

# Renal artery reconstruction and kidney autotransplantation for Takayasu arteritis-induced renal artery stenosis

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## ABSTRACT

A young woman with Takayasu arteritis and complex renal artery stenosis in a solitary functional kidney underwent an ex vivo revascularization with autologous saphenous vein graft and renal autotransplantation. Before surgery, she had resistant hypertension and recurrent episodes of acute kidney injury. Two years later, her blood pressure is 123/77 mm Hg, and there have been no acute kidney injury episodes. Computed tomography scan demonstrates no abnormal thickening of the graft despite proximal progression of disease to involve the superior mesenteric artery. As Takayasu arteritis is a progressive disease, use of autologous vein graft, which is unlikely to become involved, is of paramount importance. (*J Vasc Surg Cases and Innovative Techniques* 2019;5:156-9.)

**Keywords:** Takayasu arteritis; Complex renal artery stenosis; Surgical revascularization; Autotransplantation

Takayasu arteritis (TA) is a large-vessel granulomatous panarteritis most commonly diagnosed in middle-aged women of Asian descent. It can involve the aorta and its main branches as well as the pulmonary arteries.<sup>1</sup> When TA affects the renal arteries, it is commonly associated with stenosis, resulting in vascular occlusion and more rarely aneurysm formation because of weakness of the arterial wall.<sup>2</sup> Renal artery involvement often leads to resistant hypertension that is associated with an increased incidence of cardiac failure, stroke, and death. Endovascular interventions and surgical revascularization can successfully salvage renal mass and function, and both are associated with prolonged survival.<sup>3</sup> Which technique to use, however, depends on the complexity of the renal artery disease; simple lesions can be treated with endovascular procedures or open surgical in vivo revascularization, whereas ex vivo repair with orthotopic or heterotopic kidney autotransplantation may be required in cases of more complex lesions.<sup>4</sup> We report a successful case of a complex renal artery revascularization with autologous saphenous vein graft and renal heterotopic autotransplantation in a young woman

with resistant hypertension and a solitary functional kidney. Written consent for this publication was given by the patient.

## CASE REPORT

A 36-year-old woman was diagnosed with TA after undergoing extensive investigations for a persistent right lower lobe pneumonia. Chest computed tomography imaging incidentally demonstrated circumferential thickening of both pulmonary arteries, the abdominal aorta, and the right renal artery with an atrophic kidney. In addition to her young age and typical radiographic features, she had a blood pressure discrepancy between her upper extremities, establishing the diagnosis of TA.<sup>5</sup> Her immunosuppressive regimen consisted of prednisone, mycophenolate mofetil, and methotrexate. Despite being treated with four different antihypertensive agents in maximal doses, her blood pressure remained difficult to control. She experienced several episodes of acute kidney injury (AKI), during the most severe of which her serum creatinine concentration peaked at 6.4 mg/dL. She never required renal replacement therapy.

Surgical revascularization was performed with the goal of long-term preservation of her left kidney mass and function. Before surgery, it was established that her disease was quiescent with normal findings on positron emission tomography scan and inflammatory markers in the context of being systemically well. Preoperative imaging is shown in [Fig 1](#). In the operating room, the left kidney was mobilized, explanted, and cold perfused ex vivo while the left saphenous vein was harvested from the thigh. The renal artery was reconstructed with a reversed saphenous vein graft anastomosed just proximal to the first major bifurcation of the renal artery. This anastomosis was done ex vivo. The left kidney was then transplanted to the right iliac fossa, and the saphenous vein was anastomosed to an arteriotomy in the external iliac artery fashioned with a 5-mm punch. The renal vein was anastomosed to the external iliac vein, and the ureter was reconnected to the bladder. The procedure was done through a midline laparotomy. Doppler ultrasound showed normal renal perfusion immediately after the operation, and the patient started producing urine in the

