

Arteriovenous Fistula Complicating Transjugular Renal Biopsy

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Abstract

Percutaneous renal biopsy with sonographic guidance is the standard by which renal tissue is sampled. In patients with uncorrectable coagulopathy or other contra-indication, percutaneous biopsy may not be feasible and a transvenous approach is preferred. This method limits the risk of bleeding complications as tissue is obtained endovascularly without transgression of the renal capsule. Arteriovenous fistula (AVF), a well-documented complication of percutaneous biopsy, has yet to be reported when done from a transvenous route. This report describes a case of iatrogenic arteriovenous fistula following transjugular renal biopsy necessitating selective arterial embolization. Clinical features are reviewed in addition to spot fluoroscopic images from transarterial coil embolization of the AVF.

Keywords

Biopsy, Renal, Transjugular Kidney Biopsy

1. Introduction

Percutaneous image-guided biopsy is the standard method by which to sample renal tissue. Transjugular renal biopsy provides an alternative to the percutaneous route in patients with contraindications including, most commonly, bleeding diathesis [1]. The procedure has been shown to provide adequate an pathologic specimen and is associated with a complication rate on par with the traditional percutaneous method [2] [3]. Despite being well documented as a consequence of percutaneous biopsy, arteriovenous fistulas (AVFs) are relatively infrequently discussed in the context of a transvenous approach. AVFs are clinically relevant as they can cause hemodynamically significant bleeding and shunting of blood which results in a rapid deterioration of renal function. In this situation, selective embolization of AVFs is a very effective technique to manage this complication.

2. Case Presentation

The patient was a 45-year-old male with hepatitis C cirrhosis presenting with acute renal failure secondary to cryoglobulinemia in need of a renal biopsy. Although coagulation parameters were within normal range (Prothrombin time 15.1, International Normalized Ratio 1.2), the patient was thrombocytopenic (37,000/ul) refractory to transfusion from his underlying chronic liver disease. Given the concern for bleeding complication, interventional radiology consultation was requested for a transjugular approach to biopsy.

Following initial pre-procedural work up, the patient was brought to the angiography suite where the right internal jugular vein was accessed under ultrasound guidance with a micropuncture system (Cook, Bloomington, IN). Under fluoroscopic guidance, a 15 J wire (Cook, Bloomington, IN) was advanced into the inferior vena cava. The 14-gauge 60.5 cm transjugular sheath and Quick-Core needle biopsy system (Cook, Bloomington, IN) was placed. A 5 Fr 80 cm multipurpose catheter was used to select the lower pole right renal vein. Positioning was confirmed by venography using Omnipaque 300 (GE Healthcare) (**Figure 1**). The guide wire was exchanged for a super-stiff Amplatz wire (Cook, Bloomington, IN), over which the 14 gauge inner-stiffening cannula was advanced. The 19-gauge 70 cm (20 mm throw) core biopsy needle was then introduced and directed posterolaterally. A total of four passes were made, each under fluoroscopic guidance. Venography by hand injection of contrast was performed before and after each pass of the core biopsy needle to confirm proper positioning as well as to exclude extravasation from prior passes. Two intervention radiologists were scrubbed in during the retrieval of specimens; one to fire the cutting cannula of the biopsy gun and remove the specimen, and the other to maintain positioning of the stiffening cannula/guiding catheter. The patient tolerated the procedure well and was returned to his ICU bed in stable condition. Post procedure monitoring was overseen by the ICU team.

Within a few hours of the procedure the patient was noted to develop gross hematuria and a drop in hemoglobin from 10.1 to 8.5 g/dL. The decision was made to bring the patient back emergently to interventional radiology for selective right renal arteriography. The right common femoral artery was accessed using a micropuncture system. A 5 Fr vascular sheath was then placed. A multi-sidehole infusion catheter was advanced into the abdominal aorta over a guide wire. An aortogram was performed which demonstrated a single right renal artery. Using a 15 J wire and a 5 Fr RC1 catheter (Cook, Bloomington, IN) the right renal artery was accessed under fluoroscopic guidance. A renal arteriogram was performed using Visipaque 320 (GE Healthcare). Although no

