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# Large Biopsy-Related Renal Allograft Pseudoaneurym: Evident Sonographically but Indistinct Angiographically

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## Abstract

Percutaneous renal biopsies may be complicated by iatrogenic pseudoaneurysms. These are frequently diagnosed sonographically, and treated angiographically. This case report presents a renal transplant patient whose renal function declined after percutaneous renal biopsy. A large (5.5 cm) biopsy-related renal transplant pseudoaneurysm was readily identified on ultrasound, but was not visualized on selective renal transplant arteriography. Subsequent super selective renal transplant arteriography revealed the pseudoaneurysm, which was successfully embolized. One month after embolization, the patient's renal function nearly normalized.

**Keywords: Renal transplant pseudoaneurysm; Renal transplant complication; Renal transplant iatrogenic injury; Renal transplant biopsy; Renal embolization**

## Case Presentation

A 62 year-old male with end-stage renal disease status post living unrelated renal transplant to the right iliac fossa presented with a slowly increasing serum creatinine. Baseline serum creatinine level was 1.1 mg/dL three days after transplantation, but increased to 1.7 mg/dL thirteen days after transplantation. That day nephrology performed an ultrasound-guided percutaneous renal allograft biopsy. Two passes were made with a Max Core® spring-loaded 14 G by 16 cm core biopsy needle (Bard®, Tempe, AZ), and two samples were obtained. Pathology findings were nonspecific. The mild renal dysfunction was attributed to tacrolimus toxicity since trough levels had been borderline high. However, despite tacrolimus dose adjustments and eventual discontinuation, serum creatinine level continued to gradually increase. Twenty-five days after renal transplantation (12 days after renal allograft biopsy) serum creatinine had risen to 2.5 mg/dL. That day nephrology performed a second ultrasound-guided percutaneous renal allograft biopsy. Five passes were made with a Max Core® 14 G by 16 cm core biopsy needle, and two samples were obtained. Pathology was suspicious for acute rejection. Subsequent to the second biopsy, serum creatinine level rapidly increased to 6.4 mg/dL, which prompted a renal allograft ultrasound.

## Imaging Findings

Thirty-three days after renal transplantation (8 days after the second renal allograft biopsy) a renal allograft ultrasound was performed. Grayscale images revealed a 5.5 cm x 3.7 cm x 5 cm complex cystic structure (Figure 1a) at the renal allograft hilum. On color Doppler, the structure demonstrated red and blue turbulent flow (Figure 1b), suggesting a pseudoaneurysm. On spectral Doppler, the neck demonstrated a biphasic waveform (Figure 1c), confirming the presence of a pseudoaneurysm. The component of the pseudoaneurysm containing flow measured 2 cm in diameter. Transcatheter embolization was requested given the rapid post-biopsy rise in creatinine, overall diameter of the pseudoaneurym, and diameter of the patent component.

The same day of the ultrasound, digital subtraction arteriography of the right external iliac artery and transplanted renal artery was performed in oblique projections. A total of 96 mL of Visipaque 320 mgI/mL (GE Healthcare, Mississauga, ON) was used. These arteriograms revealed a 1 cm pseudoaneurysm in the lower pole of the renal allograft (Figure 2). A lesion corresponding to the 5.5 cm hilar pseudoaneurysm shown by ultrasound was not identified. The findings were discussed with the transplant surgery and nephrology teams, and embolization of the 1 cm lower pole pseudoaneurysm was deferred since the risk of post-embolization renal infarction and possible consequent decrease in renal function outweighed the benefit of embolizing a small pseudoaneurym.

The next day, another renal allograft ultrasound re-demonstrated the 5.5 cm hilar pseudoaneurysm. It was stable in overall diameter, but there had been some interval thrombus

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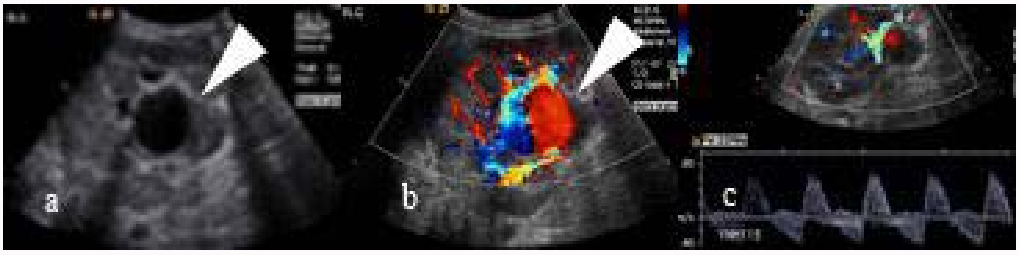


**Figure 1:** Renal allograft ultrasound (Siemens ACUSON Sequoia 512 ultrasound system, 6C2-S probe) (a) Gray scale image in longitudinal orientation demonstrates a complex cystic structure at the hilum (white arrowhead) measuring 5.6 cm x 3.7 cm x 5 cm. (b) Color Doppler image in longitudinal orientation at the same level as in (a) demonstrates red and blue turbulent flow within the cystic structure, also referred to as the "ying-yang" sign (white arrowhead). (c) Spectral Doppler demonstrates a biphasic waveform at the pseudoaneurysm neck, also referred to as "to-and-fro" flow.

