

Renal Autotransplantation for Complex Renal Arterial Disease: A Case Report

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A renal artery aneurysm in a stenotic renal artery is a rare clinical entity with an incidence of 0.015% to 1% in patients with renovascular hypertension. Interventional stent placement is the first line of treatment for simple aneurysms of the proximal renal artery. However, renal autotransplantation has been used as an alternative treatment for complex lesions and for lesions originating from the distal renal artery. We present a patient with a renal artery aneurysm, renal artery stenosis of the segmental branches of the left kidney, and occlusion of the right renal artery. The surgical strategy included renal explantation, ex vivo renal preservation, ex vivo reconstruction of the 2 renal artery branches, and renal heterotopic autotransplantation. We conclude that renal autotransplantation is a safe and effective surgical procedure for patients with complex renal arterial disease.

Key words: *Complex renal artery aneurysm, Hypertension, Renal autotransplantation*

Introduction

A renal artery aneurysm (RAA) is a rare clinical condition most often discovered incidentally. Its incidence is reported to range from 0.015% to 1% in patients with renovascular hypertension [1, 2], and only 22% of all visceral aneurysms are renal. RAAs are typically single and unilateral. In up to 30% of patients, multiple RAAs are found. The indications for the interventional or surgical repair of an RAA are

evidence of aneurysmal progression or expansion, a maximum aneurysmal diameter of more than 2.0 to 2.5 cm, renovascular hypertension, a dissecting aneurysm, localized symptoms (pain, hematuria), an RAA associated with significant renal artery stenosis, and an RAA with distal embolization [3,4]. Ruptured RAAs are associated with a high mortality rate for both mother and fetus [5].

Ischemic damage to the surgically repaired kidney may occur during the correction of renal vascular lesions. A clamping time of up to 20 minutes has been considered safe, but renal dysfunction and acute renal failure may result from even shorter periods of ischemia [6]. Multiple techniques to protect the kidney from ischemic injury during surgery have been explored, including selective perfusion of the distal renal artery, in vivo preservation, and ex vivo repair [6, 7]. Ex vivo preservation, ex vivo repair, and renal autotransplantation for complex renal vascular disease have been reported in only a limited number of patients. The best technique for renal protection during surgery to correct a vascular pathologic condition is a topic of debate. We present a patient with an RAA, renal artery stenosis of the segmental branches of the left kidney, and occlusion of the right renal artery.

Case Report

A 48-year-old man with a left RAA was admitted to the Department of General Surgery and Transplantation at Başkent University in Ankara, Turkey. His serum creatinine level was 2.2 mg/dL, and he had uncontrolled arterial hypertension (blood pressure, 160/100 mm Hg). Preoperative antihypertensive therapy included the angiotensin-converting enzyme inhibitor enalapril (5 mg/d), the beta-blocker metoprolol (100 mg/d), and the alpha-1 receptor blocker doxazosin mesylate (20 mg/d). The patient's right renal artery was completely occluded. The results of selective renal angiography confirmed the presence of a saccular aneurysm originating from a ventral

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main branch of the left renal artery (Figure 1). The aneurysm extended into 2 segmental arterial branches. The dorsal main branch of the renal artery was free of aneurysmic disease. Because of the morphologic characteristics and the site of the aneurysm, an interventional stent graft placement was not possible, and the patient was scheduled to undergo open surgical repair.



Figure 1. A renal angiogram demonstrating an aneurysm at the bifurcation.

During that procedure, the patient was placed in the supine position. After an ipsilateral Gibson incision was made and retroperitoneal dissection had been performed, the left renal vein and the proximal part of the left renal artery were exposed. After mobilization of the left colon, the left kidney was isolated, and the renal artery branches involving the RAA were prepared. The ureter was gently mobilized. An elongated external iliac artery and a severely atherosclerotic internal iliac artery were identified. The external iliac artery was preferred for anastomosis after dissection. After the renal artery and vein had been clamped, the kidney was explanted and placed in cold (4°C) saline for topical cooling. The kidney was preserved by *ex vivo* perfusion with 500 mL of Bretschneider's histidine tryptophan ketoglutarate (HTK) solution at 4°C (Gustadiol; Dr. F. Kochler Chemie, Alsbach Halhnein, Germany), which was administered over 10 minutes via a small cannula that had been inserted into the renal artery. The diseased portion of the artery was excised. The adjacent edges of 2 renal arteries were sutured together to leave a single opening, and that graft was then anastomosed end

to side to the left external iliac artery. The left renal vein was reanastomosed end to side to the left external iliac vein. Ureteral reimplantation was not performed. The left kidney was repositioned in the left pelvic region. The total time of ischemia was 62 minutes, and the autograft was reperfused homogeneously. Urine production began immediately. The initial function of the autotransplanted left kidney was excellent (urine output, 5.7 L within the first 24 hours after surgery).

