Concurrent Vascular Lesions during Renal Angiography: A Potential Distractor

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Reduced detection of radiologic findings due to the presence of a second lesion, commonly known as *satisfaction of search* (SOS), is a well-described phenomenon in the diagnostic radiology literature.^{1–7} Although not specifically described in the interventional radiology (IR) literature, it is likely that the same general phenomena of SOS holds true for procedural-based radiologists. The following case and companion demonstrates coexisting vascular pathology that diverted operators during a renal embolization procedure.

Case Report

A 17-year-old previously healthy Caucasian woman initially presented with acute renal failure of uncertain etiology. A percutaneous right renal biopsy was performed using a 16-gauge needle with one pass, complicated by an immediate right perirenal hematoma noted on the postbiopsy ultrasound (►Fig. 1a). Conservative measures were initiated; however, a declining hemoglobin level required hospital admission and transfusion with 2 units of packed red blood cells (pRBCs). A postbiopsy ultrasound performed the following day demonstrated an enlarging hematoma and renal artery pseudoaneurysm (PSA) at the level of the interpolar right kidney (►Fig. 1b). The patient was transferred to IR for embolization.

An initial embolization procedure was performed using a right common femoral artery approach. Right renal arteriography initially utilized CO₂ in an effort to minimize further renal injury; however, 11 mL of iodinated contrast was used throughout the procedure to allow better visualization of the renal vasculature. Importantly, due to acute renal failure, an aortogram was not performed, and a reverse curve catheter (Simmons 2; Cook Medical, Inc., Bloomington, IN) was used to select the right renal artery.

Selective right renal arteriography revealed a PSA and arteriovenous fistula (AVF) arising from the mid to low interpolar arterial branches (►Fig. 1c, d). No active arterial extravasation was identified during preembolization angiography. Embolization of the feeding arteries to both the PSA

and AVF was performed using three microcoils, resulting in near-static flow within the pseudoaneurysm as well as non-visualization of the AVF (►Fig. 1e). Further angiography was not performed at that time given underlying renal dysfunction and the need to minimize contrast.

Postprocedure, a more detailed review of the images several hours after the procedure by a second IR physician noted arterial contrast extravasation arising from a lower pole right kidney artery (►Fig. 1f). Further review of the images demonstrated the catheter to be in the posterior right renal artery with flash filling by reflux of the anterior right renal artery; the contrast extravasation was believed to be arising from the anterior artery (►Fig. 1g).

Given persistent bleeding necessitating transfusion of an additional unit of pRBC, the patient returned for subsequent embolization 2 days later. Repeat arteriogram demonstrated two small adjacent PSAs arising from the anterior lower pole artery (►Fig. 1h), and subsequent embolization was performed using an additional microcoil. Successful hemostasis was noted on the postembolization arteriogram (►Fig. 1i). The patient's hemoglobin level normalized, and she was discharged from the hospital after experiencing no additional bleeding complications.

Companion Case: Postbiopsy Renal Hemorrhage

A 19-year-old Ethiopian woman presented with anuria of several days. Her coagulation parameters and platelet count were normal. She underwent a percutaneous biopsy with ultrasound marking, performed by the nephrology service. After a single biopsy with a 14-gauge needle, ultrasound demonstrated a rapidly growing hematoma, which was not appreciated by the operating service. After conservative measures were initiated, a noncontrast computed tomogram was urgently performed, which demonstrated a large acute perirenal hematoma (►Fig. 2a). The patient was transferred to the angiography suite for emergent embolization.

Fig. 1 A 17-year-old woman postbiopsy of the right native kidney. (a) Immediate postbiopsy ultrasound demonstrates a large perinephric hematoma (arrows). (b) Postbiopsy renal ultrasound performed the day after biopsy reveals a pseudoaneurysm at the interpolar right kidney (arrow). (c) On the initial angiogram, renal arteriography demonstrates a pseudoaneurysm (PSA) (arrow) arising from a mid to lower interpolar artery. (d) Initial renal arteriography demonstrates early venous filling (arrow), consistent with arteriovenous fistula (AVF) of the proximal interpolar branches near the renal hilum. (e) Initial embolization with microcoils (arrow) resulted in nonvisualization of the previously identified AVF, and minimal residual flow in the PSA (arrowhead). (f) Subtle extravasation at the lower pole on initial embolization that initially went undetected (arrow). (g) Catheter position was initially in the posterior right renal artery (arrowhead) with flash filling by reflux of the anterior right renal artery (arrow); the contrast extravasation was believed to be arising from the anterior artery. (h) Angiogram demonstrates two small PSA arising from the lower pole artery (arrow). (i) Repeat microcoil embolization (additional coils indicated by arrows) resulted in hemostasis of the previously identified extravasation.