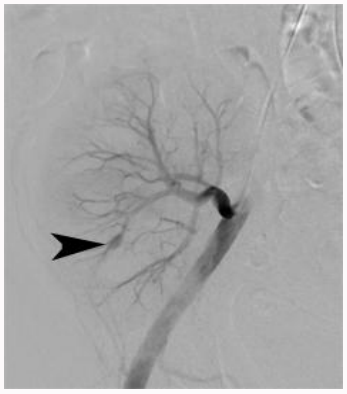

**Figure 2:** Selective renal transplant arteriogram (Siemens Artis fluoroscopy unit) through a left femoral arterial approach demonstrates a 1 cm intra renal pseudoaneurysm (black arrowhead) at the lower pole of the renal allograft.

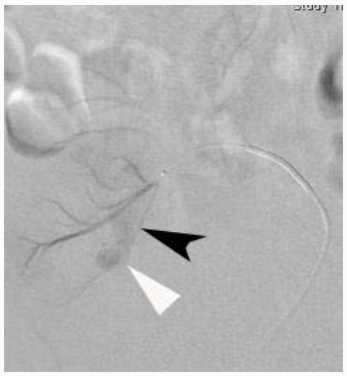

**Figure 3:** Super selective renal transplant arteriogram through a right femoral arterial approach reveals a larger pseudoaneurysm component (black arrowhead) medial to and communicating with the previously identified 1 cm lower pole pseudoaneurysm (white arrowhead).

regression paralleled by an increase in the diameter of the patent component to 3 cm. The transplant surgery and nephrology teams requested another renal transplant arteriogram with transcatheter embolization. Obtaining a CT angiogram for lesion delineation and endovascular treatment planning was considered but deferred given the patient's acute renal dysfunction.

Thirty-four days after renal transplantation, a repeat renal transplant arteriogram was performed, and showed interval increase in diameter of the previously identified lower pole pseudoaneurysm to 1.4 cm. Then, super selective arteriography of the lower pole segmental artery feeding the pseudoaneurysm revealed a larger pseudoaneurysm component just medial to and communicating with

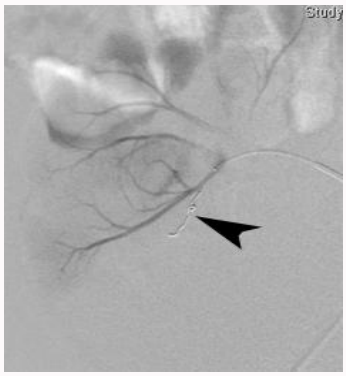

**Figure 4:** Post-embolization super selective renal transplant arteriogram demonstrates complete occlusion of the pseudoaneurysm's feeding arterial branch with one 3/2 mm Tornado microcoil.

the previously identified small lower pole pseudoaneurysm (Figure 3).

### Management

The decision was made to embolize the pseudoaneurysm. A microcatheter (Renegade, Boston Scientific, Natick, MA) was advanced into the interlobar branch directly feeding the bilobed pseudoaneurysm, and the branch was embolized with one 3/2 mm Tornado microcoil (Cook, Bloomington, IN). Completion super selective arteriography demonstrated complete occlusion of the pseudoaneurysm's feeding vessel; renal infarction was not identified (Figure 4). A total of 50 mL of Visipaque 320 mgI/mL was used.

### Follow-up

The patient was discharged two days after embolization. His serum creatinine level decreased gradually after the procedure, and reached a new baseline of 1.6 mg/dL one month after the procedure. He did not require hemodialysis after embolization (Table 1).

## Discussion

### Etiology and demographics

Biopsy-related iatrogenic vascular injuries are rare. They occur in 0.3% of renal transplant recipients, and in 1-18% of renal allograft biopsies [1-3]. Arteriovenous fistulae are the most common vascular injury, followed by pseudoaneurysms, occurring in 0.2% and 0.08% of renal transplant recipients, respectively [1]. There is no gender or age predilection, but more biopsy-related iatrogenic vascular injuries occur in adults because more adult patients receive renal transplants.

