Endovascular treatment of aortic aneurysms in patients with renal transplants

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Endovascular treatment of an abdominal aortic aneurysm was undertaken in two orthotopic renal transplant recipients with US Food and Drug Administration-approved aortic stents without specific measures taken to protect the transplanted kidney. Renal function remained unchanged in both patients. Follow-up imaging studies showed successful aneurysm exclusion. Endovascular abdominal aortic aneurysm treatment in renal transplant recipients does not appear to place the transplanted kidney at undue ischemic risk and may be the preferred approach in select patients. (J Vasc Surg 2003;37:693-6.)

Traditional surgical treatment of an abdominal aortic aneurysm (AAA) involves cross clamping of the aorta. In patients who have undergone orthotopic renal transplantation with kidneys positioned in the pelvis, interruption of blood flow to the transplanted kidney with aortic clamping usually requires specific maneuvers to minimize the ischemic insult to the kidney.1-7 Endovascular treatment of AAAs has become a recognized alternative to open AAA repair in many patients. Importantly, interruption of aortic blood flow during the course of the endovascular repair is of limited duration, making this technique an attractive option for treating AAAs in patients with renal transplants. We report the repair of AAAs in two patients with renal transplants using US Food and Drug Administration-approved aortic grafts at the University of Michigan Hospital in 2001.

CASE REPORTS

Case 1. A 70-year-old man with diabetic nephropathy had undergone a successful orthotopic kidney transplant 7 years earlier. The patient had been followed for 3 years for an asymptomatic AAA that subsequently increased to 5.3 cm in diameter. History was notable for hypertension, a prior stroke, and a previous coronary artery bypass. Preoperative baseline creatinine level was 0.8 mg/dL.

A high-resolution computed tomographic (CT) scan and abdominal aortogram revealed an infrarenal AAA extending into a 3-cm aneurysmal right common iliac artery (Fig 1). The transplanted renal artery took origin from the middle third of the right external iliac artery.

The endovascular AAA repair was performed with general anesthesia. Both common femoral arteries were exposed and cannulated through groin incisions. Percutaneous transluminal angioplasty of the right external iliac artery was necessary to allow advancement of an AneuRx endograft (Medtronic AVE, Santa Rosa, Calif) (26 × 15 × 165 mm). The proximal endograft was positioned just below the superior mesenteric artery across the native renal arteries and deployed. A right iliac endograft extension (24 × 37.5 mm) was then placed with the distal end of the graft above the right iliac bifurcation, excluding the common iliac aneurysm. A left iliac endograft extension (16 × 115 mm) was similarly deployed.

Completion arteriography showed normal blood flow through the aortic endograft, both iliac graft limbs, and the transplanted renal artery (Fig 2). A persistent small type IV endoleak at the left iliac junction was expected to close spontaneously. The patient tolerated the procedure without any complication and was discharged on the second postoperative day. Serum creatinine level was unchanged immediately after surgery and during the ensuing 12 months of follow-up. The patient has remained asymptomatic, with CT scans documenting no endoleak, a functioning renal transplant, and no evidence of continued aneurysmal dilatation.

Case 2. A 71-year-old man with end-stage renal disease of undetermined cause had undergone a right-sided orthotopic renal transplantation 11 years earlier. Baseline serum creatinine level was 2.0 mg/dL and had been stable over many years. An abdominal CT scan performed 2 years before admission, obtained during evaluation for colon cancer, revealed an incidental 5.0-cm infrarenal AAA. The patient underwent a right hemicolectomy at that time. Prolonged convalescence after colon surgery delayed treatment of the AAA, but the patient was eventually considered an appropriate candidate for endovascular repair.

A high-resolution CT scan and an aortogram with intravascular ultrasound scan showed an infrarenal AAA with moderate atherosclerotic disease extending into the proximal iliac arteries bilaterally. Near occlusion of both native renal arteries was evident. A patent transplanted renal artery originated from the right external iliac artery. There was no evidence of intraabdominal neoplasm at that time.

The endovascular AAA repair was performed with epidural anesthesia, with a bifurcated AneuRx endograft (26 × 15 × 135
Fig 1. A, Three-dimensional reconstruction of preoperative CT scan shows infrarenal AAA and transplanted kidney in right pelvis. B, Coronal CT scan shows infrarenal AAA and right common iliac aneurysm with normal transplanted renal artery.

