

Embolisation of a Renal Artery Pseudoaneurysm in a Patient with Renal Malrotation and Chronic Aortic Dissection

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Abstract

Introduction: Renal artery pseudoaneurysms may arise as a complication of percutaneous nephrolithotomy (PCNL). Prompt recognition and treatment is essential to arrest haemorrhage which may be life threatening. **Clinical Picture:** A patient with chronic aortic dissection and malrotated right kidney underwent PCNL for right renal calculus. He developed delayed gross haematuria. **Treatment:** Angiography showed a pseudoaneurysm arising from one of two right renal arteries, which in turn arose from the false lumen of the aortic dissection. The supplying artery was successfully embolised. **Conclusion:** Renal artery pseudoaneurysms can be successfully treated with prompt angiography and embolisation, even in the presence of renal malrotation and aortic dissection.

Ann Acad Med Singapore 2002; 31:107-10

Key words: Aortic dissection, Embolisation, Malrotated kidney, Percutaneous nephrolithotomy, Pseudoaneurysm

Case Report

A 40-year-old Chinese male presented with severe right loin pain. He had a history of chronic abdominal aortic dissection of unknown aetiology. He was not hypertensive and there was no evidence of ankylosing spondylitis, Ehlers-Danlos syndrome or any connective tissue disorder. Intravenous pyelography (IVP) and computed tomography (CT) showed a calculus in the right renal pelvis. The right kidney was low lying (at the level of L4 vertebral body) with malrotation along the longitudinal axis. The right renal pelvis was facing anterolaterally (Fig. 1). The abdominal aortic dissection extended to the aortic bifurcation and involved the left common iliac artery. The right kidney showed delay in renal excretion and no pseudoaneurysm. The left kidney was normal, showing normal excretion. Extracorporeal shock wave lithotripsy (ESWL) was attempted twice, but failed to fragment the right renal stone. He then underwent percutaneous nephrolithotomy (PCNL) under fluoroscopic guidance

without immediate complication. Twenty-eight days after PCNL, he developed haematuria. Urgent CT of the abdomen and pelvis showed a right perirenal haematoma and a pseudoaneurysm (measuring 30 x 40 x 45 mm) at the lower pole of the right kidney (Fig. 2). Haematuria resolved spontaneously and therefore no further intervention was performed.

On day 40 following PCNL, the patient presented with massive haematuria and shock. His haemoglobin level fell to 6.8 g/dL. CT scan of the abdomen showed an increase in size of the pseudoaneurysm to 38 x 43 x 50 mm. He was referred to our department for embolisation.

Initially, biplane abdominal aortography was performed via a right femoral approach with a 5-Fr pigtail catheter in the true lumen. An aortic dissection was noted extending from the suprarenal portion of the abdominal aorta to the left external iliac artery. The false lumen was located in the left posterolateral aspect at the level of the suprarenal aorta extending distally to end on the right anterolateral aspect at

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the level of the aortic bifurcation. The right renal arteries, which arose from the distal abdominal aorta at the level of L4, were only faintly opacified in the late arterial phase, suggesting that they were supplied from the false lumen which communicated with the true lumen (Fig. 3). The left renal artery was patent and perfused by the true lumen, arising at the level of L1 in the usual orientation. Attempts were made to catheterise the false lumen from both right and left femoral approaches but were initially unsuccessful. The false lumen was eventually successfully cannulated from a right femoral approach using a 5-Fr Cobra C1 catheter and a 0.035-in standard angled hydrophilic guidewire (Terumo Corporation, Japan), with the catheter tip directed posterolaterally to the left. This was possibly through a natural re-entry point between the true and the false lumina. Angiography of the false lumen showed two faint right renal arteries arising at the level of L4/5 (Fig. 4). Selective catheterisation of these arteries was performed with a 5-Fr shepherd's hook catheter.

The upper pole right renal arteriogram was normal. However, a large (62 x 46 mm) pseudoaneurysm was noted to arise from the lower pole of the right kidney (Fig. 5). Embolisation of the lower pole right renal artery supplying the pseudoaneurysm was then performed using two 4 mm x 4 cm Gianturco stainless steel coils (Cook, Bloomington, IN). Post-embolisation lower pole and upper pole right renal arteriograms demonstrated no filling of the pseudoaneurysm (Fig. 6).

Sonographic examination performed during embolisation showed an almost instantaneous increase in echogenicity and loss of colour Doppler signal in the pseudoaneurysm (Fig. 7).

