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# Renal Pseudoaneurysm Mimicking Local Cancer Recurrence After Partial Nephrectomy



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# ABSTRACT

The development of an iatrogenic vascular lesion, such a renal pseudoaneurysm or arteriovenous fistula, is a rare complication of partial nephrectomy. These lesions should be considered in patients presenting with an enhancing mass in the resection bed shortly following partial nephrectomy. Early timing following surgery, large relative size, and the presence of recurrent hematuria suggest the diagnosis of an iatrogenic vascular lesion. Duplex ultrasound is a useful non-invasive imaging modality for differentiating these lesions from a local tumor recurrence.

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## Introduction

The development of an iatrogenic vascular lesion, such as a renal pseudoaneurysm or arteriovenous fistula, occurs in approximately 1–2% of patients undergoing minimally-invasive partial nephrectomy.<sup>1,2</sup> latrogenic vascular lesions are diagnosed on average 14 days after surgery and most commonly present with gross hematuria.<sup>1,2</sup> In asymptomatic patients, the presence of an iatrogenic vascular lesion can mimic a local tumor recurrence on follow-up CT scans and should be considered when a sizable mass is detected in the resection bed soon after surgery. Herein, we present the case of a renal pseudoaneurysm mimicking a local tumor recurrence following robotic partial nephrectomy.

### **Case presentation**

A 72-year-old male presented for a follow-up contrastenhanced CT scan 2 months after a robotic-assisted laparoscopic partial nephrectomy of a 3 cm grade II clear cell RCC (pT1a). At that time, imaging revealed a  $2.3 \times 1.9$  cm enhancing lesion in the resection bed of the tumor (Fig. 1). The patient noted hematuria immediately following surgery, but denied any blood in the urine

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in the month leading up to imaging. The patient also denied flank pain and had no hypertension or renal bruits on exam. Given the patient's asymptomatic presentation, the diagnosis of a local tumor recurrence was entertained; however, since the resection had been performed only two months prior, there was some skepticism regarding this diagnosis. To evaluate the lesion further, a duplex renal ultrasound was performed. This study demonstrated an anechoic mass in the right kidney with high blood flow velocity and turbulence consistent with a renal pseudoaneurysm (Fig. 2). The patient has since been successfully managed with observation.

## Discussion

This case highlights the importance of considering iatrogenic vascular abnormalities in the differential diagnosis when faced with a lesion concerning for a local tumor recurrence shortly following partial nephrectomy. Iatrogenic vascular lesions after partial nephrectomy typically manifest as either renal pseudoa-neurysms or arteriovenous fistulae. A renal pseudoaneurysm is defined as a "focal, saccular dilation" of an artery in the kidney.<sup>2</sup> Likewise, an arteriovenous fistula is the pathologic communication between an artery and vein within the renal vasculature.<sup>2</sup> Of note, arteriovenous fistulae may co-occur with pseudoaneurysms or may exist in isolation. These vascular lesions may result from surgery, biopsy, trauma, or malignancy.<sup>3</sup> The classic presentation of an iatrogenic vascular lesion is recurrent



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Abbreviations: AV, arteriovenous; AVF, arteriovenous fistula; RCC, renal cell carcinoma.

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**Figure 1.** Axial arterial/corticomedullary phase contrast-enhanced CT image through the level of the interpolar regions of the kidneys demonstrating an enhancing  $2.3 \times 1.9$  cm lesion in the partial nephrectomy bed (red arrow). Tumor recurrence and an iatrogenic vascular lesion could both give this appearance.

hematuria, however they may have a variety of clinical manifestations including hypertension, flank pain, bruit, abdominal mass, anemia, dizziness, fever, or high output heart failure.<sup>1–3</sup> Patients may also be asymptomatic, as was the patient in the case discussed here.

When attempting to distinguish between local tumor recurrence and a vascular lesion in the months following partial nephrectomy, timing is a paramount consideration. Local recurrence of a renal mass within 6 months of partial nephrectomy is exceedingly rare. For example, Hafez et al reported that among 327 patients undergoing partial nephrectomy for RCC, none recurred locally within 6 months, and only 4% recurred locally at any point during follow-up.<sup>4</sup> In contrast, in a systematic review that looked at 105 renal artery pseudoaneurysms postnephrectomy, the average time to presentation was 14.9 days, with no patient presenting >90 days after surgery.<sup>1</sup> Thus, when faced with a patient with a possible local tumor recurrence within



**Figure 2.** Sagittal color duplex ultrasound image through the mid right kidney at the level of the partial nephrectomy bed showing the typical appearance of to-and-fro blood flow within a pseudoaneurysm sac (white arrow).