The patient was discharged from the hospital on postoperative day 5. The results of control-flow Doppler and renal scintigraphy (Figure 2) performed on that day revealed successful excision of the RAA, no vascular stenosis, and homogenous perfusion of the left kidney.

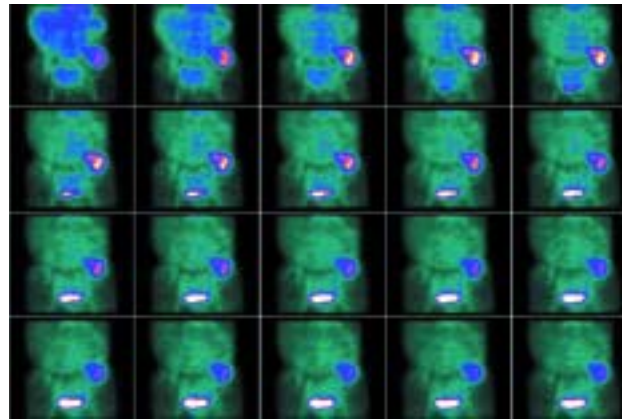


Figure 2. Renal scintigraphy shows normal renal function on day 5.

Postoperatively, the patient's mean arterial blood pressure level remained lower than it had been during the preoperative period (postoperative day 1, 110/70 mm Hg; postoperative day 5, 120/80 mm Hg). The patient's dosage of antihypertensive medication was reduced during the hospital stay. At discharge, his antihypertensive medication consisted only of the alpha-1 receptor blocker doxazosin (20 mg/d). The results of laboratory blood chemistry analyses were within the normal range (serum creatinine level, 1.4 mg/dL; hemoglobin level, 13.8 g/dL). At his 12-month follow-up examination, the patient was completely asymptomatic and demonstrated no complications from having undergone the intervention described. His renal flow was within normal limits on Doppler flow evaluation, and his serum creatinine level was within the normal range. The result of control angiography performed 12 months after surgery revealed a normal vascular system (Figure 3). At the time of this writing, his antihypertensive medication regimen has not been modified.



Figure 3. Control angiography 12 months after transplantation.

Discussion

The traditional treatment of RAA has been surgical repair or nephrectomy. In 1967, Ota and colleagues first performed an ex situ repair of a renal artery damaged by renal vascular hypertension. Recently, interventional approaches using stent grafts have been reported as being both feasible and successful in the treatment of certain types of RAA, such as a saccular aneurysm arising from either the trunk of the main renal artery or from a larger segmental branch [4, 8, 9]. However, the use of interventional therapy is restricted in some patients, such as those who were treated unsuccessfully with PTA, patients with a complex renal vascular disorder, or those with an inflammatory disease such as Takayasu arteritis. Patients deemed suitable for aneurysmectomy and reconstruction are typically treated with a venous interpositional graft. However, complex renal artery malformations involving subsequent segmental branches can be treated only by a time-consuming reconstructive procedure. Our patient had a thrombosed aneurysm in his right renal artery. Thus, preservation of the remaining organ was of utmost interest.

In renal allotransplantation, the kidney is protected from ischemic injury by infusion of a preservation solution via the renal artery. Similar techniques have been applied in renal reconstructive surgery [8, 10]. In vivo perfusion of the kidney is feasible, and reimplantation of the ureter is not necessary.

Ex vivo repair has been used in the resection of renal tumors. Only a few patients with an RAA treated via ex vivo repair have been reported [10, 11]. For

the preservation solution to be infused, we selected Bretschneider's HTK solution, which has been used successfully in Europe during renal, liver, and cardiac allotransplantation. That solution has proven to be superior to Euro-Collins solution and comparable to the University of Wisconsin solution used in renal allotransplantation [12].

A remaining diseased arterial wall may lead to later aneurysmal degeneration in venous patch plasty reconstruction. The potential complications from a standard venous interpositional graft include a mismatch in the diameter of the 3 sequential distal anastomoses and the risk of graft kinking between the distal anastomoses. We preferred an approach using ex vivo preservation and ex vivo repair in our patient, who had a saccular RAA involving segmental artery bifurcation in a solitary kidney. After external iliac artery dissection had been performed, his renal artery was easily anastomosed without an arterial conduit. In conclusion, we suggest that this procedure offers maximum safety for patients who must undergo the ex vivo repair and autotransplantation of a kidney. In atherosclerotic patients, the common, external, and internal iliac arteries dissect during surgery without the appropriate choice of an arterial anastomosis.

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