Fig. 1 (Continued)

Initial aortography demonstrated markedly attenuated vessels, and suggestion of acute contrast extravasation from the left renal artery (►Fig. 2b). Following selective catheterization of the left renal artery, angiography redemonstrated the acute extravasation (►Fig. 2c). A microcatheter was placed distally (►Fig. 2d); however, prior to embolization, access into the distal vessel was lost and could not be reobtained. At this point, the pathology department contacted the IR suite and communicated that the patient had complete nephrosclerosis with no remaining normal parenchyma. Discussion with the nephrology service confirmed that there was no chance for renal recovery, and at that point the entire kidney was embolized with alcohol. Vascular stasis confirmed complete occlusion of the right renal vasculature (►Fig. 2e).

Discussion

Renal biopsy represents one of the most commonly performed percutaneous biopsy procedures. Postbiopsy bleedings, including hematuria (3.1%) and hematoma (2.1%),⁸ are common occurrences that can be further complicated by renal artery PSA (0.1–1.0%⁹), AVF (0.4–18.0%¹⁰) and arteriocaliceal fistula formation. In addition, anatomic variations of the renal arteries including accessory arteries (20–30%)¹¹ and early arterial branching (12%)¹² are common variations that can be seen during angiography. These findings have the potential to obscure extravasation in the setting of active bleeding, a phenomenon that can be further compounded by additional external distractions during interventional procedures.¹³ In addition, as illustrated in the earlier case, there is often a need to decrease the amount of contrast used during these procedures to decrease the risk of causing further renal insufficiency.

As noted in the first case presented, lesions obvious on angiography present the potential to distract a primary operator from other clinically significant pathology. Multiple factors have been demonstrated in cognitive psychology research that impact susceptibility to this

phenomenon,¹⁴ including frequency of concurrent findings, time pressures on the viewer, and expectations about the number of lesions present. Each of these factors is important in the performance of angiography and embolization. Addressing these factors has the potential to reduce the likelihood of an operator's probability of succumbing to such pitfalls.

Regarding the frequency of secondary findings, one should be increasingly suspicious for occult processes as the number of potential incidental lesions increases. Particularly when two or more findings are present, the risk of overlooking a subtle third finding is relatively high. This concept is illustrated in the first case presented here, where the presence of two concurrent lesions (in this case PSA and AVF) distracted the operator from noting the subtle extravasation (the third finding), which was seen on only a few of the images during one angiographic run. The attending operator focused on not one but two findings, either of which could have been responsible for the bleeding postbiopsy. Why one must remain diligent in searching for additional pathology is illustrated here.

Time pressures also play an important role in missing concomitant lesions. As the speed of a procedure or just as likely the pressure to free up an angiography suite increases, so does the risk of overlooking important pathology or making errors that otherwise would not likely be made.¹³ It is a fine balance between taking care of the patient on the table and preparing to take care of the next patient. Too much time obsessing over the current patient can back a room up so much that a latter patient is either rushed through or has the procedure cancelled altogether.

Finally, an operator's expectation about the total number or location of expected lesions plays an important role in overlooking secondary lesions. For example, if a prior magnetic resonance imaging report describes a solitary renal lesion in the kidney, this finding may cause the observer to overlook a second, smaller tumor that was not anticipated. An approach that *assumes* that additional lesions are present, until proven otherwise, is advised both for diagnostic and interventional radiologists. In the first case described earlier,

Fig. 2 A 19-year-old woman postbiopsy of native left kidney. (a and b) Noncontrast computed tomogram demonstrating a large perinephric hematoma (a; arrows) with extension into the pelvis (b; arrows). (c) Aortography demonstrating diffusely attenuated vessels and contrast extravasation in the right upper quadrant (arrow). (d) Renal arteriography confirmed active contrast extravasation from the right renal artery distribution (arrow). (e) Extravasation again noted following microcatheter placement. (f) Angiogram following transcatheter alcohol ablation of the right renal artery, demonstrating complete occlusion of the intraparenchymal vasculature with a residual main renal artery stump (arrow).

the operator made an assumption—a preconceived notion—that only one bleeding site would be present. Conversely, if a site of bleeding is not identified initially, careful correlation of location and appearance of bleeding with preprocedure

cross-sectional imaging can help identify a lesion that might be overlooked.

As described here, concurrently detected vascular lesions noted during angiography have the potential to divert the

primary operator from diagnosing other clinically important findings. These pitfalls can be avoided by applying increasing diligence assessing all the images from angiographic runs, resisting time pressures, and assuming that additional lesions are present until proven otherwise. Even the most experienced operators should be wary of these potential hazards and should implement strategies into routine practice to avoid such pitfalls.

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