



# A Case of Arteriovenous Fistula After Kidney Trauma Mimicking Tumor

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## Abstract

Renal arteriovenous fistulas are rare complications of kidney injury that are usually caused by penetrating or blunt abdominal trauma, percutaneous or open biopsy, or surgery. We report a case of renal arteriovenous fistula after blunt abdominal trauma of a male patient who had traffic accidents. Computed tomography images show arteriovenous fistula lesion mimicking the tumor of the renal pelvis. Through this case, we present how to identify and avoid being confused in diagnosis as well as introduce its clinical manifestations, imaging, and treatment.

## Keywords

kidney injury, kidney trauma, renal arteriovenous fistula, renal pseudotumor, renal tumor

## Introduction

Renal trauma accounts for approximately 1% to 5% of all traumas and can be classified as blunt or penetrating trauma. Blunt trauma is the most common mechanism taking 71% to 95% of renal trauma.<sup>1</sup> Renal arteriovenous anomalies (arteriovenous fistula [AVF]; arteriovenous malformation [AVM]) are defined as abnormal communications between renal arteries and venous systems, which include congenital and acquired types. The most common acquired renal arteriovenous anomalies are AVFs resulting from an iatrogenic injury, trauma, or tumor.<sup>2</sup> Traumatic renal AVFs are caused by penetrating or blunt trauma, percutaneous or open biopsy, or surgery.<sup>3</sup> Blunt abdominal trauma in our case is a rare case of renal AVF. In the case of traumatic fistula, the symptoms include microscopic or macroscopic hematuria, flank pain, hypertension, or pseudoaneurysms located in the periphery of the kidney.<sup>2,4</sup> We report a case of a 57-year-old man who has an injured kidney and diagnosed with pseudotumor AVF renal.

## Case Presentation

A 57-year-old male was admitted to an emergency unit with abdominal trauma due to 2 motorbike crashes. His right flank hit on one side of the motorbike. The blood pressure on admission was 95/60 mm Hg, heart rate was 90 beats per minute, he was not afebrile, and had a normal respiratory system. He had minor abrasions and pain on the right flank.

Examination showed that this was a blunt injury with no related medical history. Laboratory tests included red blood cells count 4 100 000  $\mu$ L, hemoglobin concentration 10 g/dL, platelet count 160 000/ $\mu$ L, blood urea nitrogen 19 mg/dL, and serum creatinine 1.2 mg/dL. The blood in the urine was positive with >150 red blood cells and 1 to 2 white blood cells per high-power field. Other tests were within normal limits.

Ultrasound revealed the disruption of polar structures under the right kidney with surrounding hematoma, but abnormal shunt flow was not detected. Computed tomography (CT) proved kidney injury IV degree according to the American Association for Surgery of Trauma (AAST) renal injury grading scale. CT images showed stamping and deep laceration reaching up to the hilum. Besides, there was the

