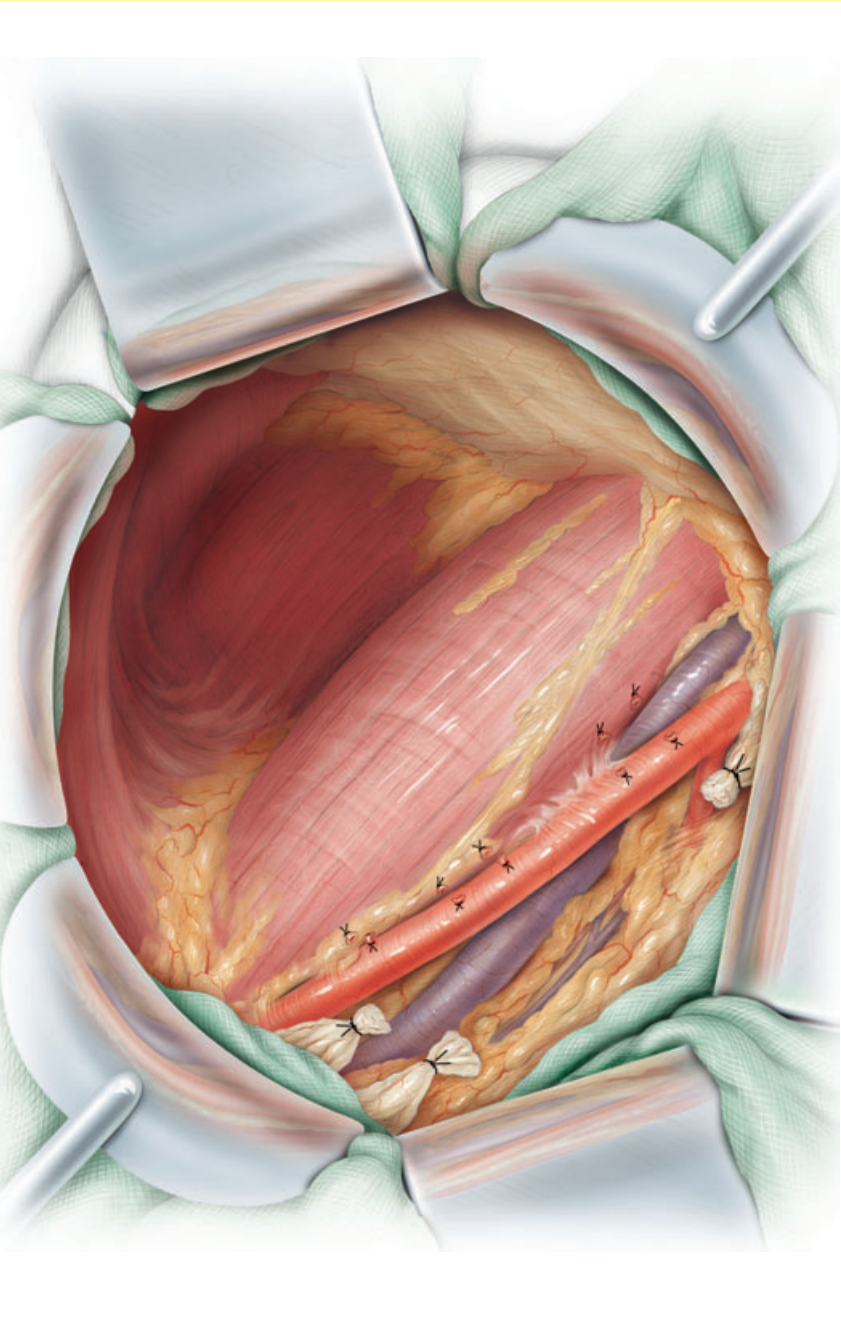


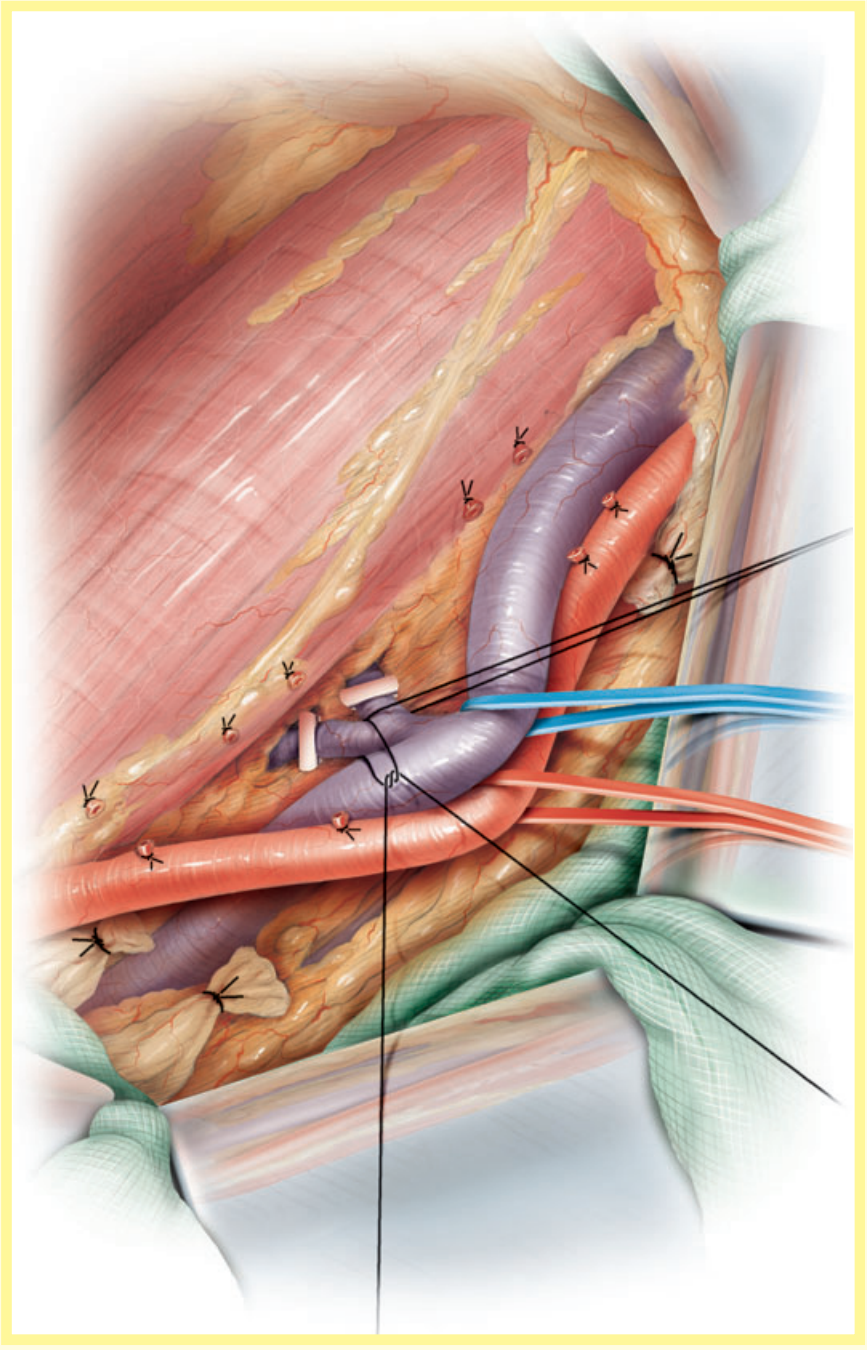
Figure 5

The iliac arteries are palpated to select reasonably plaque-free targets for the renal artery anastomosis and for the application of vascular clamps. The iliac artery targets are dissected. The lymphatics are divided between silk ligatures.

Figure 6

The external and distal common iliac veins are dissected. Heavy silk ligatures are passed around the gluteal and internal iliac veins and looped over the Bookwalter ring to retract them medially and anteriorly. These large