Percutaneous Mechanical Thrombectomy and Pharmacologic Thrombolysis for Renal Artery Embolism: Case Report and Review of Endovascular Treatment

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ABSTRACT

Renal artery embolism (RAE) is an uncommon event that is associated with a high rate of renal loss. We present a case of RAE to a solitary kidney that was treated with combined percutaneous rheolytic thrombectomy, intra-arterial thrombolysis, and supplemental renal artery stent placement.

KEYWORDS: Renal artery embolism, AngioJet, rheolytic thrombectomy, thrombolysis

Renal artery embolism (RAE) is a rare event¹ and is associated with high risk of hypertension and renal loss.¹ It has been traditionally treated using open surgical techniques such as embolectomy, thrombectomy, and aortorenal bypass.^{1,2} Although effective, open surgery can be associated with significant morbidity and mortality.² With advances in endovascular technology, percutaneous intra-arterial chemical and mechanical thrombolysis have become widely available therapeutic alternatives in the management of peripheral arterial occlusion. We present a case of RAE that was treated successfully using a combination of endovascular techniques including intra-arterial chemical thrombolysis, rheolytic mechanical thrombectomy, and stent placement.

CASE REPORT

A 68-year-old woman presented with a 2-month history of gradual worsening of hypertension and renal function.

Her blood pressure was poorly controlled despite three antihypertensive medications. The creatinine level had increased to 1.9 mg/dL from her usual baseline of 1.2 mg/dL. Gadolinium-enhanced magnetic resonance angiography (MRA) revealed a high-grade left renal artery stenosis and an atrophic right kidney. Initial aortography revealed an irregular, atherosclerotic plaque in the supra-renal aorta, and renal angiography revealed a high-grade stenosis secondary to an embolus lodged within the proximal 2 cm of the left renal artery (Fig. 1). In an attempt to recanalize the renal artery, 50 mg of recombinant tissue plasminogen activator was directly administered into the renal artery embolus through a multiple-hole infusion catheter. This resulted in improved, antegrade flow but incomplete recanalization (Fig. 2). Residual emboli were extracted using rheolytic mechanical thrombectomy (AngioJet catheter; Possis Medical Inc, Minneapolis, MN). Due to mild residual mural thrombus and an associated moderate residual stenosis, a P-154 Palmaz stent (Cordis, Johnson & Johnson International

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Figure 1 Angiography revealed a high-grade stenosis caused by an embolus lodged in the proximal left renal artery.

Systems, Warren, NJ) was placed over the lesion, and angioplasty was performed using a 5×40 mm balloon (Fig. 3). Distal embolic protection was not used during the procedure, and there was no evidence of distal embolization on completion angiography. Visipaque (iodixanol, GE Healthcare, Piscataway, NJ) (contrast (45 cc) was used. Carbon dioxide and gadolinium were not used. Transthoracic echocardiogram showed no evidence of cardiac thrombus. Her postprocedure creatinine level

increased and stabilized at 3.0 mg/dL, most likely secondary to contrast-induced nephropathy. Due to suspicion of renal emboli from atherosclerotic plaque and thrombus in the aorta, the patient was anticoagulated with heparin and was transitioned to oral anticoagulation using Coumadin (warfarin sodium, Bristol-Myers Squibb, New York, NY) on discharge. She was continued on 81 mg aspirin. The control of her hypertension improved, and her antihypertensive medication was

Figure 2 Residual mild renal artery stenosis was noted after the embolus was extracted using an AngioJet thrombectomy catheter.

Figure 3 Completion angiography revealed a patent left renal artery after stent placement.

reduced from three agents to Lopressor (metoprolol, Novartis, Basel, Switzerland) and captopril. Follow-up duplex ultrasound confirmed a widely patent renal artery without hemodynamically significant stenosis. The patient was scheduled for close follow-up using serial renal duplex of her solitary kidney.

