



Case report: Asymptomatic renal arteriovenous fistula requiring endovascular embolization in a living donor transplanted kidney more than 15-years after last protocol biopsy

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ABSTRACT

Here we present the case of an HLA-identical living-donor kidney transplant recipient, who was incidentally found to have a large complex renal arteriovenous fistula (RAVF) in their transplanted kidney that had been present for nearly 6 years but was previously misinterpreted as being part of a collection of cysts. This patient had undergone 7 protocol biopsies of the transplanted kidney, the last of which had been performed approximately 16 years prior, representing the longest interval between most recent biopsy renal allograft to RAVF diagnosis in the literature date. This report reviews the etiology and principles of management for RAVF.

1. Introduction

Renal arteriovenous fistulae (RAVFs) are a relatively common, but typically transient and self-limiting complication of percutaneous renal biopsy (PRB).¹ The reported incidence of RAVF post-PRB ranges from 8 to 14%, and data suggests that 95% spontaneously resolve within 3 months.^{2,3} Here, we present the case of a 36-year-old female transplant recipient who was incidentally found to have a RAVF with pseudoaneurysm almost 16 years after their most recent PRB and review the literature on the clinical presentation and management of RAVFs.

2. Case presentation

A 36-year-old female recipient of an HLA-identical living-donor kidney transplant presented to nephrology to modify her medications ahead of attempting to become pregnant. She had been well since transplant surgery in 2002 for end-stage renal disease secondary to glomerulonephritis, with stable creatine levels in the 130–148 range. Sirolimus was continued as tacrolimus was being titrated to therapeutic levels, which led to apparent nephrotoxicity and an abrupt serum creatine increase to 190 from dual therapy.

A subsequent renal ultrasound incidentally suggested the presence of a large complex renal arteriovenous fistula (RAVF) in the transplanted kidney (Fig. 1.). Compared to a 2015 computed tomography (CT) for

microscopic hematuria, what had been identified at the time as a collection of cysts was now understood as RAVF concomitant with several renal cysts that had grown from 2.2 to 3.2cm in diameter from 2015 to 2021. CT angiography showed that the RAVF was fed almost directly by the main renal artery (Fig. 2).

She was hemodynamically stable, and asymptomatic with respect to the AVF throughout her clinical course. No abdominal bruits or thrills were present, and her abdomen was soft and non-tender, including over the area of the graft.

She had undergone 7 protocol kidney biopsies, all unremarkable, as part of routine care at the local pediatric center, most recently nearly 16 years prior. She had a single episode of acute rejection 4 years post-transplant that was managed with high dose prednisone.

After discussion by our renal transplant surgeons, the case was brought to interdisciplinary vascular surgery rounds, and interventional radiology rounds. The decision was made to proceed with endovascular embolization due to the risk of rupture. Based on the association of the RAVF with the main renal artery, it was clear that the procedure posed a significant risk of graft loss and need for dialysis following embolization.

Embolization was successful, and fortunately graft function remained stable in the periprocedural period (creatinine 190–200). Follow-up doppler ultrasound showed an absence of persistent color flow within the aneurysm consistent with satisfactory embolization results (Fig. 3).

Abbreviations: RAVF, Renal arteriovenous fistula; PRB, Percutaneous renal biopsy.

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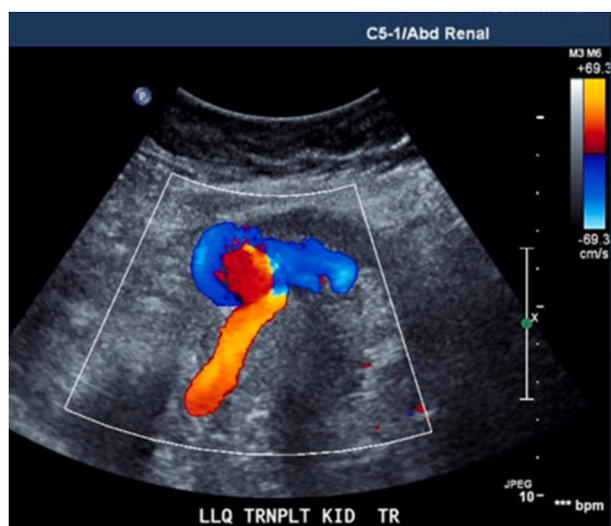


Fig. 1. Pre-operative doppler ultrasound showing renal arteriovenous fistula with pseudoaneurysm in an HLA-identical living donor kidney in the left lower quadrant.

3. Discussion

Renal vascular abnormalities (RVAs) can be broadly classified as traumatic or atraumatic. Atraumatic RVAs are further categorized as congenital, referred to as arteriovenous malformations, or acquired, arising secondarily to neoplasm, inflammation, or pre-existing renal

artery disease. Traumatic RVAs are typically iatrogenic, most commonly caused by percutaneous renal biopsy (PRB).¹ True RAVFs, comprised of a solitary direct communication between an artery and vein, are the most common form of acquired RVA, thought to account for up to 80% of abnormalities, and are often associated with pseudoaneurysms.⁴ CT angiography for this patient showed an RAVF consistent in appearance with the described morphology of iatrogenic RAVF secondary to PRB (Fig. 2.).