The patient was stable after the procedure with normal blood pressure and pulse rate, and no more haematuria was noted. He developed a low-grade fever and leukocytosis

from day 1 to day 4 following embolisation, with good response to a course of imipenem/cilastatin. Follow-up Doppler sonography 6 days after embolisation showed thrombus in the pseudoaneurysm with no colour flow or Doppler signal. No hypertension, abdominal pain or deterioration of renal function was noted in the following 10 months.

Discussion

The incidence of iatrogenic renovascular injury is increasing owing to an increase in the popularity of percutaneous renal procedures.^{1,2} The most common vascular complications following renal interventional procedures are renal artery pseudoaneurysms and arteriovenous fistulas (AVFs).³ There are a number of reported cases of successful transcatheter embolisation of renal artery pseudoaneurysms due either to trauma^{2,4,5} or iatrogenic injury.^{1,6,7} To the best of our knowledge, transcatheter embolisation of a renal artery pseudoaneurysm complicated by renal malrotation and chronic aortic dissection has not been described.

Pseudoaneurysms and AVFs are formed after laceration of the arterial wall, resulting in a high-pressure leak. Most of these lesions close spontaneously over a period of days to weeks. Some of these lesions, however, remain open with progressive increase in size, and may present with life threatening haematuria. Swana et al⁴ reviewed the literature and found that all renal artery pseudoaneurysms before the era of transcatheter embolisation were ultimately fatal. In 1969, Scott et al⁸ recommended early use of angiography and an aggressive surgical approach to patients with penetrating injuries. Rosch and associates⁹ reported successful transcatheter embolisation of gastrointestinal bleeding in 1972. Since then, successful transcatheter embolisation of potentially fatal renal artery pseudoaneurysms and AVFs has been described.

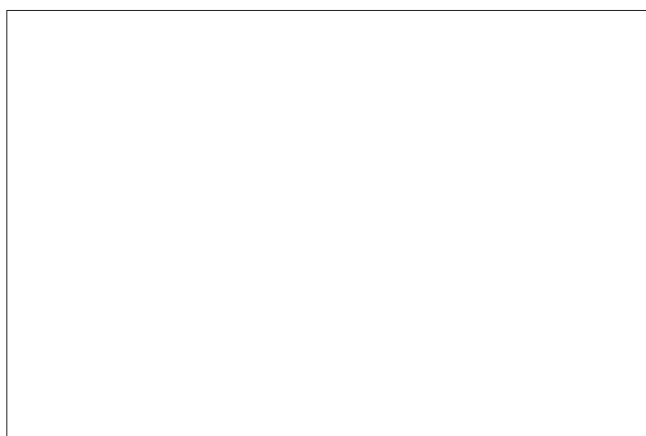


Fig. 1. CT of the abdomen after intravenous contrast shows an intimal flap in the abdominal aorta (arrow). There is a calculus in the renal pelvis of the malrotated and low-lying (at the level of L4) right kidney.

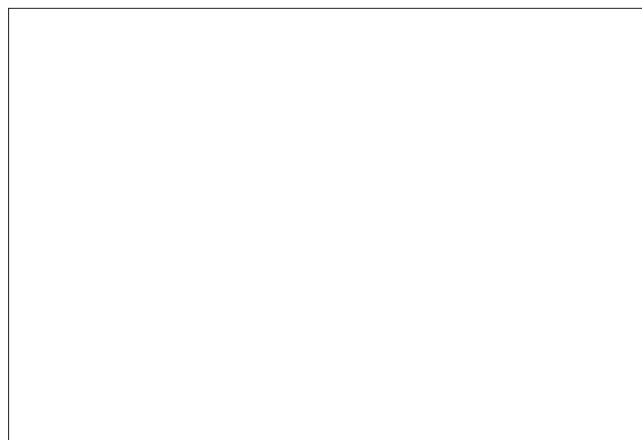


Fig. 2. CT of the abdomen after intravenous contrast shows a large saccular pseudoaneurysm (arrowhead) just lateral to the right kidney, compressed and surrounded by a huge perirenal hematoma.

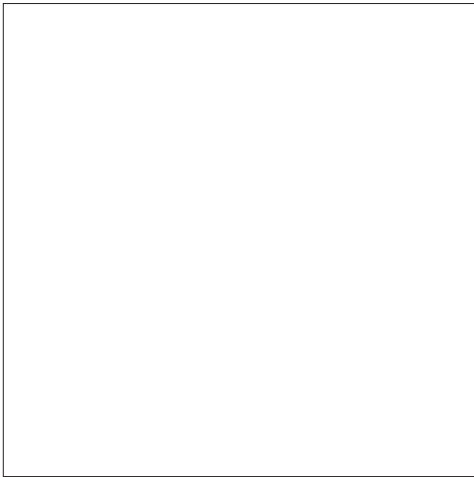


Fig. 3. Abdominal aortogram in frontal view. The pigtail catheter lies in the true lumen, which supplies the left renal artery. The lower pole right renal artery (arrow) and pseudoaneurysm (arrows) are only faintly opacified because they are supplied by the false lumen.

