Renal Embolization During Thrombolysis of Complete Aortic Occlusion Treated With Renal Thrombolysis

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ABSTRACT: Renal arterial embolism is a potential complication of thrombolytic therapy for total infrarenal aortic occlusions. We report such a case of renal embolization treated successfully with endovascular isolation of the kidney and thrombolysis. We conclude that aortic thrombolysis should only be used in the presence of a transocclusive flow channel and that isolated renal thrombolysis is a viable treatment for acute renal arterial embolism.

VASCULAR DISEASE MANAGEMENT 2014;11(6):E136-E140

Key words: renal artery stenosis, pseudoaneurysm, stenting, complications, balloon angioplasty

Chronic abdominal aortic occlusion remains a challenging problem for the vascular surgeon. Aortic occlusion may be approached via traditional open techniques or through more recently described endovascular means. An integral component of the endovascular armamentarium is pharmacologic thrombolysis, wherein lytic agents (e.g. recombinant tissue plasminogen activator) are used to reduce the occlusive lesion prior to recanalization techniques utilizing percutaneous balloon angioplasty (PTA) and stent placement. Renal dysfunction has been demonstrated in up to 16% of patients undergoing this procedure and may be related to thromboembolism of the main renal artery or intraparenchymal branches. Acute thromboembolism mandates intervention to preserve renal function. Its treatment with catheter-directed thrombolysis has been previously described. Indeed, catheter-directed thrombolysis has been extensively used for the treatment of peripheral arterial thromboembolism but is critically limited by the entry of the lytic agent into the systemic circulation and consequent hemorrhage. To reduce this risk, a variant of isolated limb perfusion, a well-established oncologic technique used to limit the systemic toxicity of chemotherapeutic agents by localizing their presence to the target limb, may be employed. Isolated limb perfusion with lytic agents for acute limb ischemia has been described in animal models and scattered human...
case reports. To our knowledge, however, isolated thrombolysis of a kidney has never been described. We report a case of pharmacologic thrombolysis of a chronic infrarenal abdominal aortic occlusion resulting in acute renal failure from proximal renal embolization successfully treated with isolated lytic therapy to both kidneys. Evaluation of this case has led to alterations in our endovascular approach to treating patients with chronic aortic occlusions.

**CASE REPORT**

A 52-year-old female presented for evaluation of a 5-year history of worsening severe bilateral lower extremity claudication. During evaluation for this complaint, she was noted to have a large, ultimately benign, pelvic mass that required an extensive resection. She represented after resection with continued complaints of life-limiting Claudication, and she was able to ambulate no more than 200 feet without severe symptoms.

Aortography demonstrated complete infrarenal aortic occlusion with high-grade bilateral renal artery stenosis, right greater than left, with retrograde filling of both external iliac arteries (Figure 1). Our practice is to initially perform pharmacologic thrombolysis prior to performing PTA and stent placement in order to facilitate recanalization. Access was achieved through the left brachial artery. Initial attempts at obtaining access across the aortic occlusion via a transbrachial approach were unsuccessful. A 5 cm infusion catheter was then placed into the occlusion, with a small length above the renal arteries, and tissue plasminogen activator (tPA) 0.5 mg/hr was infused for thrombolysis along with heparin 500 u/hr through the sheath.

Six hours after initiation of lysis, the patient became acutely oliguric and hypertensive. Given her hypertension and low fibrinogen level (50 mg/dL), thrombolysis was stopped. There was concern about the potential for retrograde propagation of the aortic thrombus with concomitant thrombosis of the renal arteries. The patient was taken urgently to the operating room where an aortogram demonstrated no increase in aortic thrombus and patent renal arteries; however, there were no nephrograms, indicating lack of renal parenchymal perfusion (Figure 2A). This was presumably secondary to microemboli from ongoing lysis. At this point the right femoral vein was cannulated and a 10 mm x 4 cm balloon was used to occlude the right renal vein. The ipsilateral renal artery was then similarly occluded with a 5 mm x 4 cm balloon and a total of 10 mg of tPA was infused distally into the kidney over 20 minutes. Thereafter the venous balloon was deflated and the kidney flushed with heparinized saline and nitroglycerin 200 mcg. The arterial balloon was let down. An identical procedure was

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**Figure 1.** Aortogram prior to intervention demonstrating total infrarenal aortic occlusion with bilateral renal artery stenosis (arrows).
then performed for the contralateral kidney. Completion angiogram demonstrated significantly improved renal parenchymal blood flow (Figure 2B). A wire was then passed through the aortic occlusion into the right external iliac artery. Balloon angioplasty of the aorta and right common iliac artery was used to dilate the flow channel. A 20 cm infusion catheter was placed through the flow channel with 5 cm above the renal arteries. Thrombolysis was initiated again with tPA 0.5 mg/hr.