RAVF and pseudoaneurysms are a relatively common complication of PRB, but are typically inconsequential, and self-limiting. One retrospective study of 327 consecutive PRBs with doppler ultrasound 24h post-biopsy found RAVFs in 14% of patients undergoing PRB. They were typically small (<1cm) and asymptomatic, with nearly half spontaneously resolving in <30 days, and 95% within 3 months. Incidence and spontaneous closure rates did not vary significantly between native and transplanted kidneys.³ A prospective analysis of 2824 PRB in transplanted kidneys reported a lower incidence of RAVF in post-PRB of 8% which was unaffected by timing of the biopsy relative to surgery up to 5 years, and whether the biopsy was for protocol or had a medical indication. This same study found that RAVFs were significantly more common in recipients of deceased donor organs, and with increasing donor age.² It is reasonable to suspect that the 7 protocol biopsies obtained during childhood conferred a heightened risk for iatrogenic RAVF formation for our patient. Despite this, we suspect that the significant length of time since most recent PRB may have lessened consideration of the diagnosis of RAVF at the time of it being conflated with existing cystic disease, and why doppler studies were not obtained at the time.

While most patients with RAVF post-PRB will remain asymptomatic with small lesions that undergo spontaneous closure, others may present with symptoms and findings of RAVF, including hematuria, and flank

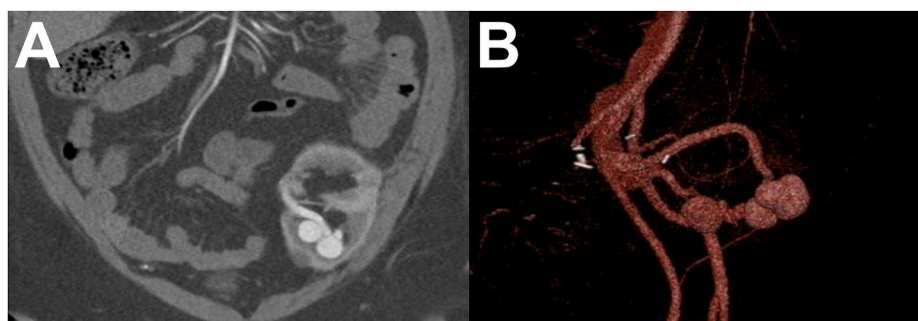


Fig. 2. CT angiogram (A), and 3D CT reconstruction (B) showing 3.2cm renal arteriovenous fistula (RAVF). The RAVF was fed almost directly by the main renal artery, apart from a few minor vessels branching prior to communication with fistula. Its appearance is consistent with the described morphology of iatrogenic RAVF secondary to percutaneous renal biopsy.

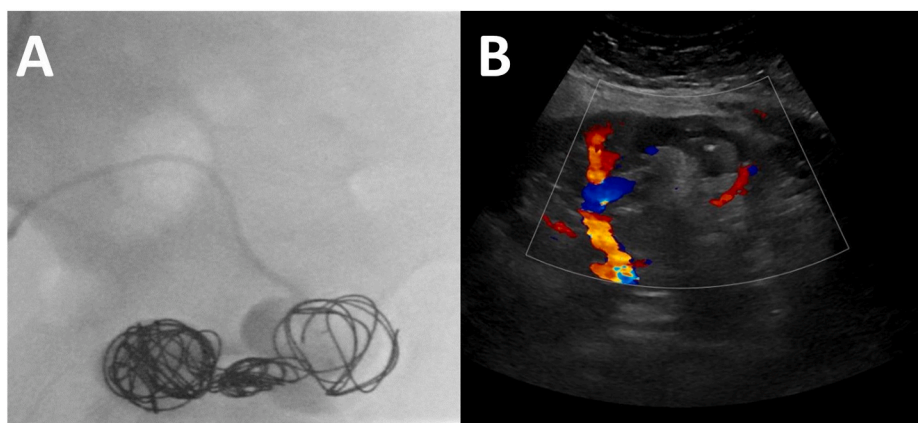


Fig. 3. Intra-operative fluoroscopic imaging of successful coiling of renal arteriovenous fistula (A) and follow up doppler ultrasound showing absence of flow to the aneurysm, consistent with successful embolization (B).

pain. Clinical signs of RAVF include hypertension, increased cardiac output, impaired renal function, palpable thrills or pulsatile masses, and continuous abdominal bruits over the area of the native or transplanted kidney. Rarely, ruptured RAVFs can present with hypotension and retroperitoneal hemorrhage, or cause high output cardiac failure or urinary obstruction from clots. If organ perfusion is sufficiently impacted, renal or allograft loss is possible.

Once identified, management of RAVFs typically involves watchful waiting or selective endovascular embolization. In general, larger, or rapidly growing lesions are considered to have a higher rupture risk, though exact thresholds for intervention based on size and growth are not well established. Symptomatic RAVF may also be considered an indication for treatment.

4. Conclusion

To our knowledge, prior to this case the longest delay in presentation of post-PRB RAVF in a transplanted kidney was 10 years.⁵ In the case of our patient, their 7th and most recent biopsy was taken nearly 16 years prior to diagnosis of the RAVF, representing what we believe to be the longest interval from PRB of renal allograft to RAVF diagnosis in the literature date. This case suggests that careful consideration should be given to apparent cystic disease in transplanted kidneys that have had numerous previous biopsies to rule out a concomitant asymptomatic RAVF, even long after most recent time of biopsy.

Consent

This patient provided consent for their case and imaging to be used in this report.

Declaration of competing interest

The authors have no relevant conflicts of interest to declare.

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