branches are ligated or clipped with three large right-angle clips where they enter the pelvis, ligated where they enter the iliac veins, and then divided.

If these branches are short, Rumel tourniquets can be applied proximally and distally, the distal tourniquet tightened, the iliac veins drained cephalad, the proximal tourniquet tightened, and the iliac veins rotated so the stump(s) can be closed with running 5–0 monofilament vascular suture(s). The tourniquets are released.



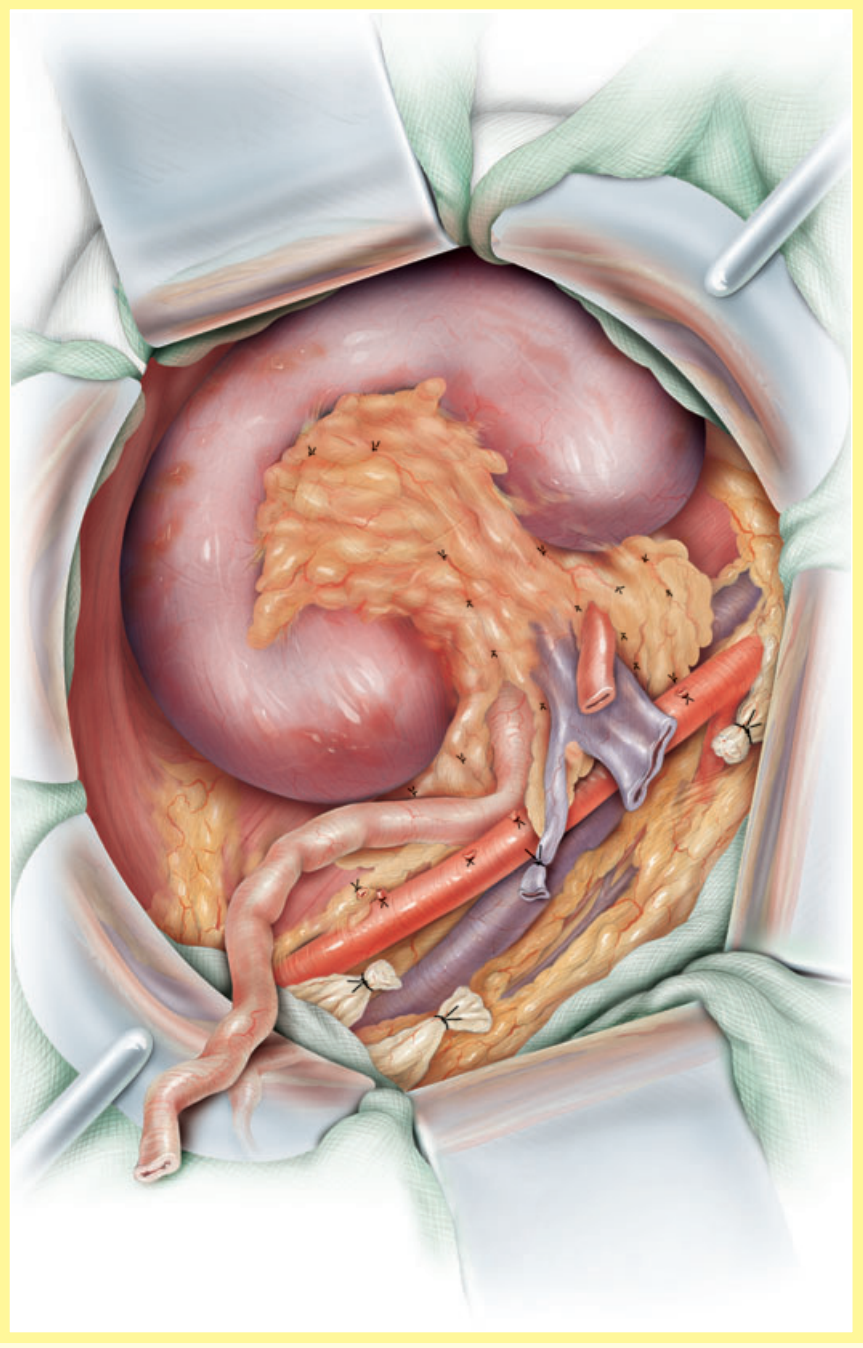
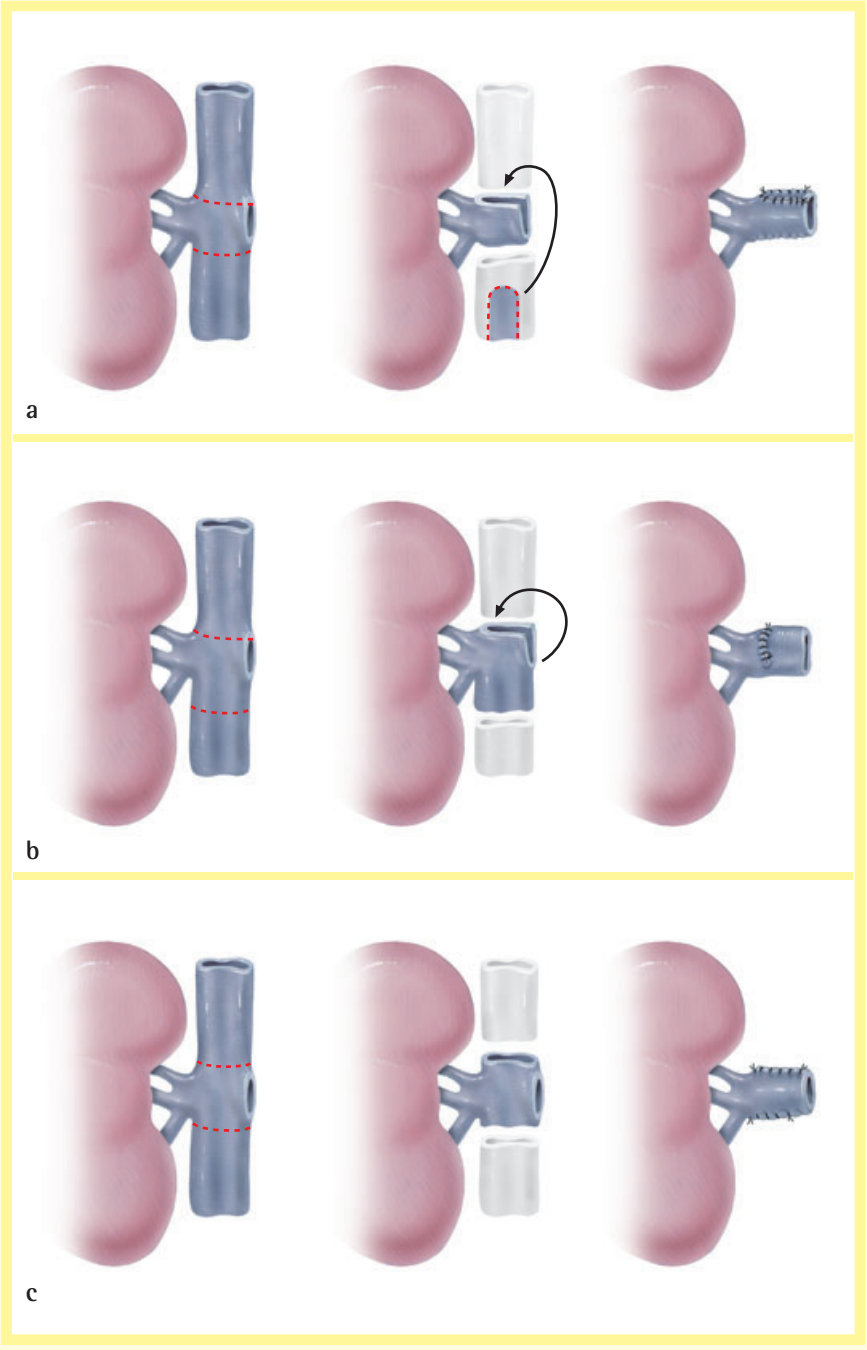