3 months of surgery, the diagnosis of a pseudoaneurysm or AV fistula must be explored.

The diagnosis of a pseudoaneurysm or arteriovenous fistula is confirmed through imaging. Angiography is considered the gold standard for diagnosing these lesions, although it is invasive.<sup>3</sup> A pseudoaneurysm may be identified as a contrast-enhancing dilation of an artery, while an arteriovenous fistula may demonstrate early venous filling in close proximity to an artery. More commonly, contrast-enhanced CT scan is the first modality utilized in the identification of these lesions. However, as evidenced from our case presentation it can be difficult to differentiate vascular anomalies from a local tumor recurrence. The pseudoaneurysm in the case presented here did not robustly enhance on CT during arterial phase (Fig. 1). While the reason for this is unclear, we postulate that the pseudoaneurysm was large in comparison to its vessel of origin and thus did not fill rapidly enough to appear as an arterial structure on the arterial phase imaging. For cases in which CT is not diagnostic, duplex ultrasound is a useful problem-solving tool. Using this imaging modality, a pseudoaneurysm appears as a cystic or anechoic lesion with characteristic to-and-fro flow within the lesion (Fig. 2), whereas an arteriovenous fistula shows high flow velocity in the venous system along with venous pulsations and/or turbulence.

This is not the first time that ambiguity on CT scan between a vascular abnormality and malignancy has been reported. On one occasion, a pseudoaneurysm following partial nephrectomy was misinterpreted as a local cancer recurrence and treated with radical nephrectomy. Subsequent pathology identified a pseudoaneurysm and was negative for cancer.<sup>5</sup> Furthermore, it is important to note that the presence of a vascular lesion does not preclude the presence of malignancy. For example, Aydin et al reported a patient that presented with hematuria and flank pain 3 month's post-partial nephrectomy for clear cell RCC.<sup>6</sup> CT was considered to be consistent with multiple arteriovenous fistulae and thus monitoring was the chosen course of action. By 9 months post-surgery, local recurrence was evident on CT and the patient underwent a radical nephrectomy with pathological confirmation of recurrent clear cell RCC as well as multiple AV fistulae. Because CT is the mainstay of post-nephrectomy RCC surveillance,<sup>7,8</sup> it is prudent to be aware of the limitations of CT with regards to iatrogenic vascular lesions when assessing for tumor recurrence. If a new renal lesion appears soon after tumor resection, follow-up duplex ultrasound is advised to distinguish between an iatrogenic vascular lesion and recurrent cancer.

### Conclusions

Development of a renal pseudoaneurysm or arteriovenous fistula is a rare complication of partial nephrectomy, and may mimic local recurrence on follow-up CT. History of recurrent hematuria and presentation within 3 months of resection should increase suspicion of an iatrogenic vascular lesion. Duplex ultrasound is a useful non-invasive imaging modality for differentiating these lesions from a local tumor recurrence.

#### **Conflict of interest**

The authors have no conflicts of interest.

#### References

- 1. Jain S, Nyirenda T, Yates J, Munver R. Incidence of renal artery pseudoaneurysm following open and minimally invasive partial nephrectomy: A systematic review and comparative analysis. *J Urol.* 2013;189:1643–1648.
- Hyams ES, Pierorazio P, Proteek O, et al. latrogenic vascular lesions after minimally invasive partial nephrectomy: A multi-institutional study of clinical and renal functional outcomes. *Urology*. 2011;78:820–826.

- **3.** Cura M, Elmerhi F, Suri R, et al. Vascular malformations and arteriovenous fistulas of the kidney. *Acta Radiol*. 2010;51:144–149.
- Hafez KS, Novick AC, Campbell SC. Patterns of tumor recurrence and guidelines for followup after nephron sparing surgery for sporadic renal cell carcinoma. *J Urol.* 1997;157:2067–2070.
- 5. Inci K, Cil B, Yazici S, et al. Renal artery pseudoaneurysm: Complication of minimally invasive kidney surgery. *J Endourol.* 2010;24:149–154.
- **6.** Aydin AM, Eldem G, Peynircioglu B, et al. Local recurrence of renal cell carcinoma that simulated multiple renal arteriovenous fistulas after laparoscopic partial nephrectomy: Report of a rare case. *Int J Urol.* 2016.
- Donat SM, Diaz M, Bishoff JT, et al. Follow-up for clinically localized renal neoplasms: AUA guideline. J Urol. 2013;190:407–416.
- 8. Ljungberg B, Bensalah K, Canfield S, et al. EAU guidelines on renal cell carcinoma: 2014 update. *Eur Urol.* 2015;67:913–924.