Percutaneous Renal Cryoablation Complicated by Hemorrhage

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ABSTRACT

The authors describe a case in which a patient underwent percutaneous cryoablation of a suspected right renal cell carcinoma complicated by bleeding. Urgent angiography revealed a lower renal pole arteriovenous (AV) fistula, correlating with the recent treatment site. This AV fistula was successfully treated with coil and Gelfoam embolization. Three days later, the patient's hemoglobin dropped following dialysis. Computed tomography (CT) imaging revealed an increase in the size of the pararenal hematoma. There were multiple pseudoaneurysms as well as a small AV fistula on repeat angiography. The right main renal artery was coil embolized.

KEYWORDS: Renal, cryoablation, complications, hemorrhage, ablation, postprocedure

CASE REPORT

The patient is a 60-year-old man with a history of a left papillary-type renal cell carcinoma diagnosed 18 months prior for which he underwent a left radical nephrectomy. Subsequently, the patient developed renal failure and was placed on dialysis. Surveillance imaging revealed a 2.0×1.8 cm mass in the midpole of the right kidney. This mass enhanced following contrast administration and was suspected to be a renal cell carcinoma (RCC). The patient refused right nephrectomy, and he was referred to Interventional Radiology for percutaneous ablation.

The patient underwent CT-guided percutaneous cryoablation of the right renal mass under conscious moderate sedation. Following hydrodissection of the adjacent duodenum and hepatic flexure with normal saline, two 2.4-mm cryoablation probes (Endocare Inc., Austin, TX) were placed into the mass. Per our standard protocol, a 10-minute freeze cycle was followed by a 5-minute thaw and then another 7-minute freeze cycle. The cryoablation probes were then removed.

Postprocedure CT scan showed a $3 \times 5.6 \times 4$ -cm cryoablation zone (Fig. 1). The procedure was considered successful and the patient did not have any immediate complications. Specifically, there was no evidence of bleeding.

Three hours following the procedure, the patient complained of abdominal pain and fullness. Stat laboratory analysis revealed a hemoglobin drop of 2 g/dL from the procedure level. An emergent CT scan of the abdomen was performed, demonstrating a moderate-sized anterior pararenal hematoma. The collection appeared hyperdense and was thought to be acute and arising from an anterior defect in the kidney (Fig. 2). The patient was slightly hypotensive (blood pressure 95/60). The patient was brought to the angiography suite for urgent right renal artery angiography. A 6-French (6 Fr) vascular sheath was placed into the right common femoral artery. A Cobra one Glidecath[®] (Terumo Medical Corp., Tokyo, Japan) catheter was advanced into the abdominal aorta. The right renal artery was catheterized and angiographic images obtained. Angiography revealed standard

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Figure 1 (A) Cross-sectional images during the cryoablation demonstrate the probes in place with ablation zone ice. (B) The second image demonstrates after the removal of the 2.4-mm diameter probes.

renal artery anatomy with no evident accessory arteries. There was an area of irregular enhancement in the lower pole of the right kidney with early venous filling, consistent with a posttraumatic arteriovenous (AV) fistula. (Fig. 3) Using a hydrophilic coated wire, selection of the inferior pole branch of the renal artery was performed. Gelfoam and coil embolization of this vessel was then performed using Gelfoam[®] (Baxter, Deerfield, IL) and 5-mm diameter 0.035" fibered platinum coils (Boston Scientific, Boston, MA). Postembolization images showed complete occlusion of the inferior pole branch. The patient was admitted to the intensive care unit and monitored with serial laboratory evaluation.

Although the patient was asymptomatic, his hemoglobin dropped from 10.4 to 7.9 g/dL 2 days following renal cryoablation. After hemodialysis 3 days following renal cryoablation, the patient's hemoglobin dropped significantly to 6.8 g/dL and the patient was transfused 2 units of packed red blood cells. It was later

revealed that the patient was fully heparinized during the dialysis session. Repeat CT showed that the right anterior pararenal hematoma had increased in size and hyperdense fluid was noted in the pelvis, likely related to acute hemorrhagic products. Recurrent renal bleeding was suspected and the patient underwent urgent repeat right renal artery angiography. This angiogram demonstrated multiple pseudoaneurysms in the upper-pole right renal artery as well as a small AV fistula again in the region of the lower pole. As the patient was dialysis dependent, the decision was made to coil embolize the right main renal artery. After placing a 6Fr vascular sheath in the right common femoral artery, a Cobra one Glidecath[®] catheter was advanced into the abdominal aorta. Selection of the right renal artery was performed and angiographic images obtained. Using a hydrophilic coated wire (Terumo Medical Corp.), the catheter was placed into the distal right main renal artery. Gelfoam and coil embolization of the right renal arterial supply was performed using Gelfoam[®] and 5-mm diameter 0.035" fibered platinum coils (Boston Scientific). Post-embolization images demonstrated complete occlusion of the main right renal artery (Fig. 4).

The patient is now 4 months out from renal cryoablation and subsequent right renal artery embolization. There has been no evidence of recurrent hemorrhage or other complication. Serial CT examinations have shown progressive decrease in the size of the hematoma as well as the renal mass.

Figure 2 Postcryoablation computed tomography scan of the abdomen: This shows a right anterior pararenal hematoma that has hyperdense areas consistent with acute/active bleeding.