Figure 7

The cold kidney graft is placed into the wound to determine the best fit, and the final targets are selected for renal revascularization. The kidney transplant is removed and replaced into a pan of ice-cold preservation solution for further dissection and vascular reconstruction.

Figures 8 and 9

The short right renal vein of a deceased-donor kidney transplant can be extended or repaired in various ways. A–E shows methods that use the attached inferior vena cava, and F is a method that uses donor external iliac vein or native left renal vein.



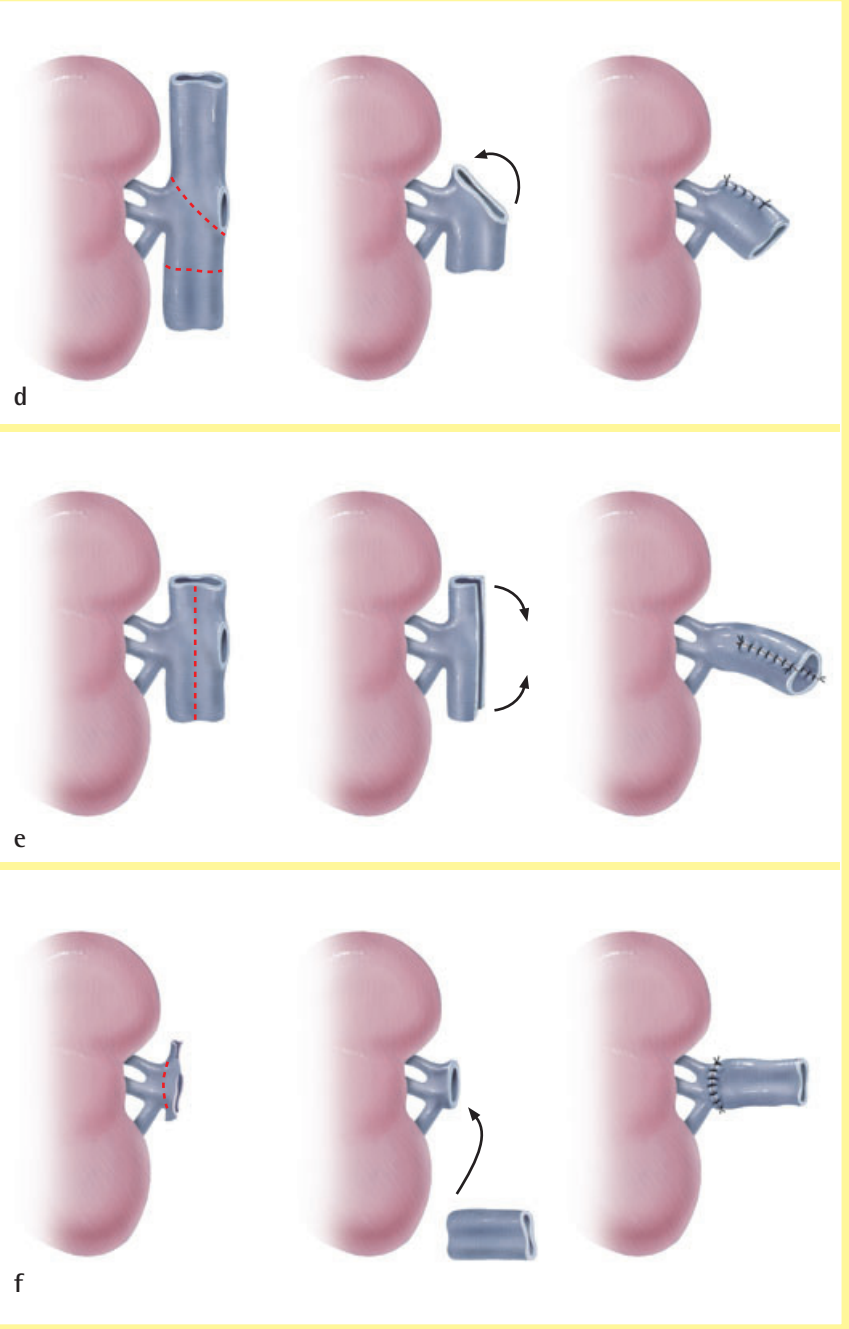
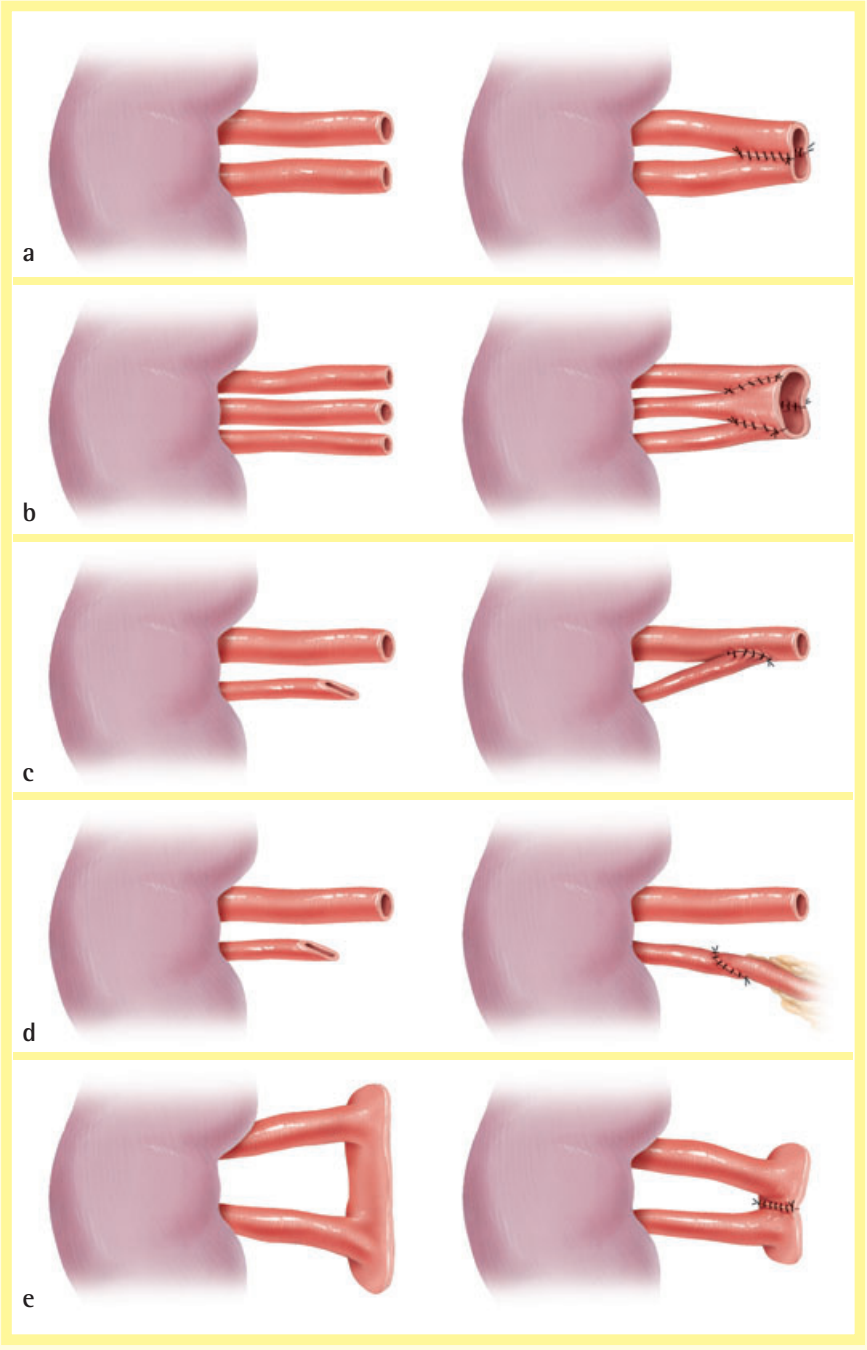


Figure 10

The renal artery can be reconstructed in several ways. A–C shows methods of reconstruction when segments of aorta are not attached to the renal arteries. D shows the use of the inferior epigastric artery to revascularize a segmental renal artery. E shows removal of a segment of aorta when the renal arteries are widely separated on an aortic patch.