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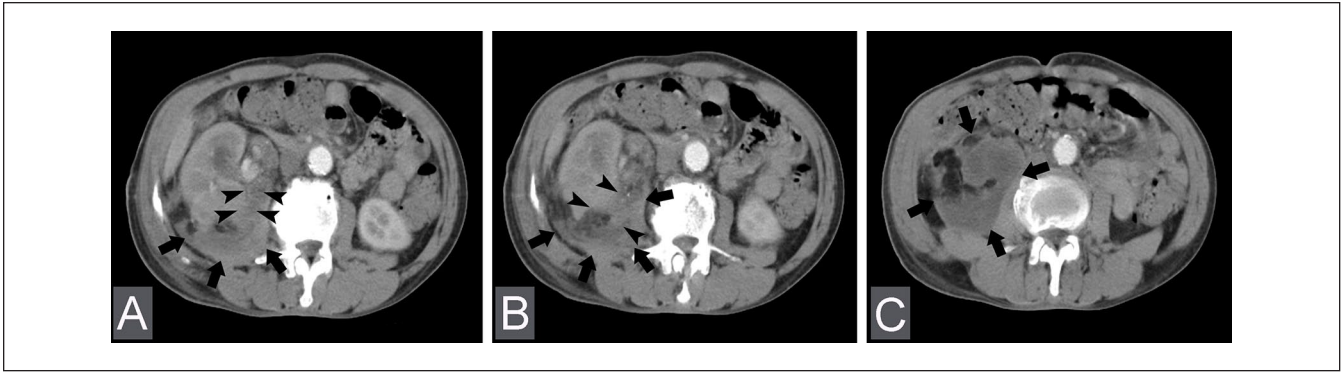
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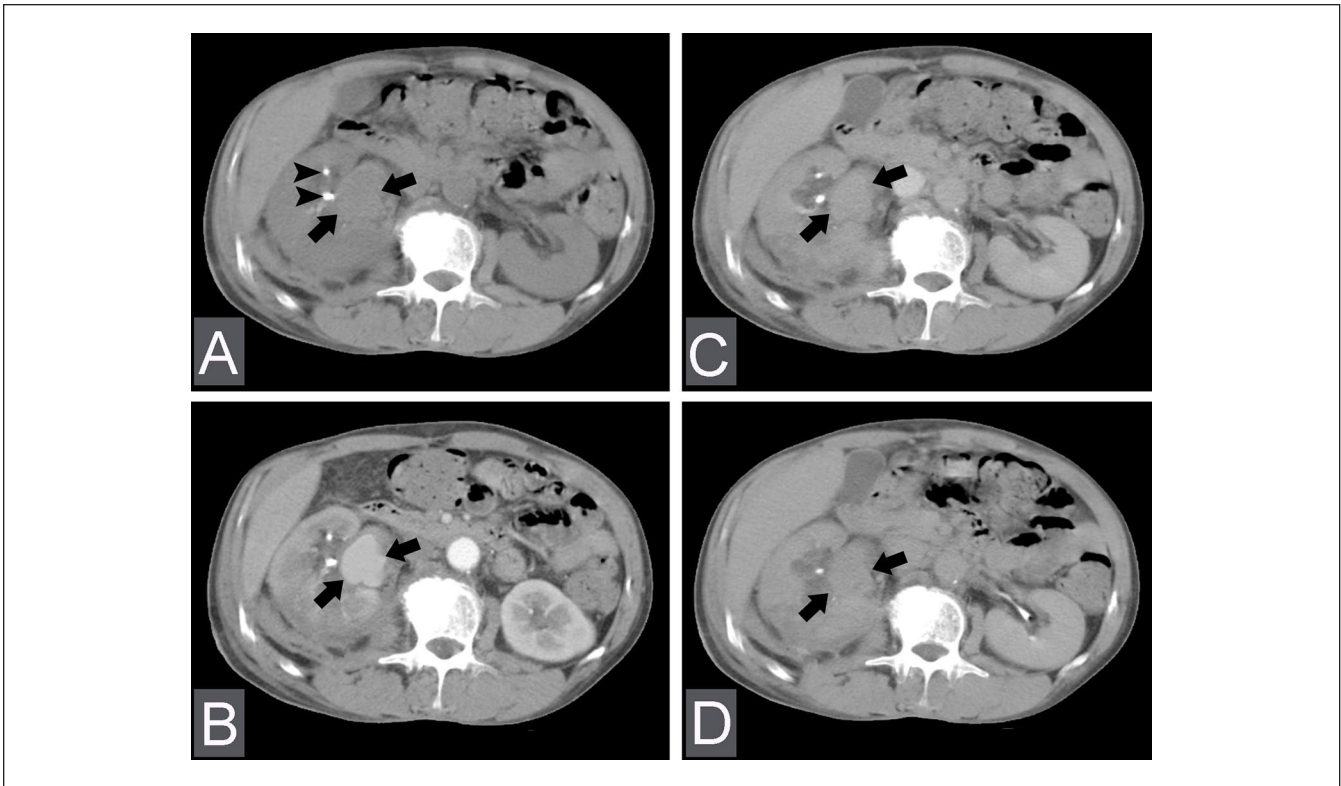
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**Figure 1.** Contrast-enhanced computed tomography images in the arterial phase showed right renal injury classified as grade IV according to the American Association for Surgery of Trauma. There was a deep laceration at under pole reaching up to the hilum (arrowheads in A, B). There was a disruption of pararenal fascia and a large hematoma adjacent (arrows in A, B, and C).