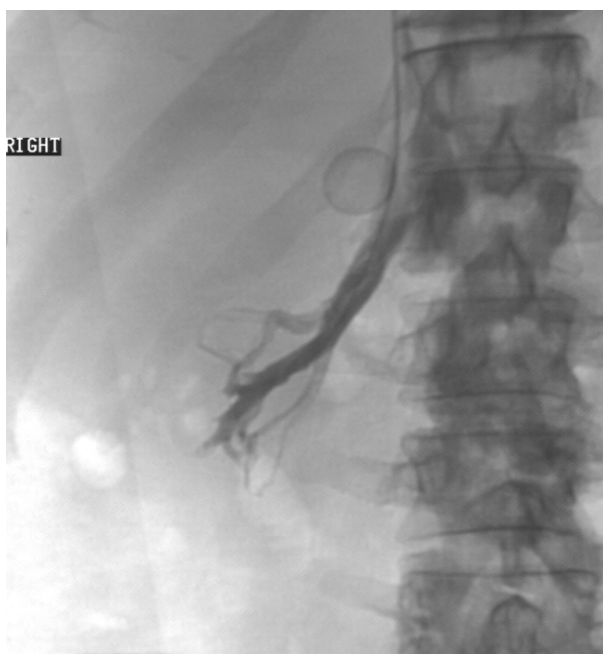


Figure 1. Venogram confirms appropriate access to lower pole renal vein. Note that lack of cortical enhancement could suggest inadequate peripheral wedging.

vascular injury was identified, a segmental artery supplying the lower pole was selected. Selective arteriogram demonstrated an AVF with early opacification of a draining vein (**Figure 2**). Using a coaxial system, the lobar artery was selected with a 3 Fr microcatheter (Renegade STC; Boston Scientific, Natick, MA). After confirming catheter positioning with superselective angiography, embolization was performed using Interlock microcoils (Boston Scientific, Natick, MA) (**Figure 3**). Post-embolization angiogram of the lobar artery and right main renal artery (**Figure 4**) confirmed occlusion of the arteriovenous fistula. The patient's hematuria subsequently resolved with stabilization of his hemoglobin level.

3. Discussion

Percutaneous renal biopsy, either under ultrasound or CT guidance, is the current standard procedure by which glomerular tissue is obtained. This procedure permits direct sampling of the renal cortex without transgressing larger vessels in the hilum and medulla. However, it does require puncture of the renal capsule, placing the patient at risk for significant bleeding complications such as perinephric hematoma and gross hematuria. Major



Figure 2. Selective arteriogram of an inferior pole segmental renal artery demonstrates an arteriovenous fistula with opacification of a draining vein.

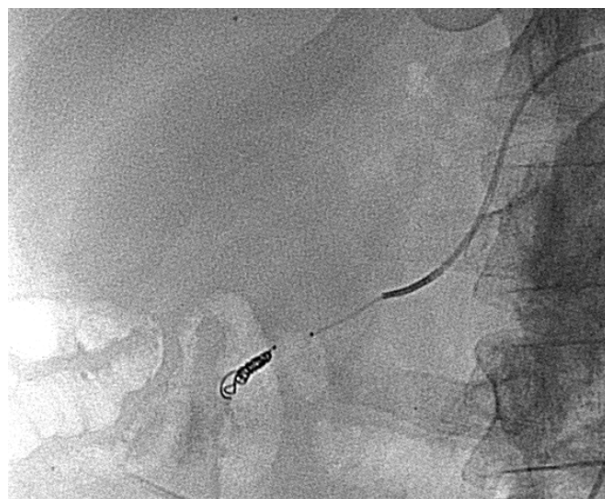


Figure 3. Microcoil embolization of the lobar artery supplying the arteriovenous fistula.



Figure 4. Successful embolization of arteriovenous fistula with resolution of previously demonstrated early draining vein. Note careful sparing of flow to ureteric artery.

complications, defined by clinically significant bleeding requiring transfusion or intervention, have been reported to occur in up to 6.4% of cases [2].