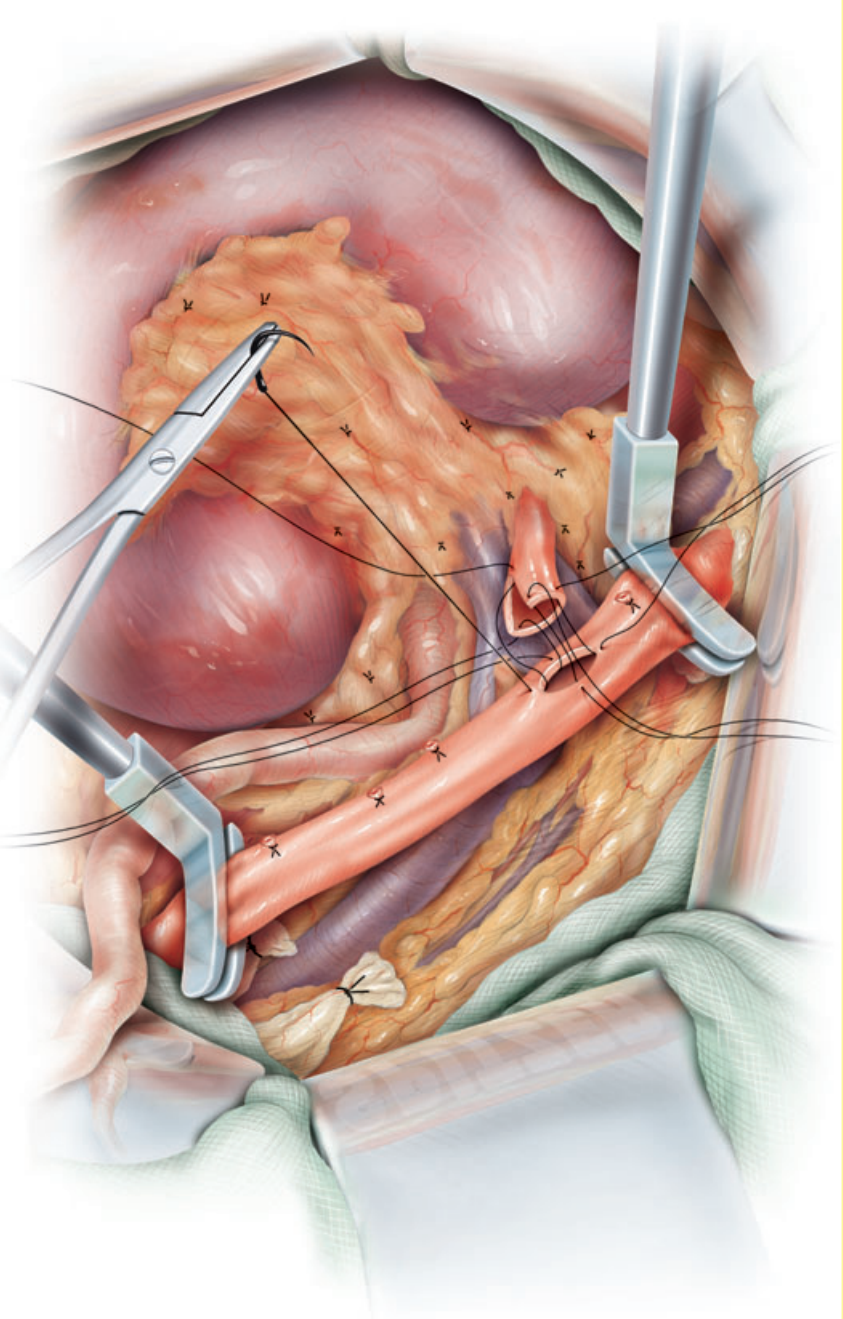


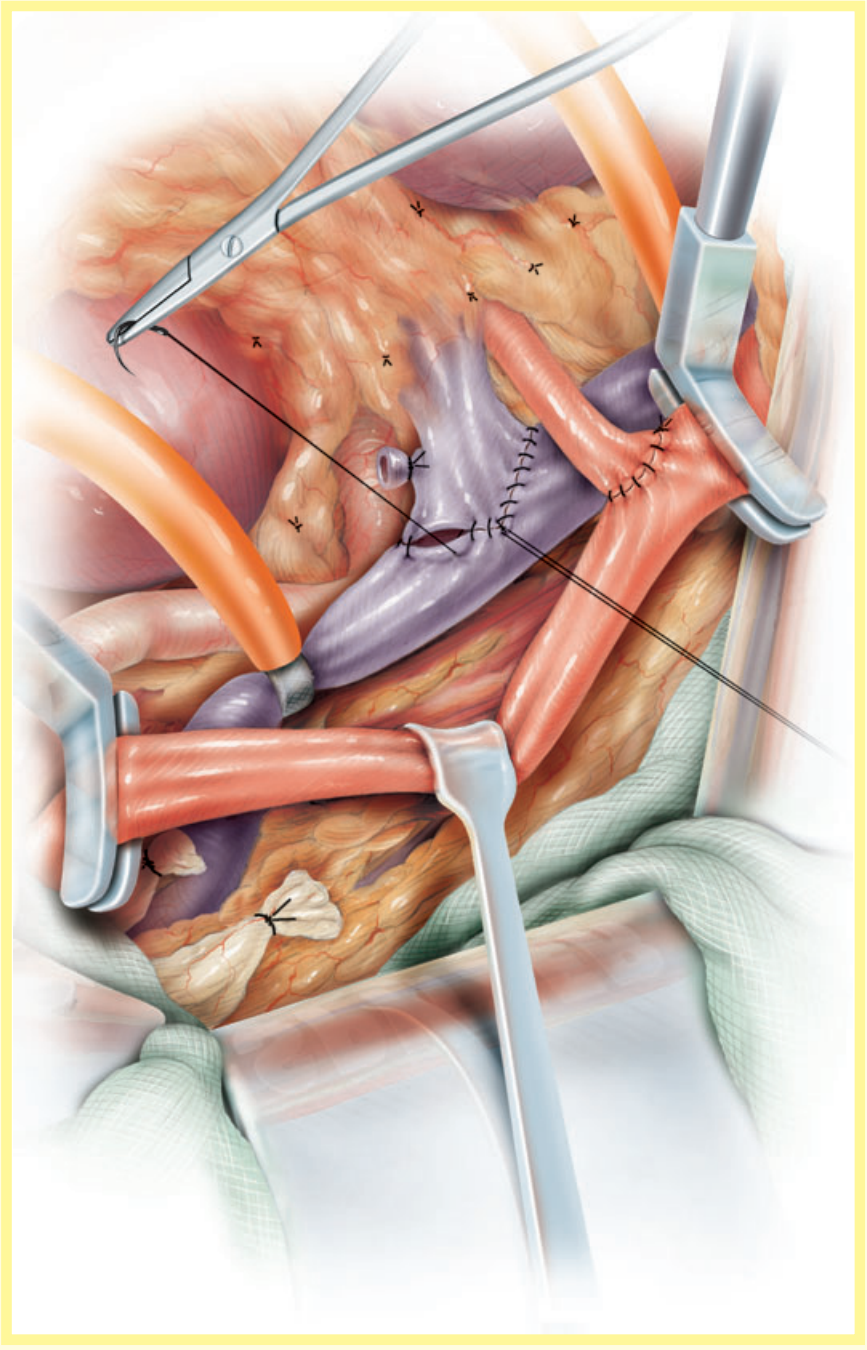
Figure 11

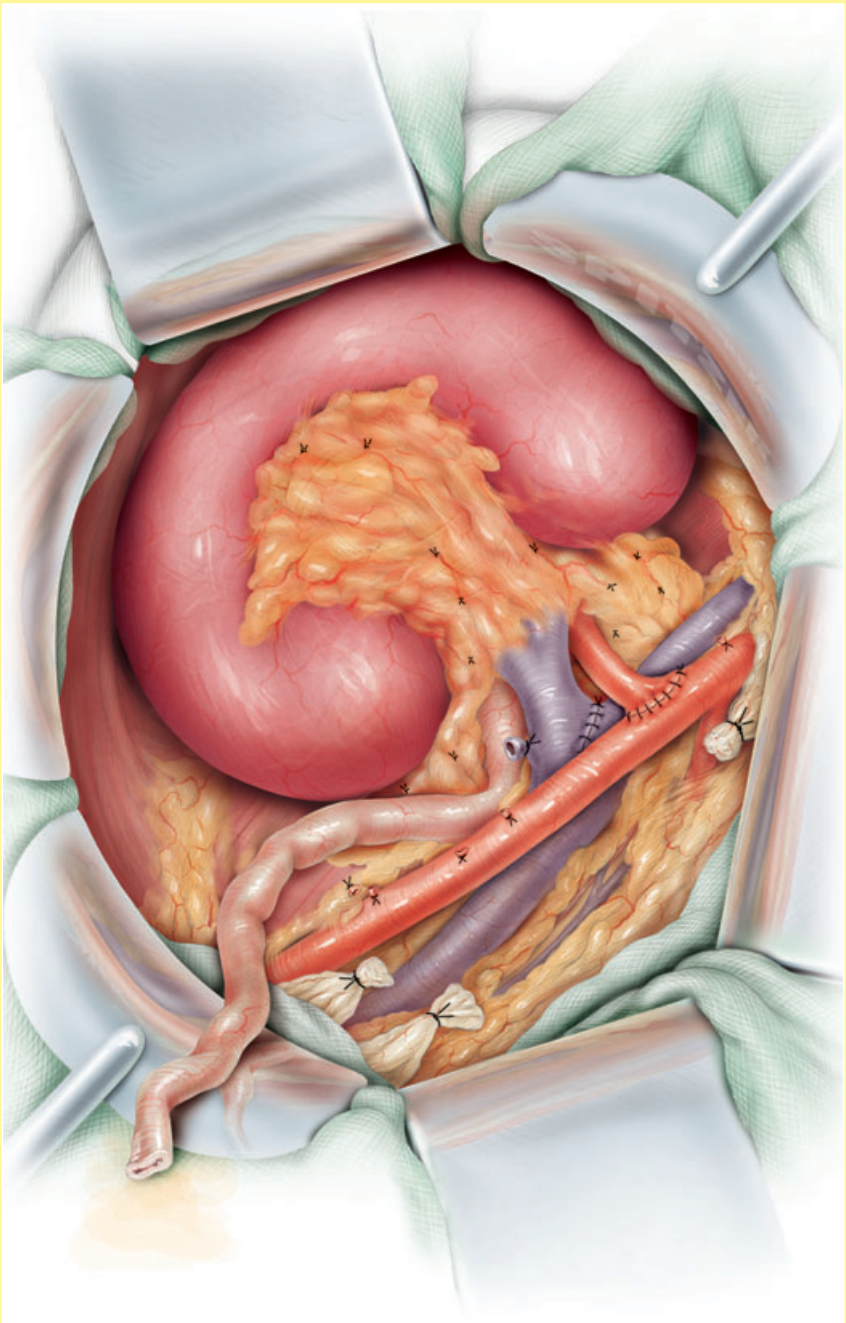
The anaesthetist administers heparin 30 units/kg i.v. If the internal iliac artery is to be used, it is ligated distally, and vascular clamps are applied. In the case shown, the external iliac artery is selected. It is incised with a no. 11 blade and the arteriotomy is enlarged with a vascular punch. The lumen is irrigated with heparinized saline.

Vascular sutures are placed in the four quadrants of the arteriotomy and the renal artery, and the arterial anastomosis is completed with a running 5–0 or 6–0 vascular suture.

