Coil embolization of ruptured distal renal artery pseudoaneurysm with gross hematuria and hemorrhagic shock

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ABSTRACT

Renal artery pseudoaneurysms have been infrequently reported in the literature. In the present report, we have described a case of a ruptured renal artery pseudoaneurysm requiring coil embolization. A 49-year-old man had presented to our institution with a hypertensive emergency. Computed tomography revealed a 3.4-cm right renal artery pseudoaneurysm. Nonemergent coil embolization was planned for the following day. However, he became hypotensive, exsanguinating frank blood from the urethra. An arteriogram showed extravasation of contrast into the pseudoaneurysm sac, renal pelvis, and ureter, consistent with intrarenal pseudoaneurysm rupture. We have demonstrated coil embolization as a method of repairing a ruptured renal artery pseudoaneurysm with gross hematuria. (J Vasc Surg Cases Innov Tech 2022;8:210-3.)

Keywords: Hematuria; Renal artery embolization; Renal artery pseudoaneurysm

The incidence of renal artery pseudoaneurysm is unknown, given that it is often asymptomatic.[1] When symptomatic, renal artery pseudoaneurysms can result in flank pain, hematuria, perinephric hematoma, abdominal mass, and/or hypertension.[2] Renal artery pseudoaneurysms are caused by iatrogenic or traumatic penetrating injuries, blunt trauma, and inflammatory disease.[3-5] Pseudoaneurysms form when injury to the arterial wall has occurred, resulting in a perfused hematoma in communication with the arterial lumen.[2] Pseudoaneurysms rupture when the hematoma dissolves and the connection between the arterial lumen and extraluminal space is reestablished.[6] Treatment is critical, because a ruptured pseudoaneurysm can result in hypovolemic shock and death.[1,2,4] The use of endovascular interventions, such as coil embolization and covered stents, has resulted in decreased morbidity and mortality compared with open surgical repair.[2,7] Treatment should be pursued once a renal artery pseudoaneurysm has been identified.[6]

Renal artery pseudoaneurysms resulting from renal procedures can cause delayed hematuria, which will often present days or weeks after the penetrating renal artery injury.[8,9] Delayed hematuria has been defined as the occurrence of gross hematuria after hospital discharge, often within the first 1 to 3 months after surgery or trauma.[10-12] In the present report, we have described a case of a ruptured renal artery requiring coil embolization in a patient with hemorrhagic shock. The patient provided written informed consent for the report of his case details and imaging studies.

CASE REPORT

The patient was a 49-year-old man with end-stage renal disease requiring hemodialysis, atrial fibrillation, coronary artery disease, and heart failure with a reduced ejection fraction (30%). He also had a complex vascular surgery history that included occluded aortobifemoral bypass, occluded femoral–femoral bypass, a patent right axillofemoral bypass, and left above-the-knee amputation. One month before the current event, he had presented to an outside hospital with acute embolic occlusion of the right renal artery. Endovascular lysis and thrombectomy were performed because he had had stage 3 chronic kidney disease and did not yet require dialysis.

However, 1 month later, his renal disease had progressed, and he presented to the same hospital with right flank pain and hematuria. A computed tomography angiogram of the abdomen and pelvis showed multiple renal infarcts and a 3.4-cm pseudoaneurysm of the right renal artery. He was transferred to our institution and admitted because of a hypertensive emergency with systolic blood pressure in the 240s. On admission, he was in atrial fibrillation, had a hemoglobin of 9 g/dL, did not have flank tenderness, and his hematuria had decreased since his initial presentation. Computed tomography demonstrated a 3.4-cm right renal artery pseudoaneurysm (Fig 1).

In the cardiac intensive care unit, he was hemodynamically stable and denied chest pain or shortness of breath. His physical examination did not reveal flank tenderness. Coil embolization was planned for the following day. However, he developed gross

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hematuria, hypotension, tenderness over the abdomen, and bladder distension. A massive transfusion protocol was initiated for class 4 hemorrhagic shock with a hemoglobin of 4.3 g/dL. He was taken emergently to the operating room for coil embolization. Access was obtained through the left brachial artery, and the right renal artery was cannulated. An arteriogram of the right renal artery showed extravasation of contrast from the distal renal artery into the renal pelvis and right ureter, consistent with intrarenal pseudoaneurysm rupture (Fig 2).

