

Case – Renal artery pseudoaneurysm: A life-threatening occurrence following thulium laser lithotripsy

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Introduction

Renal artery pseudoaneurysm post-laser lithotripsy is a rare and potentially life-threatening complication. Traditionally, the most common modalities used for treatment of urinary tract stones were holmium laser lithotripsy and extracorporeal shockwave lithotripsy. However, thulium laser has recently gained momentum in the treatment of urinary tract stones, with increasing use and availability in healthcare systems. We report a case of renal artery pseudoaneurysm post-thulium laser lithotripsy who presented in hemorrhagic shock after ureteral stent removal and was subsequently stabilized by endovascular embolization.

Case report

A 24-year-old male with past medical history of recurrent renal calculi presented with left 6 mm renal pelvis and 7 mm upper pole calculi diagnosed on computerized tomography (CT) abdomen and pelvis. He underwent flexible ureteroscopy with thulium laser lithotripsy and double J ureteral stent insertion. The procedure was uneventful, with institutional standard pulsed thulium soft stone laser settings of 0.4 J at 40 Hz totalling 16 W of power and hard stone settings of 2 J at 20 Hz totalling 40 W of power for duration of procedure. The patient was discharged home from the ambulatory setting the same day, with ureteral stent in situ and planned outpatient stent removal.

On postoperative day 20, the patient presented to the emergency department (ED) with haematuria since the previous night associated with penile pain, tremors, and

cold sweats. CT abdomen/pelvis with IV contrast showed moderate amount of amorphous intermediate density present in the lumen of the urinary bladder, which likely represented the presence of blood or blood degradation products (Figure 1). The left ureteral stent was visible in appropriate anatomic positioning and without associated hydronephrosis. The pain and cold sweats subsided with spontaneous passage of the urinary clot in the ED. His vitals remained unremarkable and laboratory testing exhibited: hemoglobin (Hgb) 6.45 mmol/L; white blood cell (WBC) count 18.8, urinalysis (3+ blood, nitrite +, leukocyte esterase 2+, WBC 26–100, red blood cell (RBC) count >100, moderate bacteria). He was given 1 g of intravenous ceftriaxone and discharged on oral bactrim for seven days to treat for a presumed urinary tract infection.

The next day, he underwent cystoscopy for stent removal, which yielded the presence of a small volume retained urinary clot in the bladder lumen originating from the left ureteral orifice. On postoperative day 2 after stent removal, the patient presented to the ED with syncopal episodes, gross bright red hematuria, passage of large urinary clots, peripheral numbness and tingling, palpitations, and chills. Vital signs were consistent with stage 4 hemorrhagic shock, which was confirmed with Hgb 4.65 mmol/L from preoperative 8.75 mmol/L and accompanying metabolic acidosis. Tranexamic acid (TXA) was administered, along with two units of packed RBC with continued worsening of mentation and unstable vital signs.

CT angiography of the torso was performed, revealing a 10 mm x 7 mm left renal artery pseudoaneurysm arising from an early branching segment (Figure 2). He was emergently transferred to the interventional radiology suite and underwent selective renal artery embolization. Post-embolization, the patient was then transferred to the intensive care unit, having received a total of five PRBCs, TXA, and 3 L of crystalloid intravenous fluids for resuscitation.

The patient was discharged from the hospital on day 3, with well-controlled left flank pain on oral hydrocodone acetaminophen 5/325 mg, no further hematuria, and stable

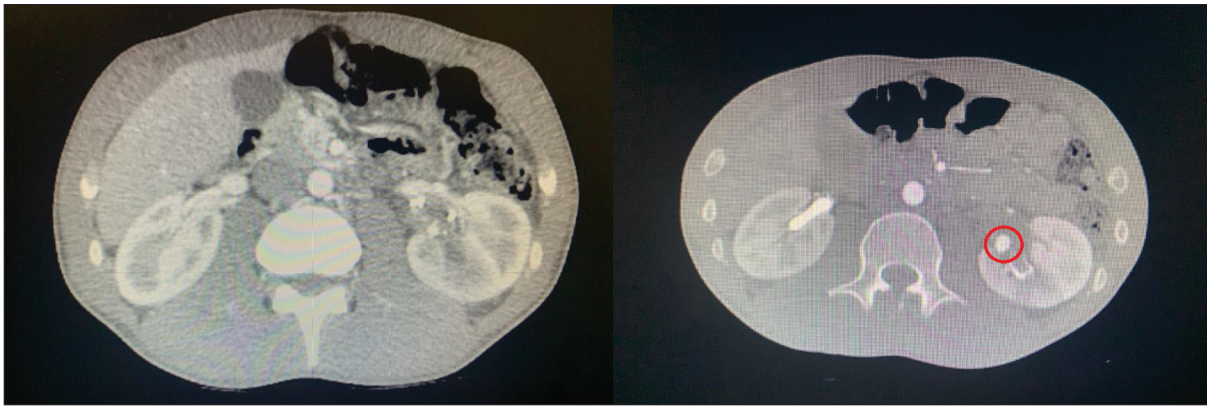


Figure 1. Left: Computed tomography of the abdomen/pelvis from postoperative day 20 showing possible vascular defect, though not diagnosed. Right: Computed tomography of the abdomen/pelvis from postoperative day 22 with renal artery pseudoaneurysm.