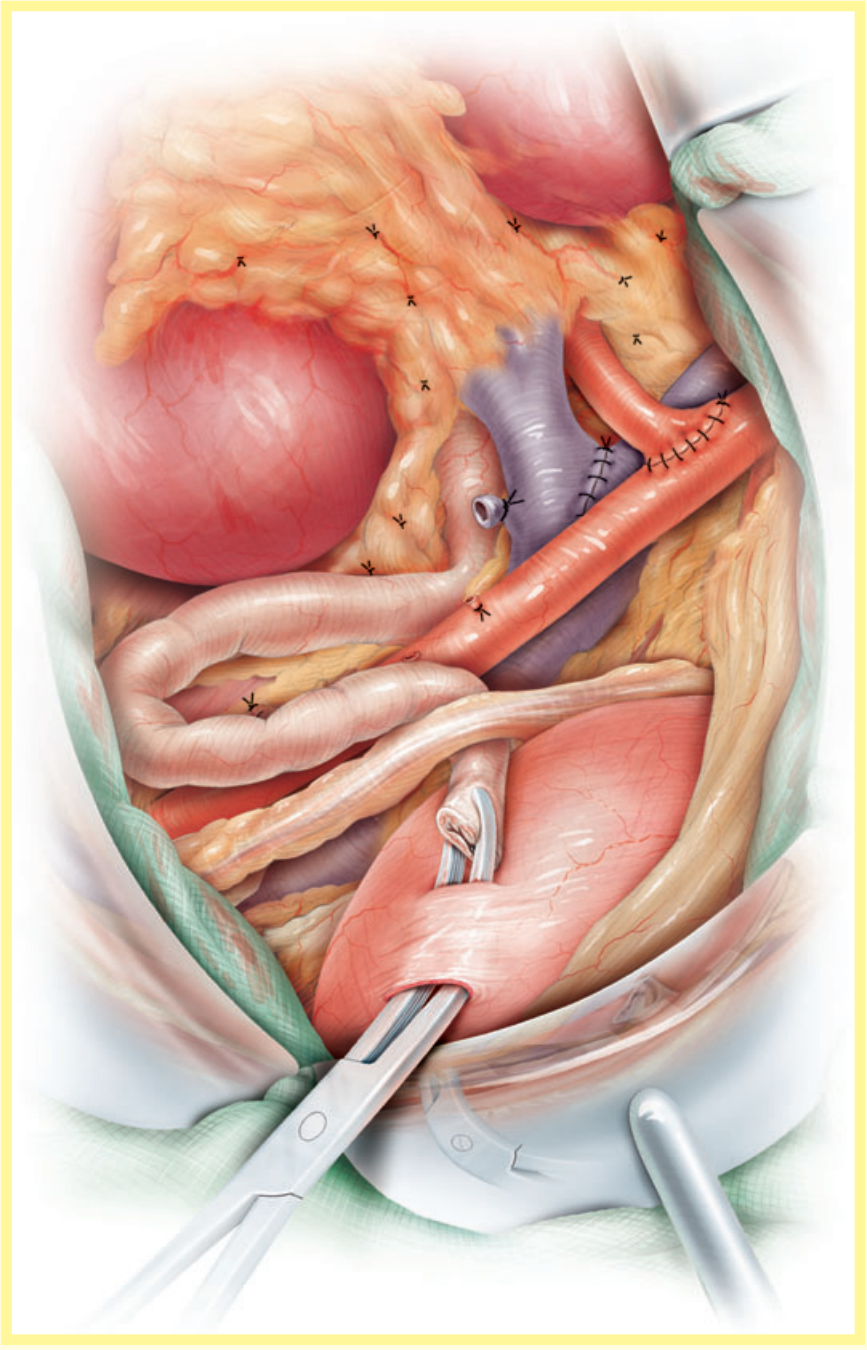
Figures 12 and 13

The Rumel tourniquets are tightened to isolate a segment of the iliac vein. The ends of the tapes can be looped over the ring of the self-retaining retractor and tagged with haemostats to retract the vein anteriorly. The vein is incised, the lumen is irrigated with heparinized saline, and a running vascular anastomosis with 5–0 vascular suture is made via the quadrant technique. The vascular clamps are removed in the following sequence: cephalad vein, distal artery, proximal artery and, after the kidney is pink, distal vein.