Roughly 5% of renal biopsies are contraindicated by this percutaneous approach [4]. Common contraindications include bleeding diathesis, maintenance anticoagulation, morbid obesity, ascites, uncontrolled hypertension, and small kidneys [1]. A transvenous approach presents several theoretical advantages in this high-risk population. First, it avoids perforation of the renal capsule, lowering the risk of significant hemorrhage. Secondly, when bleeding does occur, it should simply return back to the venous system by which it was sampled [5]. Disadvantages to this access include transgression of the medullary parenchyma and consequent risk of injury to larger central vessels. Also, specific lesions cannot be targeted which also limits its usefulness. Most importantly, the reported major complication rates are highly variable and range between 1% - 40% [6] [7].

When performing a transjugular renal biopsy, there are a few points to consider with respect to optimizing the technical success rate and preventing complications. First, the right renal vein is preferred due to its shorter length and relatively more direct access route from the inferior vena cava. Second, one should advance the biopsy cannula as distally as possible into a medullary interlobar vein of the lower pole. This ensures cortical sampling and reduces the risk of damage to a large vessel [8]. Note that this is in contrast to the technique for transjugular hepatic biopsy. Third, it is important to angle the biopsy needle laterally and posteriorly to avoid colonic puncture [9].

The most commonly reported complication with transvenous renal biopsy is capsular perforation. The majority of these are associated with gross hematuria. More severe cases may result in large retroperitoneal bleeds, which are fortunately usually self-limiting from the tamponade effect of the perinephric fat. Misra *et al.* reported no correlation between extravasation seen on venography and bleeding seen at follow-up imaging [2]. Paradoxically, capsular perforation has been shown to be associated with better specimens in animal studies. It is also interesting to note that no correlation between the number of biopsy needle passes and rate of major complication was seen in a series by See *et al.* [10]. This series did however report a higher risk of capsular perforation.

Concurrent biopsy tract embolization in cases of venographically identified capsular perforation has been described [4]. The biopsy tract may be cannulated with a hydrophilic wire and 5 Fr multipurpose catheter. A Gelfoam (Upjohn, Kalamazoo, MI) pledget may then be placed within the tract. Although this concept may work in theory, it can be difficult to cannulate the tract, and the Gelfoam pledget can become displaced. Also, Gelfoam embolization is less likely to be successful in the setting of urinary tract perforation. Additionally, clinically significant bleeding occurs from high-pressure arterial bleeding, and embolization of the arterial inflow, rather than the venous outflow would likely be more efficacious at hemostasis. By the same reasoning, it would also be un-

likely to diagnose an arteriovenous fistula via post-biopsy venography.

The incidence of AVF after percutaneous renal biopsy is reported to range between 1% - 18% [11]. Up to 80% of post-percutaneous biopsy AVFs resolve spontaneously. Of the reviewed literature, no AVFs resulting directly from transjugular renal biopsy were reported. There was only one documented case of calyceal disruption requiring embolization. Although a transvenous route for biopsy has been touted as a safer choice to the percutaneous option, our case illustrates that major bleeding complications do exist with this approach [3]. Given that larger central vessels are present when a transvenous biopsy is performed, the potential for major vessel injury should not be ignored. Despite techniques that are intended to limit this risk (*i.e.* sampling from a distal interlobar medullary vein), the overall technique remains a “blind” procedure with respect to the arterial anatomy. Furthermore, the current existing data is unclear as to the true major complication rate when a transjugular biopsy is performed.

With this in mind, a drop in hemoglobin in the setting of hematuria following transvenous biopsy is an indication for prompt arteriography. Our clinical scenario demonstrated the potential for a communication between an artery and calyx that most likely extended to the venous outflow given the biopsy technique. Once an AVF is angiographically identified, we prefer transcatheter embolization with microcoils for treatment. Furthermore, superselective embolization of the affected artery using a coaxial system minimizes loss of renal parenchyma while effectively achieving embolic arrest of the fistula.

4. Conclusion

To our knowledge this is the first reported case of arteriovenous fistula following renal biopsy from a transvenous approach. Although a clinically significant and potentially life threatening complication, this entity can be effectively managed by transarterial coil embolization.

Conflict of Interest

The authors state that they have no financial or other conflicts of interest to disclose.

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