DISCUSSION

Cancer of the kidney is the third most common malignancy of the urinary tract,¹ with the incidental discovery of RCC rising secondary to the increased use of cross-sectional imaging.² For small (< 3 cm) renal masses, image-guided percutaneous ablation is becoming the

Figure 3 Imaging from the first angiogram. (A) The first image shows a postcryoablation selective angiogram image showing lower pole extravasation and arteriovenous fistula. (B) The second image shows successful embolization of the arteriovenous fistula with no evident extravasation.

standard of care.³ Both radiofrequency (RF) ablation and cryoablation have been used in RCC. A recently published comparative study revealed that cryoablation of renal tumors results in similar outcomes compared with RF ablation.⁴ Although these results need to be substantiated with randomized studies, many interventional radiologists prefer cryoablation over RF ablation for several reasons. These include less procedural pain and thus decreased anesthesia use, and real-time visualization of the ablation zone.

Potential bleeding complications of thermal ablations include procedural bleeding, perinephric hematomas, and transient hematuria.⁵ One advantage of RF ablation is the ability to perform tract ablation during

electrode withdrawal. Similarly, a preclinical study reported that percutaneous tract injection of gelatin sponge after cryoablation significantly reduced acute blood loss.⁶

The overall incidence of bleeding following renal cryoablation appears to be similar to that seen after renal RF ablation. In a report by Littrup et al, 7 of 49 renal masses (14%) being treated with cryoablation developed hematomas.⁷ None of these episodes were life threatening or required treatment. Another series by Rodriguez et al reported large perinephric hematomas in 2 patients (of 117 renal masses being cryoablated). Both patients required blood transfusions but no other intervention.⁸ Much of the literature regarding operative

Figure 4 Imaging from the second angiogram. (A) The first image shows multiple small pseudoaneurysms as well as small arteriovenous fistulas. (B) The second image shows successful embolization of the main right renal artery.

(laproscopic/open) renal cryoablation report similar rates.⁹

Johnson et al conducted a multiinstitutional review of 139 cases of cryoablation and 133 cases of RF ablation. They reported only two instances of postprocedural hemorrhage, one minor, one major (requiring transfusion), both of which occurred after cryoablation.¹⁰ Another RF ablation study reported minor bleeding complications in 33% (9 out of 27 ablations). They reported no major bleeding complications.¹¹ Gervais et al reported on 34 patients who underwent RF ablation of 42 RCC tumors over a 3.5-year period. The total number of ablations was 54. They reported 1 minor hemorrhage, 2 major hemorrhages, and 1 ureteral stricture. No surgical intervention or embolization was required in these patients.¹²

Several studies published within the last decade remind us that we also must consider the risk of hematuria when reporting complications of renal tumor ablation. Though a less life-threatening complication, it also is a form of bleeding. Hematuria is seen more commonly in tumors involving the renal sinus.¹³

When evaluating a patient for cryoablation, laboratory parameter considerations are similar to those for RF ablation and many other interventional radiologic procedures. Correction of the international normalized ratio (INR) should be done with the proper products so as to achieve a level ≤ 1.5 . The partial thromboplastin time (PTT) should be < 1.5 times control and platelets $> 50,000$. If a patient is taking Plavix[®] (Bristol-Myers Squibb/Sanofi, Bridgewater, NJ), this should be discontinued 5 days prior to the procedure and if low-molecular-weight heparin is prescribed, the dose before the procedure held. If a more complex ablation procedure is expected, in addition to the above, aspirin should be withheld for 5 days and fractionated heparin for up to two doses.¹⁴ An additional consideration in complex cryoablation cases (particularly in the liver) is a preference for higher platelet counts. This is due to the risk of cryoshock for larger ablation zone volumes.

Hemorrhage following renal cryoablation can be diagnosed clinically with the symptoms of vague abdominal pain or fullness. Hemodynamic instability is also a concerning symptom. Bleeding can be confirmed by serial decreases in hemoglobin or hematocrit levels. Imaging with ultrasound or abdominal CT is especially helpful in the early diagnosis of postprocedure bleeding, and these studies should not be delayed in patients presenting with signs or symptoms of bleeding. CT can also be useful in quantifying the amount of extravasated blood and pinpointing the location of the bleeding.

After identifying the bleeding complication, it may be very likely that the fascial planes, if still intact, can tamponade the bleeding within the perirenal space. Blood transfusion and correction of any coagulopathy are

important initial steps. However, if the patient is unstable and the hemorrhage is not self-limiting, blood transfusion alone will likely not suffice. Emergent angiography should be performed and a surgical consult should be obtained. The site of the bleeding can usually be diagnosed and treated very efficiently with angiography and current embolization techniques. Gelfoam and coil embolization is most typically employed. Though cryoablation is a modern technology, angiography and arterial embolization for renal bleeding has been performed since the early 1970s.¹⁵ Many considerations need to go into the planning of renal embolization. Interventional radiologists commonly devascularize kidneys in a preoperative setting using intraarterial alcohol. Although this is very effective, it is difficult to control with partial renal embolization. More precise methods of embolization are commonly employed when dealing with renal-sparing strategies. Thrombogenic coils and particulate matter are much easier to deploy in a specific location and are thus generally the instruments of choice.

In conclusion, patients experiencing bleeding following cryoablation tend to do well. Through the years, the risk for postablation hemorrhage has been shown to be low and the need for embolization very rare. Nevertheless, when bleeding occurs, it needs to be recognized early. If necessary, angiography with embolization should be employed.

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