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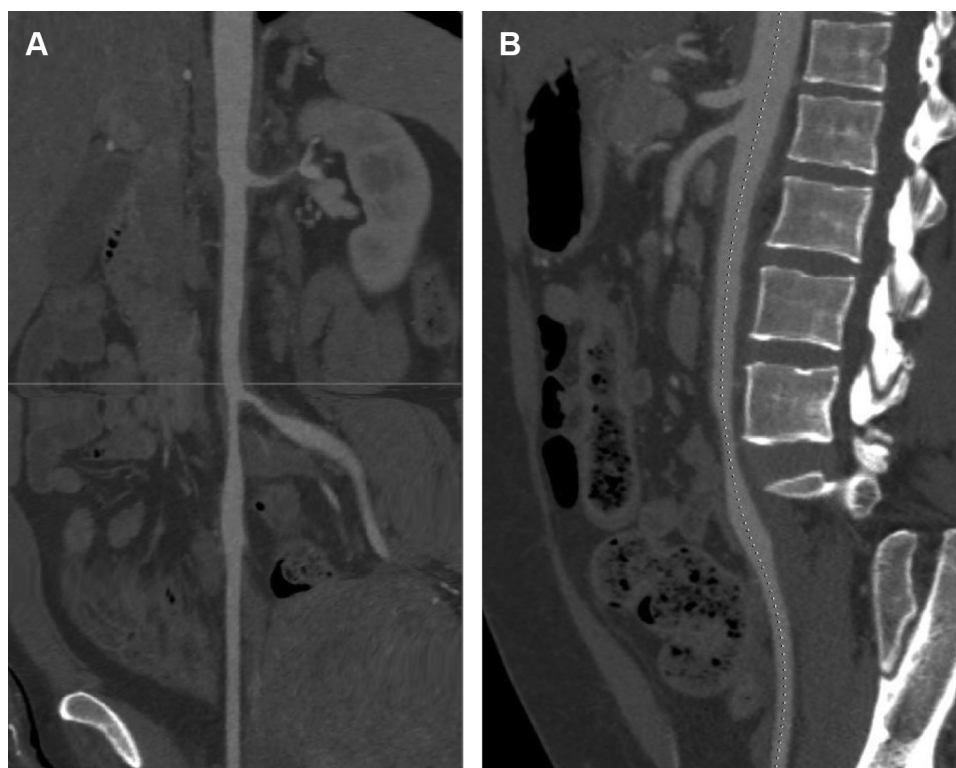
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**Fig 1.** Coronal (A) and sagittal (B) reconstructions of the preoperative computed tomography angiogram demonstrate high-grade stenosis of the left renal artery extending distally to the first major bifurcation and occlusion of the right renal artery. Note the extent of the arterial wall thickening associated with Takayasu arteritis (TA) from the level of the superior mesenteric artery (SMA) to the common iliac arteries.

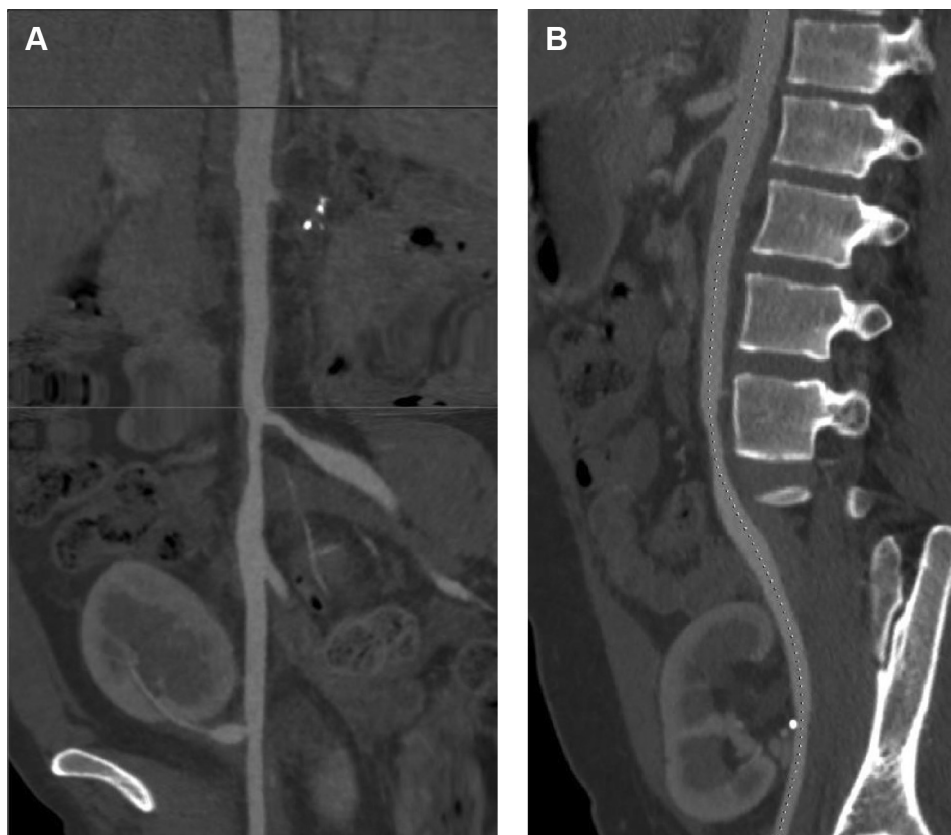
operating room. Postoperative imaging 14 months after surgery demonstrated normal enhancement and vasculature of the transplanted kidney despite significant progression of the aortic thickening of the proximal aorta to involve the superior mesenteric artery (SMA; Fig 2).

