Endovascular Abdominal Aortic Aneurysm Repair in Patients with Renal Transplants: Reports of Two Cases

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The artery and vein of the transplanted kidney are generally anastomosed to the external iliac artery and vein, respectively. Therefore, in open abdominal artery aneurysm (AAA) repair in renal transplant patients, kidney ischemia due to a proximal aortic clamp is a serious problem. We successfully performed endovascular aneurysm repair (EVAR) of AAA without aortic clamping in two renal transplant recipient cases. The two patients were diagnosed with large AAAs following the renal transplant, and EVAR was performed. To protect the renal function, we used N-acetylcysteine premedication and hydration before the operation, and we could then reduce the iodine contrast medium by using echography of the artery during the operation. In this report, a case where EVAR with renal function protection is a useful treatment for renal transplant recipients with AAA is described.

Keywords: renal transplantation, abdominal aortic aneurysm, endovascular surgery, contrast-induced nephropathy, renal artery occlusion

Introduction

Recently, the number of renal transplants is increasing in Japan. Recipients are surviving longer with advances in immunosuppressive therapy. The diabetic, hypertensive, and hyperlipidemic side effects of immunosuppressant promote vascular disease in these recipients. The renal artery and vein of the transplanted kidney are usually anastomosed to the external iliac artery and vein, respectively. Therefore, during open abdominal artery aneurysm (AAA) repair in renal transplant patients, renal ischemia due to a proximal aortic clamp is a serious problem. We hereby report two cases of endovascular aneurysm repair (EVAR) in patients with transplanted kidneys for whom renal ischemia could be avoided.

Case Report

Case 1

A 76-year-old man with previous renal transplant was admitted for a large AAA in 2010. He had originally developed renal failure due to a polycystic kidney. He had undergone renal transplantation from his wife and removal of the bilateral kidneys in 1990. He continued taking steroid and immunosuppressant (methylprednisolone and cyclosporin). He could temporarily stop hemodialysis, but had to be dialyzed again, because his renal function had gradually worsened due to chronic rejection since 2010. Laboratory studies showed a serum creatinine (s-Cr) of 2.5 mg/dl, estimated glomerular filtration rate (eGFR) of 11.8, D-dimer of 10.6 μg/ml, and fibrin
degradation products (FDP) of 15.3 μg/ml. Enhanced computed tomographic angiography (CTA) indicated a 60 mm AAA, 30 mm right internal iliac artery aneurysm, and artery of the transplanted renal allograft anastomosed to the right external iliac artery. The internal diameter of right common iliac artery was 24 mm and there were many calcifications and mural thrombi in this area. Between right iliac artery bifurcation and the site of renal artery of the transplanted kidney, which is end-to-side with the right external iliac artery. The internal diameter of iliofemoral artery was 8 mm and larger (Fig. 1A). Under these conditions, we performed EVAR and coil embolization of the right internal iliac artery to minimize renal dysfunction of the transplanted kidney due to aorta cross clamping, because hemodialysis had been reintroduced to the patient, but he could produce urine. We used a Cook Zenith (Cook Medical Inc., Bloomington, Indiana, USA) device. The main device (20Fr Z-Trank Introduction System) was introduced through the right common femoral artery. The proximal landing zone was under the superior mesenteric artery branch due to bilateral removal of the kidneys. The right side of the distal landing zone was the right external iliac artery, and the left side was left common iliac artery. During this operation, we did not perform protection of the transplanted renal artery because there were few calcifications and mural thrombi at external iliac artery. There were no endoleaks, although the inferior mesenteric artery was described on CTA after operation (Fig. 1B). After the operation, laboratory values had not deteriorated (s-Cr of 3.12 mg/dl, eGFR of 16.2, D-dimer of 3.8 μg/ml, and FDP of 8.0 μg/ml) and the patient could produce urine.

Case 2

A 61-year-old man with previous renal transplant was admitted for a large AAA in 2011. He had originally developed renal failure due to gout kidney disease. He had undergone renal transplantation from his wife in 2000 and could stop hemodialysis. He continued taking steroid and immunosuppressant (methylprednisolone, mycophenolate mofetil, and tacrolimus). Laboratory studies showed s-Cr of 2.15 mg/dl, eGFR of 25.8, D-dimer of 8.8 μg/ml, and FDP of 14.3 μg/ml. Enhanced CTA revealed an AAA measuring 65 mm in diameter and an artery of the transplanted renal allograft anastomosed to the right external iliac artery. The internal diameter of right common iliac artery was 13.6 mm and left was 12 mm. The internal diameter of bilateral iliofemoral artery was 10 mm and larger (Fig. 2A). We employed EVAR to minimize allograft ischemia. Renal function was protected by means of sufficient hydration and N-acetylcysteine premedication before EVAR procedure, and amount of iodine contrast dye used for angiography was reduced as small as possible by the use of ultrasound for endoleak evaluation during this procedure. The
EVAR for Renal Transplanted Patients

