Chronic Total Occlusion and Successful Drug-Eluting Stent Placement in Takayasu Arteritis–Induced Renal Artery Stenosis

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Abstract

Takayasu arteritis-induced renal artery stenosis (TARAS) is a condition rarely described in the literature. Although percutaneous transluminal angioplasty and stenting has been well-described in the treatment of atherosclerotic renal artery stenosis, its role has not been established in non-atherosclerotic TARAS. We report a case of a female, age 17 years, with Takayasu arteritis who presented to the hospital with seizures and hypertensive crisis. A renal angiogram showed chronic total occlusion (CTO) of the left renal artery. Renal angioplasty and stenting was successfully performed after multiple attempts to deliver a wire distal to the CTO. After sequential balloon predilation, a drug-eluting stent was deployed, resulting in full reperfusion of the kidney. The patient’s blood pressure improved dramatically, and patency of the stent was demonstrated with magnetic resonance angiography over 9 months after the procedure.

Keywords: Hypertension, renovascular; Renal artery stenosis; Takayasu arteritis;
Takayasu arteritis (TA) is a rare, nonspecific granulomatous inflammatory arteritis that affects large and medium sized arteries with an incidence of 2.6 cases per million persons per year.\textsuperscript{1} It was first described in Japan in 1908 and has subsequently been referred to as “pulseless” disease because of involvement of the brachiocephalic arteries and absence of radial pulses.\textsuperscript{2} Renal artery stenosis that is predominantly atherosclerotic in nature is estimated to affect 1\% to 5\% of individuals with hypertension.\textsuperscript{3} There is an increase in prevalence in elderly patients, as well as in those with coronary artery disease and peripheral vascular disease. Takayasu arteritis-induced renal artery stenosis (TARAS) has been described in the literature in case series primarily from Asia.\textsuperscript{2} Its incidence is unknown, but it is exceedingly rare, especially in North America. Endovascular treatment including primary angioplasty and stent placement could represent a viable option, especially if the patient is not exhibiting objective findings of a pro-inflammatory state. We report the treatment of a chronic total occlusion of the left renal artery in a patient with TARAS with a drug-eluting stent.

**Case Report**

A young woman, aged 17 years, with a known history of Takayasu arteritis was diagnosed 4 months prior after a significant difference was found in the systolic blood pressure in her upper extremities during a school physical examination. She also noted symptoms of left arm claudication for several months prior for which she had magnetic resonance imaging/angiography (MRI/MRA) demonstrating occlusion of the left subclavian artery with distal reconstitution, in addition to medial wall thickening of the descending thoracic and upper abdominal aorta and superior mesenteric artery. The patient did meet at least three of the six criteria based on the American College of Rheumatology classification criteria of age $\leq$40,
claudication of extremity, and arteriographic narrowing of the aorta or any of its primary branches. She met criteria for a diagnosis of Takayasu arteritis and was started on prednisone and methotrexate. At that time it was noted that her right kidney was 11.0 cm in length and the left kidney was 9.5 cm.

The patient presented to our hospital and was admitted with generalized seizures and hypertensive crisis (blood pressures 200–260/100–140 mgHg). Brain MRI showed posterior reversible encephalopathy syndrome, and abdominal MRA demonstrated circumferential thickening of the thoracic aorta, superior mesenteric artery, and two patent right renal arteries. The left renal artery could not be visualized clearly, with a questionable focal stenosis at the ostium.

The patient underwent renal angiogram via right transfemoral approach using a 6Fr pigtail catheter, and 20ml of contrast was injected at 20ml/sec by pressure injector. This confirmed two patent right renal arteries but no left renal artery (figure 1a). Selective cannulation with a 4Fr renal double curve (Merit Medical) catheter was unsuccessful, but a small stump off the aorta was located (figure 1b). A CPS Venture™ wire control catheter (St. Jude Medical) was then used after multiple attempts to successfully engage and pass a 0.014-inch Cougar® LS wire (Asahi Intecc) distal to the chronic total occlusion (CTO) (figure 1c). Sequential balloon dilatation with a 2.0 x10mm Mini-TREK™ coronary balloon (Abbott) showed reperfusion of the renal artery (figure 1d); therefore, a 2.5 x10mm balloon was inflated again at the ostium. A 3.0 x 28mm Xience® drug-eluting stent (Abbott) was then deployed in the ostial proximal and mid-portion of
the renal artery (figure 1e) and expanded with a 3.0 x 20mm Mini-TREK™ balloon, resulting in 0% residual stenosis and full reperfusion of the kidney (figures 1f).