Two years later, she has not experienced any further AKI episodes. Serum creatinine concentration is 1.0 mg/dL, and blood pressure is 123/77 mm Hg on lower doses of the four antihypertensive medications. Imaging demonstrates further progression of wall thickening of the aorta proximal to the renal arteries to above the SMA, with almost complete occlusion of the SMA. The saphenous vein graft of the autotransplanted kidney remains normal.

## DISCUSSION

Both percutaneous transluminal renal angioplasty and surgical revascularization are reported as safe and effective methods of blood pressure control and renal function preservation in TA.<sup>3</sup> Whereas endovascular interventions are being increasingly used to treat anatomically complex lesions that involve the distal renal artery or segmental branch vessels, caution must be exercised. Although it is often feasible from a technical standpoint, the results of endovascular repair for complex renal artery lesions are subject to ischemic

complications and uncertain long-term durability. Large case series of complex nonatherosclerotic renal artery disease report better long-term outcomes with an open surgical approach. Ham et al<sup>3</sup> reported outcomes of 79 renal artery interventions in a cohort of patients with nonatherosclerotic renal artery disease, more than half of whom had TA. Open revascularization demonstrated superior 1-year (91% vs 73%) and 5-year (80% and 49%) patency rates compared with endovascular intervention. Another study of 40 patients compared endovascular intervention with open repair of renal artery aneurysms (mostly in the setting of fibromuscular dysplasia). During a mean follow-up of 36 months, both groups had equivalent perioperative outcomes and similar freedom from reintervention. Whereas there was no statistical difference in glomerular filtration rate (GFR) decline between groups during follow-up, the adjusted mixed linear model predicted that the endovascular group would experience a GFR decline of 15 mL/min/1.73 m<sup>2</sup> at 36 months with no change in GFR in the open repair group.<sup>6</sup> Ham and Weaver<sup>7</sup> reported long-term outcomes in 24 ex vivo renal artery reconstructions for complex renal artery disease, of which 3 patients had TA. All patients underwent vascular reconstruction using saphenous vein and orthotopic placement into



**Fig 2.** Coronal (**A**) and sagittal (**B**) reconstructions of the postoperative computed tomography angiogram (14 months) demonstrating the autotransplanted left kidney in the right iliac fossa. The arterial vein graft is anastomosed to the right external iliac artery proximally and one of the arterial branches into the hilum of the kidney distally. Note that the arterial wall thickening associated with Takayasu arteritis (TA) has progressed and extends from above the superior mesenteric artery (SMA) to the common iliac artery, and there is now a severe stenosis of the SMA.

the renal fossa. Overall, primary, primary assisted, and secondary graft patency rate was 94% at 5 and 10 years. In those who were hypertensive, revascularization reduced or cured hypertension in 94%. Kidney function was preserved at 24 months, and renal size and cortical thickness measured by ultrasound remained unchanged at 68 months of follow-up.

In this case, an endovascular technique was not considered because of the complexity of the renal artery lesion. Specifically, the distal extent of the disease process located just proximal to the first major renal artery bifurcation in the renal hilum would not provide an adequate distal landing zone for balloon angioplasty or stent placement without compromising perfusion to one pole of the kidney. Simple surgical bypass was also not considered, given the extent of aortic involvement and the complexity of the lesion. There was reluctance to bypass from the supraceliac aorta because of the fear that the graft would become compromised in the case of TA progression, and a retrograde bypass from the external iliac artery would necessitate a very long graft. Finally, a distal renal

artery reconstruction in situ would have been technically challenging to perform because of the deep position of the kidney and would have resulted in a prolonged warm ischemia time. Ex vivo renal artery reconstruction allowed the performance of a more technically challenging anastomosis with ideal surgical exposure; autotransplantation to the pelvis allowed use of a very short vein graft and relocation of the proximal anastomosis to a site unaffected by vasculitis. If arterial stenosis develops proximal to the anastomosis in the future, an endovascular intervention, such as angioplasty and stenting of the iliac artery, can be performed with more ease and lower risk than if the graft originated from the supraceliac aorta.

## CONCLUSIONS

In young patients with complex renal artery lesions secondary to TA and severe comorbidities including resistant hypertension and recurrent AKI episodes, a definitive management strategy is necessary to preserve remaining renal mass and function. In these cases, an open surgical technique and autologous vein graft are

avored to maximize long-term outcomes and should be considered the definitive modality of choice in these patients.

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