We deployed four 14 cm × 10 mm and four 14 cm × 6 mm Nester coils (Cook Medical, Inc, Bloomington, IN) into the renal artery, starting distally and working toward the origin of the right renal artery. We performed coil embolization flush to the aorta (Fig 3). With adequate resuscitation, his hemodynamics improved after embolization, and he was transferred back to the intensive care unit. His postoperative course was complicated by volume overload requiring intubation, pneumonia, right upper extremity cellulitis, and atrial fibrillation. On postoperative day 2, continuous renal replacement therapy was initiated via an internal jugular tunneled dialysis catheter. He underwent atrial fibrillation ablation via pulmonary vein isolation on postoperative day 23. The upper extremity cellulitis had likely resulted from placement of an arterial catheter and was resolved with vancomycin. He remained anuric, requiring hemodialysis, and was discharged home on postoperative day 26 with appropriate follow-up scheduled.

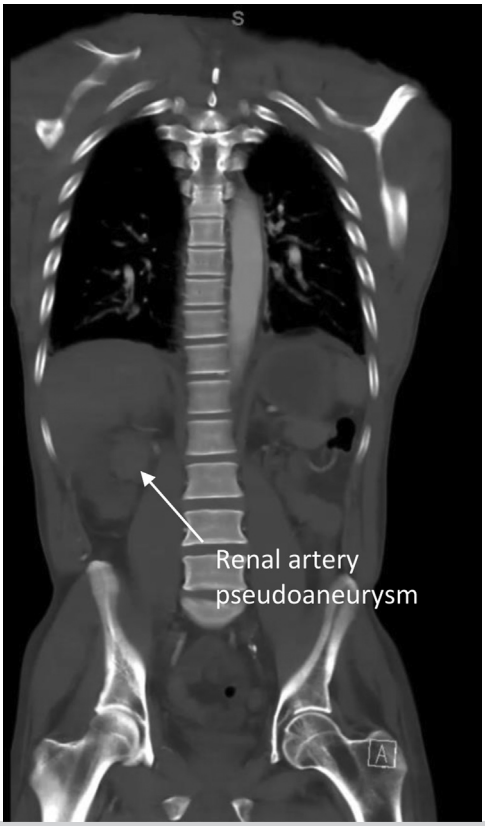

Fig 1. Computed tomography scan showing right renal artery pseudoaneurysm (*arrow*) and right kidney.

DISCUSSION

The incidence of renal artery pseudoaneurysms in the general population is largely unknown. The reports of cases have been rare; however, this vascular pathology can be caused by penetrating iatrogenic injuries such as percutaneous procedures and partial nephrectomy.[2] Renal artery pseudoaneurysms can be found in 1% of renal transplant patients.[13] In renal transplant patients, pseudoaneurysms can result from infection or technical failure at the site of the anastomosis.[6] Blunt trauma is a rarer cause of renal artery pseudoaneurysms and is thought to result from stretching of the renal artery and vein or by collision of the vessel wall with the vertebral bodies.[2,3,12] Pseudoaneurysms can result from vasculitis caused by Behçet disease and Kawasaki disease.[4,5] Pseudoaneurysms of the intraparenchymal vasculature can be caused by amphetamine use.[2]

Spontaneous resolution of renal artery pseudoaneurysms is rare, and intervention should be pursued.[6] Endovascular intervention is favored over open surgical intervention, because stent grafting and coil embolization have been associated with a shorter length of stay and lower rate of postoperative complications.[2,14,15] The decision to use stent grafting or coil embolization depends on the characteristics and location of the aneurysm or pseudoaneurysm. Stenting is preferred when an adequate sealing zone is present. Coil embolization should be preferred when collateral vessels are present. Coil embolization has been associated with a shorter length of stay and fewer postoperative complications compared with open surgery.[16,17] Despite the efficacy of coil embolization, postembolization syndrome, characterized by hyperpyrexia, leukocytosis, pain, and vomiting, is a risk of treatment.[18]

Some groups have used ultrasound-guided percutaneous thrombin injections to treat extrarenal pseudoaneurysms.[19,20] Ultrasound-guided percutaneous thrombin injections have been recommended for hemodynamically stable patients. However, thrombin injections pose a risk of microembolization from the pseudoaneurysm, and coil embolization remains the preferred treatment option.[6,19]