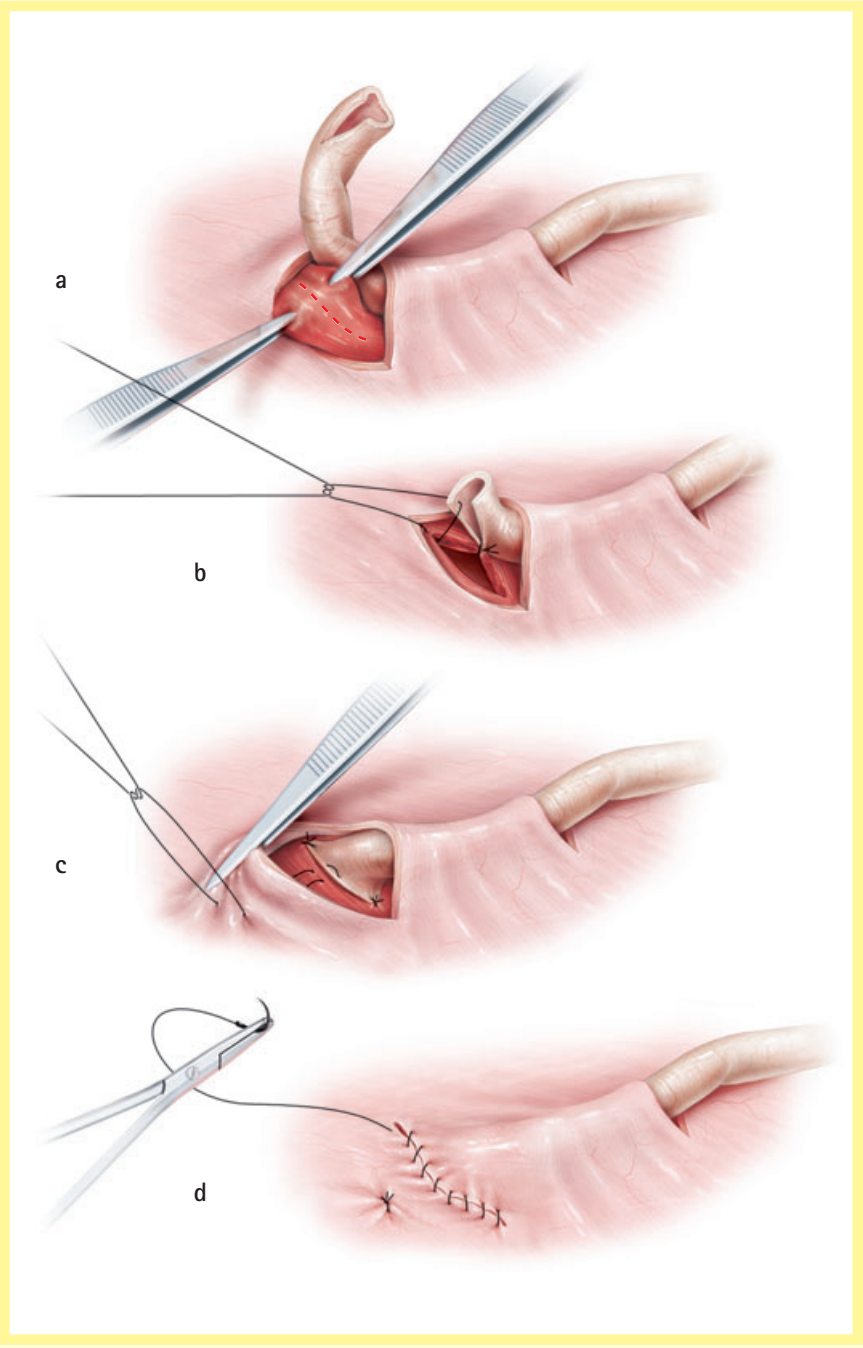


Figures 14 and 15



The bladder is filled to ≈250 mL with the Y-system, and the retractor blades are repositioned to expose the lateral surface of the bladder. The prevesical fat and peritoneum are dissected off the anterolateral surface of the bladder, and the proposed bladder incisions 2 cm apart are marked with cautery. The seromuscular layers are incised until bladder mucosa bulges into the incisions. 50 mL of the bladder solution is removed via the Y-system, and a submucosal tunnel is created between the incisions. The ureter is drawn through the submucosal tunnel, shortened and spatulated. Distal ureteric vessels are ligated with fine absorbable ligatures. If so inclined, a 5 F × 12 cm double-pigtail stent can be placed over a wire at this time. The bladder mucosa is grasped with vascular forceps, the bladder is drained, the mucosa is incised, and the interior of the bladder is touched with a cotton swab and sent for culture. Beginning with the crotch of the incised ureter, it is anastomosed to the bladder with interrupted fine absorbable sutures. The distal suture is a vertical or horizontal mattress suture to anchor the toe of the ureter to the full thickness of the bladder. The distal seromuscular incision is closed with a running, fine absorbable suture. A suction drain is placed in the deep wound and brought out through a stab wound cephalad and lateral to the incision.

If the muscle and fascial layers are of good quality, the deep wound is closed with heavy running monofilament absorbable sutures. If tissue quality is not good, the deep layers are closed with interrupted sutures of heavy monofilament absorbable sutures. A long-acting local anaesthetic is injected into the wound. Scarpa's fascia is closed with absorbable sutures. If the patient is obese, this layer is closed over a subcutaneous suction drain. The skin is closed with a running fine absorbable subcuticular suture. The drain(s) is/are sutured to the skin.



POSTOPERATIVE CARE

The dry sterile dressing is removed on the second day after surgery, and the wound is redressed if necessary. The drains are removed when the output is <50 mL, or in 3 weeks, whichever is first. The patient is instructed to swab the drain exit site(s) with an antiseptic once a day until the drain(s) is/are removed. The drainage is sent for an estimate of creatinine concentration if the drainage is persistent and there is concern about a urine leak. The intraoperative urine culture results are checked and any UTI is treated.

The bladder catheter is removed 5 days after surgery, after a bedside dipstick urine analysis for nitrites and administering a broad-spectrum oral antibiotic. This is usually trimethoprim-sulpha or nitrofurantoin.

If a stent had been placed and tied to the indwelling bladder catheter, it will come out with catheter removal. If not, it is removed in the outpatient clinic 3 weeks to 3 months later.

FROM SURGEON TO SURGEON

Predictors of a difficult case are obesity, atherosclerosis, a compromised or reconstructed urinary drainage system, a stoma in the proposed operative field, previous lower abdominal surgery, and repeat transplantation into an operative site.