DISCUSSION

RAE is a relatively rare condition^{1,3} usually caused by distal embolization from a cardiac source in the setting of atrial fibrillation.⁴ Other risk factors include heart failure, valvular disease, and hypercoagulable states.^{3,5} The clinical presentation of RAE can be variable. Some patients present acutely with abdominal or flank pain and elevated blood pressure.^{3,5} Others present subacutely with poorly controlled chronic hypertension and worsening renal function.⁶ Diagnosis is often delayed due to nonspecific symptoms and can be made using duplex ultrasound, computed tomography scan with contrast,

gadolinium-enhanced MRA, or renal artery angiogram.⁴⁻⁶

The traditional treatment for RAE has been anticoagulation and open surgery.^{1,2,6} Open surgical revascularization includes open embolectomy and/or aortorenal bypass.² Although effective in restoring renal function and improving blood pressure control, open surgery can be associated with significant morbidity and mortality.² In parallel with advances in endovascular technology, percutaneous intra-arterial thrombolysis and mechanical thrombectomy have been used to treat RAE. Intra-arterial thrombolysis for treatment of RAE was first reported in 1981.⁷ Since then, multiple reports have been published describing successful percutaneous thrombolysis in the treatment of RAE and renal artery thrombosis⁸⁻²³ (Table 1). Bleeding is the most worrisome complication of intra-arterial thrombolysis, and severe complications including intracranial bleeding and hemorrhagic stroke have occurred in up to 6% of patients.²⁴ The decision to perform thrombolysis in

Table 1 Case Series of Intra-Arterial Thrombolysis in the Treatment of RAE (Studies with More than Three Patients)

Author	Year	Agent	Number of Patients	Complications
Cronan and Dorfman ⁹	1983	Streptokinase	3	None
Salam et al ¹⁶	1993	Streptokinase, urokinase	10	20%; one mesenteric embolism and one renal artery thrombosis
Blum et al ¹⁷	1993	NR	14	NR
Piffaretti et al ²³	2008	Urokinase	4	50% minor complication; pulmonary edema and urinary tract infection

RAE, renal artery embolism, NR, non-reported.

Table 2 Case Reports of Percutaneous Mechanical Thrombectomy in the Treatment of RAE

Author	Year	Number of Patients	Procedure	Complications
Greenberg et al ²⁹	2002	1	Balloon angioplasty, AngioJet thrombectomy, thrombolysis (rTPA)	None
Siablis et al ³⁰	2005	1	AngioJet thrombectomy, thrombolysis (urokinase)	None
Syed et al ^{32,*}	2010	2	Power-pulse spray AngioJet thrombectomy (rTPA)	None

rTPA, recombinant tissue plasminogen activator.

*Total of two cases; one patient after endovascular abdominal aneurysm repair.

RAE should be individualized to different patients, and both absolute and relative contraindications to thrombolysis should be taken into account. Mechanical rheolytic thrombectomy has been used for treatment of acute limb ischemia,²⁵ pulmonary embolism,²⁶ deep venous thrombosis²⁷ and dialysis access complication.²⁸ As with our patient, percutaneous rheolytic thrombectomy using the AngioJet catheter has been used successfully by others to treat RAE and thrombosis^{29–31} (Table 2). The AngioJet thrombectomy device relies on a high-pressure saline jet passing from the tip of catheter, then up the catheter shaft to the external system to create a low-pressure zone at the catheter tip to facilitate thrombus extraction. Adjuvant procedures such as intra-arterial thrombolysis, balloon angioplasty, and renal artery stent have been used during percutaneous thrombectomy of RAE.^{29–31} More recently, rheolytic pharmacomechanical thrombectomy has been used to successfully treat acute RAE.³²

Complications of endovascular treatment of RAE are reported to occur in up to 3% of cases³³ and include access site complications, distal embolization, arterial rupture, cardiac events, and death.³⁴ The renal parenchyma is intolerant of distal embolization, and efforts to minimize this complication during renal artery intervention are of paramount importance, particularly in patients with impaired renal function or a solitary functioning kidney. The presence of a bulky thromboembolus with possible coexisting fresh thrombus placed our patient at high risk of distal embolization. Although pharmacologic thrombolysis may have a limited effect on subacute embolic material, it can often remove sufficient thrombus to allow for safe passage of adjunctive devices for further intervention. Other techniques to minimize distal embolization include distal protection using a variety of devices that are used in coronary and carotid interventions.³⁵ Familiarity with a wide spectrum of available endovascular devices and techniques optimizes the likelihood of successful recanalization of renal artery in these challenging situations.

CONCLUSION

RAE is rare but can be associated with a high risk of renal loss. Percutaneous interventions including intra-

arterial thrombolysis and mechanical thrombectomy can be used effectively to treat renal artery thromboembolism.

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