The device used was Zenith flex. The main device (22Fr Z-Trank Introduction System) was introduced through the right common femoral artery. The proximal landing zone was under the renal artery branch. The bilateral distal landing zones were the common iliac arteries. Echography of the artery indicated Type 1a endoleak (Fig. 2B). An additional stent was deployed at the proximal site. In this operation, we did not need to prevent renal allograft ischemia because there were few calcifications and mural thrombi at the external iliac artery. The endoleak disappeared, but the right renal artery was occluded (Fig. 2C). After the operation, laboratory values had not deteriorated (s-Cr of 2.21 mg/dl, eGFR of 25.0, D-dimer of 9.1 μg/ml, and FDP of 15.6 μg/ml) and the patient could produce urine. The right renal artery was occluded, but the blood pressure did not increase. Echography of the artery at 1 week and 3 months after the operation, respectively did not show endoleaks.

Discussion

Recently, the number of renal transplants is increasing in Japan. There were 1484 renal transplants in 2010. It is approximately twice the 749 that were performed in 2000. Recipients are surviving longer with advances in immunosuppressive therapy. The diabetic, hypertensive and hyperlipidemic side effects of immunosuppressants promote vascular disease in these recipients. The artery and vein of the transplanted kidney are usually anastomosed to the external iliac artery and vein, respectively. Therefore, with open AAA repair in patients with renal transplants, kidney ischemia due to a proximal aortic clamp is a serious problem. Open AAA repair in renal transplant recipients using a range of different techniques to protect the transplanted kidney have been reported. Sadat, et al. reported techniques to protect the transplanted kidney as (1) short duration of clamping (under 50 minutes), (2) axillo-femoral artery bypass, (3) aorto-femoral artery bypass, (4) pump oxygenation, (5) cold perfusion and topical cooling, and (6) systemic hypothermia. Although each of these techniques has good results, they complicate the procedure of open repair, and time limitation on the operation, and there are adhesions around the iliac artery and vein. EVAR has been reported as an available treatment that provides a minimally invasive method and avoids ischemia of the transplanted kidney. We have positively selected EVAR if the shape of the AAA of the transplant recipients was indicated in the Instructions for Use (IFU). We then achieved good results with the treatment. However, EVAR has some problems: renal dysfunction due to the iodine contrast medium, ischemia of the transplanted kidney because the stent-graft has to be passed through a narrow access route, and occlusion of the transplanted
renal artery due to the additional treatment of Type 1b endoleaks, or an access route complication, etc. In case of impaired function of the transplanted kidney, the iodine contrast medium may sometimes cause complete renal failure, and then the recipient will need hemodialysis. We can prevent contrast-induced nephropathy by hydration and N-acetylcysteine premedication before the operation. Many reports, that N-acetylcysteine can prevent contrast-induced nephropathy, have been published.\textsuperscript{8–10} N-acetylcysteine is a potent antioxidant that may scavenge a wide variety of oxygen-derived free radicals and may be capable of preventing contrast-induced nephropathy both by improving renal hemodynamic and by preventing direct oxidative tissue damage. N-acetylcysteine is generally given orally at a dose of 600–1200 mg twice a day—on the day before and on the day of administration of the contrast medium—for a total of 2 days.\textsuperscript{9,10} By using echography of the artery for the estimation of endoleaks, we could reduce an amount of iodine contrast medium. Chao, et al. reported the use of carbon dioxide digital subtraction angiography for EVAR to the patients restricted to use iodine contrast medium.\textsuperscript{11} However, the major complications of intestinal infarction, rhabdomyolysis, and neuropathy, etc. were reported,\textsuperscript{12} therefore, we have to select the best method. In case of a narrow access route, the transplanted renal artery may possibly be occluded for a short time by the delivery sheath. In such a case, the main body with a larger delivery sheath has to be inserted through the contra-lateral artery. In such cases, we could introduce the delivery sheath through the right common femoral artery, which was the transplanted kidney side, without any complications, because the external iliac artery was bigger than the delivery sheath, and there were no calcifications or intramural thrombi. If dissection occurred, we also had to deploy a bare stent in the true lumen to avoid low flow. We can avoid arterial flow complications if we properly estimate the access route and deployment site.

There are some problems with EVAR for AAA in renal transplant recipients. However, we consider that this treatment is available if the AAA shape is properly assessed, and the deployment method and sufficient renal protection are properly planned.

**Conclusion**

With the recently increasing number of renal transplants, we consider that the number of AAAs in renal transplant recipients will be increasing. Renal transplant recipients who have any complications have to be treated with a minimally invasive method and without exacerbating renal dysfunction. There are some problems with EVAR for AAA in renal transplant recipients. EVAR for the AAAs of renal transplant recipients is available treatment, if assessment of the size and planning of the deployment method and renal protection (hydration, N-acetylcysteine, premedication, etc.) are properly performed.

**Disclosure Statement**

Shinnosuke Okuma and other co-authors have no conflict of interest.

**Reference**