Adequate renal function in patients with renal artery pseudoaneurysm before and after intervention must be considered. Pseudoaneurysms of the renal vasculature can be extraparenchymal or intraparenchymal. Intraparenchymal pseudoaneurysms can present as clusters throughout the parenchyma, and coil embolization at these locations could potentially cause loss of functional renal mass.[2,18,21] Renal function after treatment of renal artery aneurysms has been investigated. Tsilimparis et al[17] found a 30% reduction in the glomerular filtration rate in 9.1% of patients who had undergone endovascular repair and 12.5% of patients who had undergone open surgical repair. However, this difference was not clinically significant.[17]

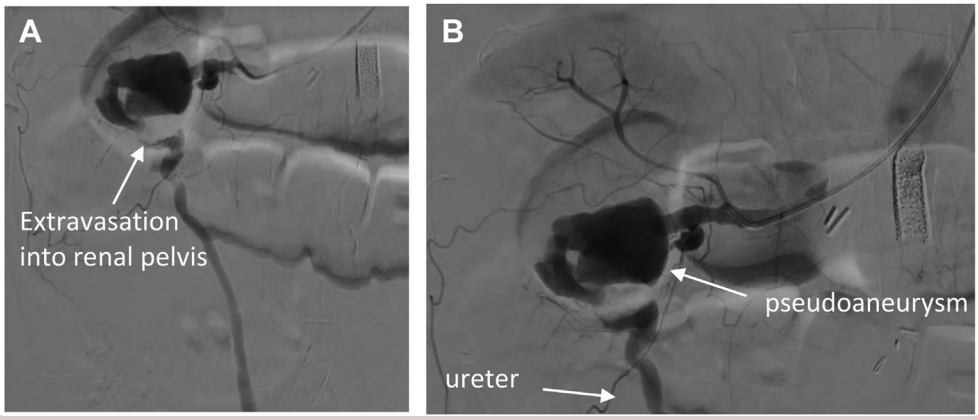

Fig 2. A, Arteriogram showing extravasation of contrast into the right ureter (*arrow*). **B,** Arteriogram showing contrast filling the right renal artery and extravasation of contrast into the pseudoaneurysm (*arrow*), renal pelvis, and right ureter (*arrow*).

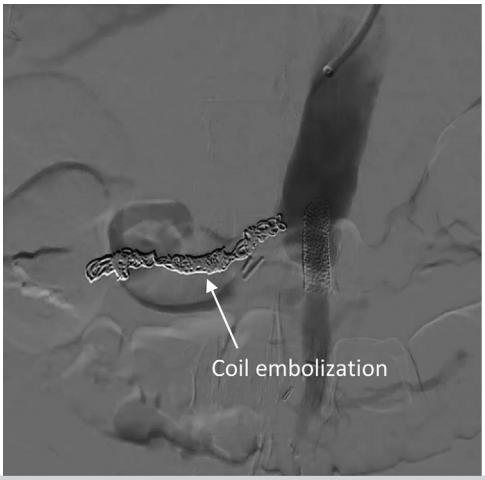

Fig 3. Imaging study showing coil embolization of the right renal artery with four 14-cm × 10-mm and four 14-cm × 6-mm Nester coils.

Gross hematuria is a common presentation of renal artery pseudoaneurysms.[22] Gross hematuria secondary to renal artery pseudoaneurysms occurs when restoration of normal hemodynamics has occurred into the pseudoaneurysm, causing erosion into the pelvicalyceal system.[8] Gross hematuria is also a common presentation of arterial–urethral fistulas. At our institution, and in the literature, patients with gross hematuria due to iliac arterial–urethral fistulas have been successfully treated with either stent grafting or coil embolization.[23-27] This highlights the utility of endovascular procedures in the treatment of vascular pathology causing gross hematuria. Our case adds to the existing literature describing iatrogenic causes of pseudoaneurysm, and our results support the efficacy of coil embolization.

CONCLUSIONS

We have described a case of renal artery pseudoaneurysm, with subsequent rupture into the renal pelvis. The present case of a patient with gross hematuria in the setting of a ruptured renal artery pseudoaneurysm has demonstrated the importance of timely intervention. Despite the efficacy of coil embolization as a treatment of renal artery pseudoaneurysms, the risk of the loss of kidney function should be considered if the patient does not already require hemodialysis.

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