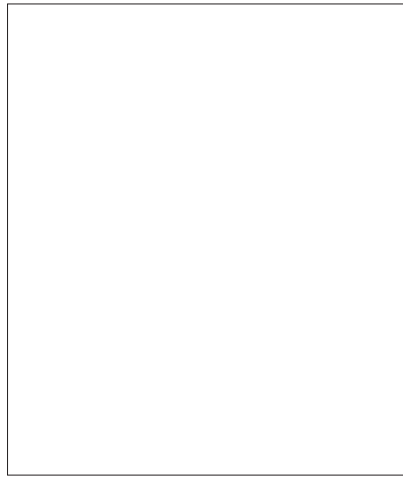


Fig. 4. False lumen abdominal aortogram showing two right renal arteries (arrows) arising at the level of L4/5. The upper pole right renal artery was normal (confirmed by selective arteriogram, not shown). The pseudoaneurysm arises from the lower pole right renal artery.

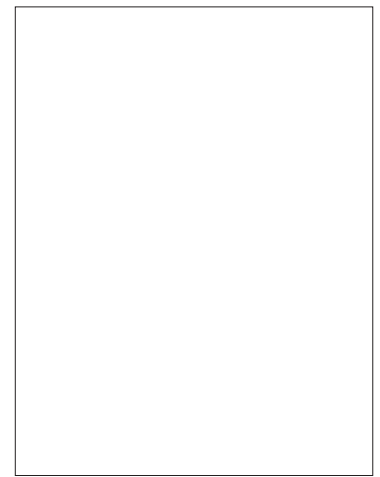


Fig. 5. Selective lower pole right renal arteriogram shows a huge pseudoaneurysm.

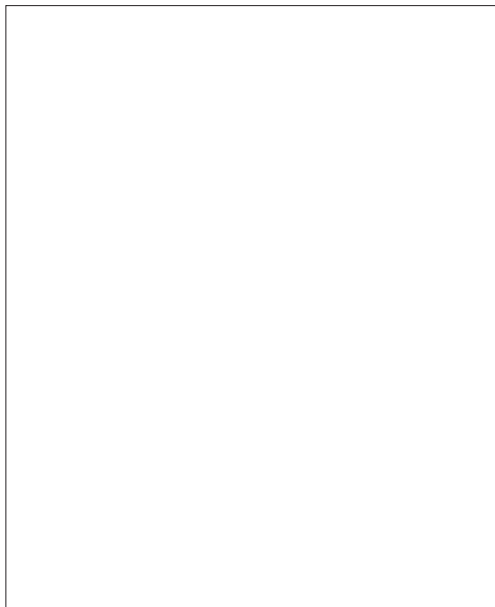


Fig. 6. Post-embolisation of the lower pole right renal arteriogram shows no flow of contrast into the pseudoaneurysm. The upper pole right renal arteriogram (not shown) also shows no filling of the embolised pseudoaneurysm.

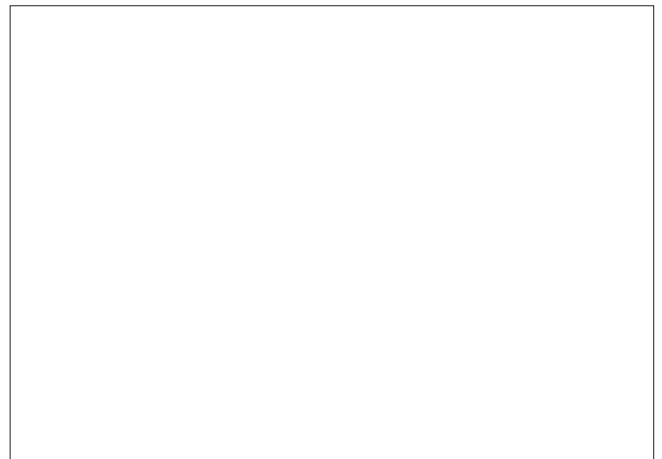


Fig. 7a.

