Iatrogenic renal pseudoaneurysm following laparoscopic tumorectomy: CT diagnosis and interventional treatment

Gross haematuria, stable vital signs and unremarkable physical findings 5 weeks after laparoscopic resection (including calyceal access) of a 3-cm pT1a clear cell carcinoma of the left kidney, with uneventful early postoperative course (ureteral stent removed 15 days after surgery). Haemoglobin and renal function unchanged compared to preoperative laboratory tests.

Imaging Findings:

The attending urologist requested prompt comprehensive investigation of possible postoperative complications with multidetector CT (Fig. 1). The lateral aspect of the left kidney, corresponding to the surgical resection site, showed a roundish well-demarcated 4.5x4 cm mass centred in the renal parenchyma and mostly isoattenuating save for its hyperdense ventral portion. After intravenous contrast medium (CM) administration, the lesion showed strong internal enhancement synchronous with that of the aorta on corticomedullary-phase images, and became isoattenuating with the blood pool in the nephrographic phase acquisition. Both kidneys showed normal size, parenchymal thickness and nephrographic appearance. Perinephric blood, signs of CM extravasation indicating bleeding, and abnormal collections were not seen.

Selective renal artery angiography (Fig. 2a, b) confirmed the CT diagnosis of pseudoaneurysm by showing a contained ovoid CM "blush". After superselective catheterization and embolization with coils, repeated angiography (Fig. 2c) confirmed complete exclusion of intralesional bleeding in the pseudoaneurysm.

Discussion:

According to the European Association of Urology, iatrogenic renal vascular injuries (IRVIs) encompass arteriovenous fistulas and renal pseudoaneurysms (RPA), and rank among the rarest (0.43%-0.9%) complications after renal biopsy, nephrostomy, nephroureterolithotomy, renal artery angioplasty or stenting, and nephron-sparing surgery (NSS). If unrecognized, IRVIs may result in significant morbidity including life-threatening retroperitoneal haemorrhage, gross haematuria, need for nephrectomy or renal function deterioration [1-3]. Although uncommon, IRVIs are increasingly encountered due to the growing number of percutaneous, endoscopic
and surgical urologic procedures. Specifically, laparoscopic NSS is surpassing open surgery as the mainstay treatment for small-sized benign, indeterminate and malignant renal masses, as it allows renal function preservation and optimal oncologic outcome for renal cell carcinoma but with a non-negligible rate (4.5-10%) of major complications, the commonest being haemorrhage requiring transfusions [1-7].

Following iatrogenic injury to an intrarenal artery, the main renal artery or one of its major branches, RPA form the combined effect of hypotension, coagulation, and pressure from the adjacent structures leads to temporary bleeding cessation. Afterwards, when clot degradation results in restored blood flow, a RPA may form and eventually grow, become unstable, or erode into the surrounding perinephric tissues or the pelvicalyceal system. RPA usually manifest 2-3 weeks (exceptionally up to a few months) after surgery with abdominal or flank pain, gross haematuria, fever, hypotension or laboratory signs of blood loss [1-3, 5-7].

Patients with suspected iatrogenic renal injuries require comprehensive investigation with multidetector CT including mandatory arterial-phase acquisition. The hallmark of RPA is a rounded well-demarcated lesion (usually 1-3 cm) with contained early enhancement synchronous to the arterial vessels, isoattenuating relative to the blood pool in the nephrographic phase. RPA may be missed in the unenhanced and excretory phases when the characteristic enhancement is absent. Colour Doppler ultrasound may diagnose RPA by the characteristic “to-and-from” internal flow appearance seen within a cystic mass or liquefied haematoma [1, 3, 8].

Although minor occurrences may heal under conservative management, transarterial embolisation (TAE) using coils or other agents is warranted as the preferred, safe and effective minimally invasive treatment for most IRVIs, with excellent technical (complete angiographic exclusion of bleeding) and clinical (haemodynamic stabilisation without blood transfusions) success rates. Super-selective embolisation is recommended to minimise parenchymal loss and long-term renal function impairment [1-3].

In conclusion, the uncommon RPA require a high clinical index of suspicion, accurate CT-angiography diagnosis, and timely treatment (with TAE as a well-established first-line nonsurgical option) to obviate its possible severe consequences [1-3].

**Differential Diagnosis List:** Iatrogenic renal pseudoaneurysm after laparoscopic tumorectomy, treated by transarterial embolisation., Normal postoperative imaging appearance, Perinephric haematoma, Active renal haemorrhage, Arteriovenous fistula, Arteriocalyceal fistula, Pyelonephritis / renal abscess, Urine leak / urinoma

**Final Diagnosis:** Iatrogenic renal pseudoaneurysm after laparoscopic tumorectomy, treated by transarterial embolisation.

**References:**


Description: Unenhanced acquisition showed a 4.5x4 cm rounded mass (caliper) at the site of resection (lateral aspect) of the left kidney, mostly isoattenuating with the parenchyma save for a hyperattenuating ventral portion. Origin: Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)
Description: After intravenous contrast administration, corticomedullary-phase axial (b) and coronal (c) images showed the lesion with intense internal enhancement (arrowheads) synchronous with that of the aorta. Normal perirenal fat planes (+). Origin: Tonolini Massimo, Department of Radiology, “Luigi Sacco” University Hospital – Milan (Italy)
Description: After intravenous contrast administration, corticomedullary-phase axial (b) and coronal (c) images showed the lesion with intense internal enhancement (arrowheads) synchronous with that of the aorta. Normal perirenal fat planes (+). Origin: Tonolini Massimo, Department of Radiology, “Luigi Sacco” University Hospital – Milan (Italy)
Description: Nephrographic phase axial (d) and coronal (e) images showed normally enhancing kidneys. The left renal lesion showed persistent internal enhancement isoattenuating with the blood pool (arrowheads). Normal perirenal fat planes (+). Origin: Tonolini Massimo, Department of Radiology, “Luigi Sacco” University Hospital – Milan (Italy)
Description: Nephrographic phase axial (d) and coronal (e) images showed normally enhancing kidneys. The left renal lesion showed persistent internal enhancement isoattenuating with the blood pool (arrowheads). Normal perirenal fat planes (+). Origin: Tonolini Massimo, Department of Radiology, “Luigi Sacco” University Hospital – Milan (Italy)
Description: Selective left renal artery angiography (a,b) showed an ovoid "blush" of contrast medium corresponding to the pseudoaneurysm diagnosed at CT. Origin: Tonolini Massimo, Department of Radiology, "Luigi Sacco" University Hospital – Milan (Italy)
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**Description:** After superselective catheterization and embolization with coils, repeated angiography confirmed complete exclusion of intrallesional bleeding in the pseudoaneurysm. **Origin:** Tonolini Massimo, Department of Radiology, “Luigi Sacco" University Hospital – Milan (Italy)