Pseudoaneurysms result from isolated laceration of the arterial wall [4]. Typically, extra renal pseudoaneurysms develop at the

**Table 1:** Summary table of the key characteristics and imaging findings of biopsy-related renal transplant pseudoaneurysms **[**1,4,5,9,11**].**

| | |
|---|---|
| Etiology | Isolation laceration of the atrial wall. |
| Incidence | Iatrogenic renal transplant pseudoaneurysms occur in 0.08% of all renal transplant recipients |
| Gender Ratio | No gender predilection |
| Age | No age predilection. The entity predominantly occur in adults since adult patients receive more renal transplants than pediatric patients. |
| Risk Factors | Renal transplant alograft biopsy. |
| Treatment | Transcatheter super selective renal embolization, patial nephrectomy, total nephrectomy |
| Prognosis | Super selective embolization has a technical success rate of 95%-100%. After this procedure, signs and symptoms resolve in 88%-100% of patients and 10%-32% of patients experience renal function detrioration. |
| Imaging Findings | On ultrasound biopsy related iatrogenic renal pseudoaneurysms demonstrate turbulent flow depicted as alternating jets of forward and reverse color ("Ying-Yang" sign). Spectral wave forms at the pseudoaneurysm neck demonstrate a classic biphasic "to and fro" pattern. Angiographycally, pseudoaneurysms commonly have a lobular appearance; less commonly, the injured vessel demonstrates ontour abnormality, or an abnormal caliber change. |

arterial anastomosis secondary to surgical technique or perigraft infection, while intra renal pseudoaneurysms develop at the renal poles secondary to percutaneous biopsies [5,6].

### Clinical and imaging findings

Most biopsy-related iatrogenic renal pseudoaneurysmsare asymptomatic, are found incidentally on surveillance imaging, and resolve spontaneously [7]. When symptomatic, they may present with massive or persistent hematuria, obstructive uropathy from clot retention, or an elevation in serum creatinine level [6,8,9].

Initial evaluation of suspected iatrogenic renal pseudoaneurysms is performed with ultrasonography. Contrast enhanced CT scans may also be used, but they are usually avoided since administration of intravenous iodinated contrast may exacerbate underlying renal dysfunction. Arteriography is performed if treatment is warranted.

Although on gray-scale ultrasound pseudoaneurysms appear as simple or complex renal cysts, their color and spectral Doppler ultrasound characteristics are pathognomonic. Color Doppler ultrasound shows turbulent flow in the central lumen - typically depicted by alternating jets of forward and reverse color - described as the "ying-yang" sign. Spectral waveforms at the pseudoaneurysm neck demonstrate a classic biphasic "to-and-fro" pattern [5,7]. Detection of intra renal vascular complications by ultrasound has a reported sensitivity and specificity of 77% and 100%, respectively [2]. Angiographically, pseudoaneurysms commonly have a lobular appearance; less commonly, the injured vessel demonstrates contour abnormality, or an abnormal caliber change.

In our case, ultrasonography was unequivocal in revealing a pseudoaneurysm, but localized the lesion to the renal allograft hilum. After the initial iliac and selective renal transplant arteriograms failed to reveal a pseudoaneurysm at the renal hilum, super selective renal arteriograms of the upper and lower poles should have been obtained because these are the areas typically biopsied. This would have revealed the larger component of the lower pole bilobed pseudoaneurysm.

Alternatively, carbon dioxide renal arteriography could have been performed. Carbon dioxide is not nephrotoxic, and has been described to be more sensitive in the identification of biopsy-related renal arteriovenous fistulas when compared to iodinated contrast [10]. The increased sensitivity was attributed to the lower viscosity of carbon dioxide, especially when compared to that of Visipaque, which is the iodinated contrast medium usually selected for patients with underlying renal dysfunction [10]. Carbon dioxide arteriography may also have a higher sensitivity in the detection of biopsy-related pseudoaneurysms.

### Treatment and prognosis

The treatment of choice for biopsy-related iatrogenic renal pseudoaneurysms, especially in the setting of renal allografts, is transcatheter super selective embolization. Embolization should be performed if the lesion is symptomatic, or if asymptomatic but progressively enlarging or larger than 2 cm in diameter. Super selective embolization has a technical success rate of 95%-100%. The clinical sign or symptom that prompts the procedure resolves in 88%-100% of patients [9,11].

If the lesion is not amenable to super selective embolization, super selective embolization has failed, or the procedure is not available, the indicated treatment is partial or complete nephrectomy. However, compared to these surgical alternatives, super selective embolization preserves the most renal function.

After super selective embolization, 10%-32% of patients experience progressive deterioration of renal function [9,11]. Whether all of these patients experience renal impairment as a consequence of the procedure remains uncertain. Nonetheless, cases in which super selective embolization causes significant renal parenchyma infarction may result in decreased renal function [9,11,12].

## Conclusion

If a biopsy-related renal transplant pseudoaneurysm is identified on ultrasound, but not on selective renal arteriography, super selective upper and lower pole renal arteriograms should be performed because the pseudoaneurysm is most likely to be found in these areas. The treatment of choice for this lesion is transcatheter super selective embolization.

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