It is preferable to place a left kidney transplant into the right iliac fossa, and vice versa, so that the ureter and renal pelvis are the most medial structures in case future urinary tract reconstruction is necessary because of a urinary drainage complication. It is easier to transplant a kidney into the right iliac fossa of an obese patient because the iliac vessels are more superficial on that side. It is easier to transplant a kidney into the right iliac fossa or retroperitoneum of a child because the common iliac vein and inferior vena cava are easily available for the venous anastomosis.

Preparation of the entire abdomen will allow the surgeon to open the opposite iliac fossa without re-preparing and draping the patient if scar or pelvic atherosclerosis precludes transplantation into the original site. A left Rutherford Morison incision can be extended to the left costal margin for orthotopic kidney transplantation. It allows for native nephrectomy and for the splenic artery, native renal vein and native ureter to be used for reconstruction.

Something that makes the procedure easier for transplantation into the iliac fossa is for the surgeon to stand on the side opposite the incision, so that the flow of the operation is towards the surgeon.

Substitution of a Lahey/Sweet gallbladder forceps for the standard right-angle dissecting clamp provides the surgeon with two advantages: longitudinal rather than cross serrations and a <90° angle. The former prevents tissues from being caught on the forceps and the latter keeps the dissecting hand out of the line of sight.

Be careful not to mistake the genitofemoral nerve for a lymph vessel. This nerve lies on the psoas muscle lateral to the external iliac artery and can cross the distal third of this artery.

The ureteroneocystotomy can be checked for a leak by filling the bladder with the Y-system.

Skin closure with an absorbable subcuticular suture is more comfortable for the patient than skin staples or nonabsorbable sutures, which must be removed later.

My most challenging case was that of a third kidney transplant in an obese man. The resident and I started the day by doing a donor nephrectomy in one of the patient's siblings. The operating room was turned over, and we made a left supracostal incision in the recipient at 13.00 hours in anticipation of a left native nephrectomy and an orthotopic renal transplantation using the splenic artery for arterial reconstruction. The splenic artery was pulse-less. It had become occluded since the depiction of a normal splenic artery on an angiogram 3 months earlier. We did a left nephrectomy, a native renal endarterectomy, revascularized the kidney, and removed the vascular clamps. The renal artery became pulse-less after a few minutes and we redid the anastomosis twice with the same result. We removed the kidney transplant, passed embolectomy catheters to remove renal artery clots, re-flushed the kidney with ice-cold preservation solution and repackaged it. The kidney transplant now had two renal arteries and two renal veins from cutting back on the vessels to have fresh stumps for the anastomoses. We closed the flank incision, and positioned and prepared the patient for a right Rutherford Morison incision. After an hour or two, we were able to isolate suitable iliac vessels, do a 'pair-of-pants' renal arterioplasty, a 'pair-of-pants' renal venoplasty and complete the kidney transplant. At 14 h after making the incision in the donor, we closed the recipient's second wound and waited 3 weeks for adequate renal function to return and for haemodialysis to be discontinued. The serum creatinine level was 1.5 mg/dL at 33 days after transplantation, and 1.4 mg/dL the day before he died from cardiac disease 43 months later.

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