Hgb of 6.02 mmol/L. Repeat CT abdomen/pelvis on the morning of discharge found no persistence of the previously identified pseudoaneurysm or vascular contrast extravasation and only expectant thrombus of a subsegmental left renal artery, with infarct and stable embolization.

Discussion

Renal artery pseudoaneurysms are exceedingly rare vascular lesions that occurs due to damage of the arterial wall structure with locally contained hematoma that is covered by coagulated and fibrous tissue.^{1,2} Renal artery pseudoaneurysms may also be marginally more common than reported, as CT with contrast is not routinely performed following the majority of endoscopic urological procedures.¹ Complications can include thromboembolism, neurovascular compression, infection, and life-threatening rupture with exsanguination. While the risk of rupture is low, it is associated with high mortality rates reaching 80% in reported cases and the risk of bleeding increases if the size of the pseudoaneurysm >2 cm.³ Renal artery pseudoaneurysms have been reported in various clinical scenarios, including blunt renal trauma, surgery, percutaneous procedures, and spontaneously secondary to inflammatory or neoplastic processes within the kidney.⁴ Patients typically present with flank pain, hematuria, or unexplained anemia, although many can be asymptomatic. In severe cases, these aneurysms may rupture and lead to hemorrhagic shock warranting emergent intervention for survival.

The diagnosis of pseudoaneurysm in this case was made with CT angiography performed on postoperative day 22 prior to proceeding with intravascular embolization for definitive treatment. On further retrospective analysis of imaging performed during the patient's first ED presentation, a subtle dilation of the lower pole subsegmental renal artery at the site of the later diagnosed pseudoaneurysm could be seen, however, was incompletely imaged during an

insufficient arterial phase on CT imaging. Earlier detection of this vascular injury would have aided in prompt treatment of the injury, decreasing the risk of life-threatening hemorrhage seen in this case.

A major factor that may have increased the risk of pseudoaneurysm in our patient was the use of high-energy settings for renal stone fragmentation. The use of 40 W energy output fragmentation, when paired with a renal pelvis stone location, allows for a thin barrier of tissue between the laser and abutting posterior renal hilar vasculature. Contemporary recommendations for thulium laser lithotripsy settings range from 15–30 W within the renal collecting system, 10–15 W



Figure 2. Left: Computed tomography of the torso showing the left renal artery pseudoaneurysm. Right: The left renal artery pseudoaneurysm with injection of contrast.

within the ureter, and 30–50 W within the bladder lumen.⁵ Lower optimized power recommendations are further echoed by manufacturer recommendations of total power outputs no greater than 25 W for renal calculi and 20 W for ureteral calculi.

Thulium laser has recently been gaining momentum in the treatment of renal stones.^{6,7} This laser has been proven to be effective, as it emits more well-distributed pulsed laser waves, resulting in rapid stone ablation and lower retro-pulsion in comparison to holmium laser.^{8,9} We performed a thorough search of contemporary publication databases and failed to find any reports describing renal artery pseudoaneurysms after thulium laser lithotripsy.

Renal artery pseudoaneurysms can be managed by either open surgical or endovascular access, depending on the stability of the patient.¹⁰ Endovascular selective angioembolization is the mainstay of treatment, although open surgical correction might be indicated if surgeon is unable to obtain hemostasis of endovascular techniques or if repairs of the arterial wall defect are required.¹¹ For patients with contraindication to the use of contrast or complex vascular anatomy, including numerous intraluminal calcifications, percutaneous ultrasound-guided embolization may be used.² Open surgical ligation, endovascular stent, and intra-aneurysmal thrombin with balloon occlusion have also been described as alternative treatment options. Further literature has described spontaneous resolution of pseudoaneurysms after continued observation, however, due to the difficulty in accurately predicting the outcome, it is best to intervene.^{2,12}

Conclusions

A low threshold of suspicion for a renal vascular injury, such as a pseudoaneurysm, should be maintained when a patient presents with profuse gross hematuria post-endoscopic urological interventions using energy devices. The recognition of this injury as a most probable diagnosis and early vascular control with endovascular intervention may prevent potential life-threatening hemorrhage, as described in this case with a vascular injury known for high mortality rates.

Competing interests: The authors do not report any competing personal or financial interests related to this work.

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