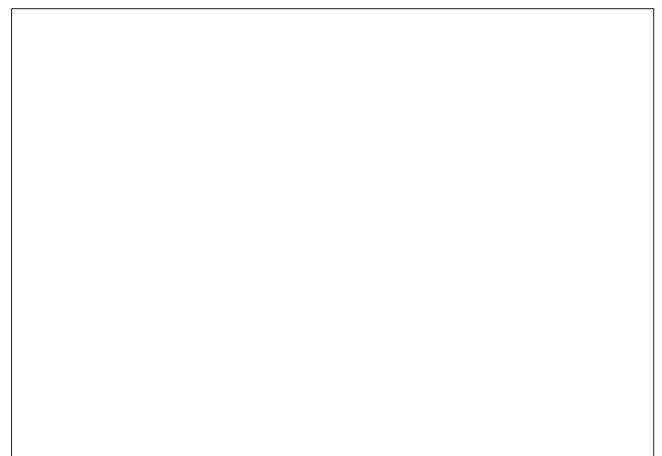


Fig. 7b.

Fig. 7. Ultrasound Doppler examination of the pseudoaneurysm just before (a) and immediately after (b) embolisation. The pseudoaneurysm showed almost instantaneous increase in echogenicity and loss of Doppler signal after embolisation, indicating effective embolisation. The short white streaky lines in (a) are due to film artifact.

Renal artery pseudoaneurysms can be diagnosed by Doppler ultrasound, contrast-enhanced CT or angiography. Patients with delayed or recurrent haematuria after an interventional procedure should be investigated with angiography.⁷ The reported incidence of pseudoaneurysm following PCNL is 0.6% to 1%.¹⁰ Though the incidence of pseudoaneurysm after PCNL in malrotated kidneys is not known, one would expect a higher incidence than in normal kidneys because the recommended posterolateral approach to a middle or lower pole calyx along Brodel's

avascular line is technically more difficult. In our patient, the pseudoaneurysm is unlikely to be due to an intrinsic vascular abnormality because the pre-PCNL contrast CT scan showed no evidence of pseudoaneurysm. The pseudoaneurysm was therefore likely to be due to a complication of PCNL. In our case, the pseudoaneurysm progressively increased in size with time, reaching about 60 mm in maximum diameter by 40 days, similar to the case reported by Swana et al.⁴

Transcatheter embolisation is a well-documented life-saving mode of therapy for renal artery pseudoaneurysm.^{1,2,4,5} Embolisation is minimally invasive, simple, rapid, and has a high success rate. It can be repeated, if clinically indicated, avoiding emergency nephrectomy. Abdominal aortography is normally performed before selective catheterisation of the renal artery to map out the vascular anatomy including the location and the number of renal arteries.

In patients with aortic dissection, a biplane abdominal aortogram should be performed in order to show the anatomy, the extent of the aortic dissection and which lumen is responsible for the perfusion of the renal artery pseudoaneurysm. This allows direction of the catheter to the correct aortic lumen to facilitate selective catheterisation of the appropriate renal artery. In thoracic aortic dissection, communication sites between the false and the true lumen may be single or multiple and are often related to the origin of aortic branches. These communication sites may be identified in the appropriate projection by seeing contrast medium passing from one channel to the other channel.¹¹ Similarly, as the false lumen of our patient was located at the left posterolateral aspect of the abdominal aorta and extending to the right anterolateral aspect at the aortic bifurcation, the catheter should be directed to the left posterolateral aspect to identify the communication site between the false and the true lumina. If aortography has to be performed in the false lumen, this should be done with care and the technique should be modified to prevent aortic rupture.

In our patient, stainless steel coils were selected for embolisation, with the aim of permanent occlusion. Injection of large amount of gelatin pledgets, a temporary embolic agent, into a renal artery pseudoaneurysm of this size is not recommended, as re-bleeding or an increase in intra-pseudoaneurysmal pressure may occur during delivery. Our patient did not show recurrent haematuria, hypertension or deterioration of renal function in the following 10 months.

In conclusion, prompt angiography and embolisation should be performed once a renal artery pseudoaneurysm is suspected, to prevent the potential hazard of massive haemorrhage. Embolisation is effective in preventing further increase in the size of the pseudoaneurysm and consequent morbidity or mortality. Interventional procedures in malrotated kidneys should be performed with extreme caution, preferably under sonographic and/or CT guidance. Transcatheter embolisation is the treatment of choice as a life-saving measure in renal artery pseudoaneurysm. This is true even when the pseudoaneurysm is perfused by the false lumen of a dissected abdominal aorta. Long-term follow-up and assessment is essential to rule out post-embolisation hypertension.

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