On admission the patient had required a nitroglycerine drip to control her blood pressure and was switched to four oral anti-hypertensives. Forty-eight hours after the procedure, throughout her hospital stay and 12-months after the intervention, the patient had well-controlled blood pressures on only two medications. Her creatinine levels had been normal pre- (0.78 mg/dl; ref values 0.55-1.05 mg/dl) and post-intervention (0.81 mg/dl) respectively. Of note, the patient’s erythrocyte sedimentation rate and C-reactive protein were in the normal range before the procedure, which allowed for use of a stent (table 1). MRA of the left renal artery, including maximum intensity projections, was done 9 months after the procedure and demonstrated patent stent without restenosis (figures 2a and 2b). The patient was continued on aspirin and clopidogrel during this time.

Discussion

As Takayasu arteritis is an uncommon disease in North America, there is a paucity of literature about treating its complications such as renal artery stenosis. Data regarding primary outcomes and endovascular procedures to treat TARAS are limited, with only three reported studies from India.5-7 In one study of 20 patients who underwent 33 angioplasty procedures to treat TARAS, Sharma et al5 reported a technical success rate of 85%, with clinical blood pressure improvement in 82%. Selective angiographic follow-up at a mean of 8 months demonstrated recurrent stenosis in 21%. A follow-up experience from Sharma et al6 described results in 62 patients with TARAS. Immediate technical success and positive blood pressure response was 95% and 89%,
respectively. Cure of hypertension was demonstrated in 23% of patients. Mean follow-up was 22 months, and a recurrent stenosis rate of 16% was angiographically documented in patients with recurrent hypertension. The degree of blood pressure response was not provided, and discussion of renal function and cardiac function was not included. Tyagi et al\textsuperscript{7} studied 54 patients with 75 renal lesions from TARAS. An 89% technical success rate was reported, and a 14% recurrent stenosis rate was documented at 14 months of follow-up.

In one of the largest studies to date, Weaver et al\textsuperscript{2} reported that among 40 interventions on TARAS patients, only 2 had percutaneous transluminal angioplasty. Most patients had bypass or implantation procedures. There have been no studies reporting the use of drug-eluting stents in TARAS. This needs to be tempered by the role of pro-inflammatory states and complications of in-stent restenosis and stent thrombosis.\textsuperscript{8} A variety of biomarkers have been studied (matrix metalloproteinase [MMP-2, MMP-9], pregnancy-associated plasma protein A [PAPPA], plasminogen activator inhibitor-1 [PAI-1], C-reactive protein [CRP]) including genetic biomarkers (toll-like receptor-2 [TLR-2], p27kip1 gene) of which CRP has been studied the most. It seems that serum CRP levels correlate best with acute stent thrombosis in drug-eluting stents. In our patient, who received a drug-eluting stent, CRP levels were not elevated; therefore, we were confident placing a stent in this case.\textsuperscript{9,10}

The aforementioned studies reported intervention in stenotic TARAS. In this case, a unique approach to recanalizing a chronic total occlusion with a drug-eluting stent in TARAS has been described for the first time. Durable results without restenosis over 9 months after the procedure has been demonstrated.
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References


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Table 1. Patient’s laboratory results and blood pressures prior to, day of, and after procedure

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BP, blood pressure; Na, sodium; K, potassium; Cr, creatinine; HCO3, bicarbonate; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate
Figure Legends

Figure 1. (a). Patent two right renal arteries (arrows) but no visible left renal artery on aortogram. (b). Selective angiography showed small stump off aorta (arrow). (c). Wire passed through distal to chronic total occlusion (arrow). (d). Dilatation with smaller diameter balloon showed reperfusion. (e). Deployment of drug-eluting stent (arrow). (f). Images of stent expanded with balloon and full reperfusion.
**Figure 2.** (A). Magnetic resonance angiogram (MRA) with maximum intensity projection demonstrating cobalt chromium stent (black) with perfusion post stent. (B). MRA cross sectional view demonstrating stent patency