Fig 2. A, Completion angiogram after endovascular repair shows successful exclusion of aneurysm, with patent iliac arteries, and B, patent right renal transplanted artery originating from right iliac artery.
The graft was advanced through the left iliac artery and deployed just below the origin of the native renal arteries with endograft extensions into the right and left common iliac arteries (15 × 85 mm and 20 × 37.5 mm, respectively). A type I endoleak at the left iliac extension was managed successfully with balloon angioplasty. Additional 16 × 115 mm and 24 × 37.5 mm stents then were deployed in the right and left common iliac limbs, respectively. Completion aortography revealed adequate positioning of the endograft and patency of the right renal allograft transplant artery (Fig 3). A small type II endoleak was evident, arising from a lower lumbar artery. The patient tolerated the procedure without complication and was discharged from the hospital on the second postoperative day with a serum creatinine level of 2.1 mg/dL.

A routine follow-up CT scan at 3 months revealed satisfactory exclusion of the aneurysm without endoleak. Shortly thereafter, the patient had advanced metastatic colon cancer develop, which was unresponsive to chemotherapy, and he died 5 months after having undergone endovascular treatment of the AAA.

**DISCUSSION**

The long-term survival of patients with renal transplants has resulted in increasing numbers of these patients having AAAs develop. Compounding this issue is the fact that renal transplantation is being performed more frequently among the elderly with known risk factors for aneurysmal disease.

Patients with renal transplant may tolerate standard open AAA repair without protective measures for the transplanted kidney, but renal ischemia can result in irreversible deterioration in kidney function. Various means have been described to address renal ischemia during these circumstances, including performance of an axillofemoral shunt and an extraanatomic aortofemoral bypass. However, these may place the transplanted kidney at risk of thromboembolization. Perfusing the transplanted kidney through the femoral artery with a pump oxygenator was reported from the authors’ practice, but this procedure also carries operative risks, as does cannulation of the femoral artery and in situ hypothermic perfusion of the transplanted kidney. Explantation with temporary perfusion of the kidney followed by replantation has also been described but is even more complex than in situ perfusions.

Temporary interruption of the pelvic blood flow during deployment of an aortic endograft lasts only a few minutes and, in the currently reported experience, appears to have
been well tolerated. In general, the smaller introducer device is placed through the side of the transplant. Care should be taken when passing these devices in the ipsilateral iliac artery. The usual anatomic criteria for endovascular treatment of an AAA regarding adequate length of the aortic neck below the renal arteries may not be relevant if maintenance of blood flow to the native renal arteries is inconsequential. Theoretic concern for renal infarction and consequent hypertension were not realized in the patient whose endograft excluded the native renal arteries.

Preoperative assessment of the aortoiliac anatomy must be pursued cautiously. Those patients with normal renal function usually are able to tolerate iodinated contrast for arteriographic studies or CT scans. However, those with compromised renal function are at increased risk for contrast-related nephropathy.\(^{11}\) In these circumstances, preoperative arteriograms or CT scan studies and arteriographic monitoring during the endovascular intervention itself are best performed with gadolinium as the contrast agent.\(^{16}\) Gadolinium has been shown to be safe for catheter-based arteriography in patients with azotemia and with renal transplants and in these unusual circumstances should be considered an alternative contrast agent.\(^{12,14-16}\) Follow-up imaging studies should include routine CT scans with contrast. In those patients with renal insufficiency, postoperative imaging and treatment of endoleaks should be performed with ultrasonography or magnetic resonance angiographic studies.

This experience supports the tenet that patients with a renal transplant may safely undergo endovascular treatment of an AAA. Four other renal transplant recipients are known to have undergone successful endovascular repair of AAAs, all with non-Food and Drug Administration-approved grafts, none treated in the United States. Three patients had been treated in Europe—two received Vanguard grafts (Boston Scientific, Natick, Mass)\(^{17,18}\) and one received a Talent graft (Medtronic AVE).\(^{19}\) A fourth patient in Canada was treated with a Talent graft.\(^{20}\) Endovascular treatment of AAAs in patients with functioning kidney transplants provides a useful alternative to open AAA surgery.

REFERENCES


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