The following day the patient was brought back to the operating room for imaging follow-up. A series of balloon-expandable covered stents were deployed within the aorta and bilateral common iliac arteries. Nitinol stents were placed in the external iliac arteries because of the extensive stenosis. There was significant persistent right renal artery stenosis, which was treated with a balloon-expandable stent. Completion aortogram demonstrated a patent aorta, renal arteries, and iliac system bilaterally, with easily visible nephrograms (Figure 3A, 3B).

Despite reestablishment of renal blood flow, the patient developed anuric acute renal failure. Her preoperative serum creatinine was 0.89 mg/dL; it was 4.97 mg/dL on the day after her final operation, and she was started on hemodialysis. Within 3 months of discharge, the patient recovered her renal function and no longer required dialysis. At her 9-month follow-up the patient was able to walk one mile without claudication; her left and right ankle-brachial indices were 1.01 and 1.03, respectively. Her serum creatinine at that time was 2.4 mg/dL.

**DISCUSSION**

Abdominal aortic occlusion has been historically treated with aortobifemoral bypass. Alternative treatments have included aortic endarterectomy and, for high-risk patients, extraanatomic bypass. McDaniels's metaanalysis of 4302 patients undergoing aortobifemoral bypass for
aortoiliac occlusive disease demonstrated 1-year and 5-year primary patencies of 92% to 98% and 82% to 92%, respectively, with a mean 30-day mortality of 3.1%. In contrast, several groups employing endovascular therapy of aortic occlusions have reported 0% 30-day mortality. Primary patency has also been impressive. Moise et al reported on a group of 31 patients with Transatlantic Intersociety Consensus (TASC) D aortoiliac occlusions that underwent balloon angioplasty and stenting with selective thrombolysis. The primary patency at 1 and 3 years was 85% and 66%, respectively, and the secondary patency rates were 100% and 90%. Treatment of patients with less severe TASC classes has yielded even better results. Irrespective of specific results, it is clear that endovascular therapy offers the possibility of safe and possibly quite durable results for aortic occlusive disease. Thrombolysis, however, has been a controversial component of this therapy given that it alone is nearly always inadequate and that cases of angioplasty and stenting without lysis have been successfully reported as noted above. Proponents argue, however, that in cases of juxtarenal thrombus, lysis may be necessary to facilitate angioplasty and stent placement as it clears the juxtarenal segment of the aorta from thrombus burden, allowing the underlying primary atherosclerotic occlusive lesion to be treated. In our case the inability to cross the aortic occlusion mandated the use of thrombolysis to assist in recanalization. Unfortunately, the lack of a flow channel also led to embolization of thrombus fragments that had pooled above the occlusion to the kidneys. This complication was effectively treated with lytic therapy to each kidney after achieving vascular isolation via balloon occlusion of the renal vein and artery. It does, however, demonstrate the likely etiology of renal insufficiency and failure that has been identified in up to 16% of patients undergoing aortic thrombolysis. To overcome this problem, we believe it is necessary to establish a flow channel, in cases of complete aortic occlusion, prior to

Figure 3. Angiogram demonstrating restoration of infrarenal aortic patency (A) and improvement in renal parenchymal blood flow along with right renal artery stent placement (B).
initiation of thrombolysis. Currently, we typically gain access across the occluded aorta and establish a flow channel by performing PTA with a smaller diameter (i.e. 4 mm or 5 mm) balloon. If transocclusive access cannot be established, then the procedure should be terminated and alternative means of revascularization should be considered.

CONCLUSION

We conclude that aortic thrombolysis should only be used in the presence of a transocclusive flow channel and that isolated renal thrombolysis is a viable treatment for acute renal arterial embolism.

Editor’s Note: Disclosure: The authors have completed and returned the ICMJE Form for Disclosure of Potential Conflicts of Interest. The authors report no conflicts of interest regarding the content herein.

Manuscript received June 1, 2013; provisional acceptance given July 29, 2013; final version accepted January 15, 2014.

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