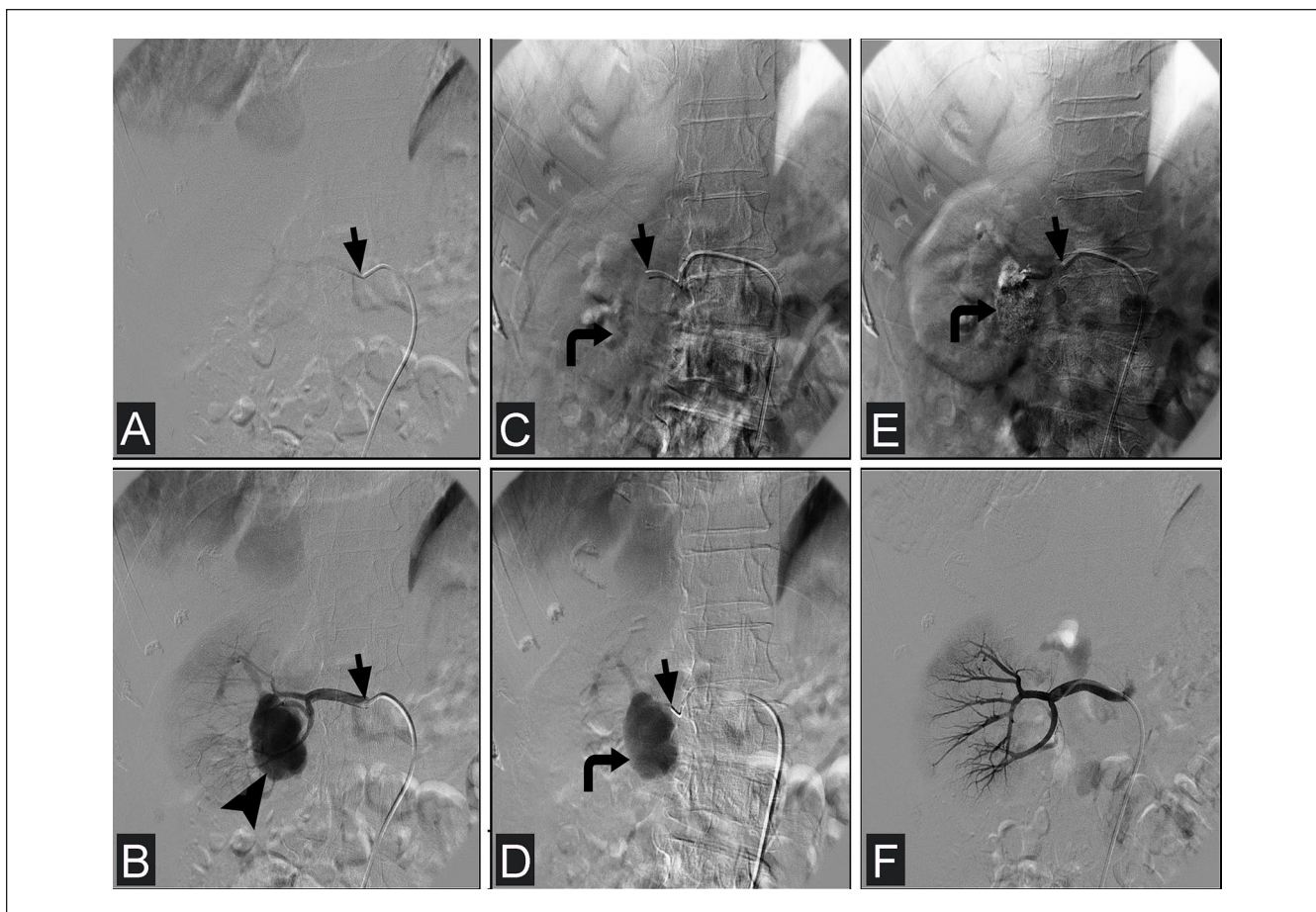


**Figure 2.** Computed tomography images unenhanced phase (A) and contrast-enhanced phases with the arterial (B), venous (C), and delayed (D). Arteriovenous fistula mimicking tumor in the right pelvis renal. Manifesting as a mass, enhancement in arterial phase, and washout in the venous and delayed phase. They seemed to match the blood pool in every single phase of contrast enhancement (arrows). Note that there were several stones in the lower renal calyx (arrowheads).

presence of hematoma around the polar under the kidney spreading down pelvic lumbar muscles (Figure 1). There was a mass structure in the renal navel region with enhancement after contrast injection. There was enhanced material in the arterial phase, and there was washout in the venous and delayed phase. These images were initially misdiagnosed as a kidney tumor because it had the form of a mass. However, when we analyzed carefully, this lesion was related to artery

and vein in the renal navel region and defined as AVF. The areas of enhancement in this AVF matched the attenuation of the appropriate vessels (blood pool) at all phases (Figure 2). In the arterial phase, the enhancement of AVF had the same attenuation value as the enhancement of aorta, while in the venous phase, it matched the enhancement of the vein.

The patient underwent subsequent vascular intervention to resolve the AVF. Digital subtraction angiography (DSA)



**Figure 3.** Interventional therapy for right renal arteriovenous fistula (AVF) with digital subtraction angiography. (A) The catheter tip image in the right main renal artery (arrow). (B) After the injection of contrast, the AVF bulge was detected (arrowhead). (C) Push the tip of the catheter into the middle renal artery branch adjacent to AVF (arrow). (D) Inject more contrast material to identify the lesion. (E) Injecting embolization material to cause AVF obstruction. (F) The lesion was gone, and the renal blood vessels were circulated normally.

images showed that the right renal artery consists of 2 main branches that come from the aorta. The upper branch supplied blood to a small portion of the upper pole and adrenal glands. The lower branch supplied blood to the upper, middle, and lower areas of the right kidney. The fistula artery came from the middle branch (Figure 3). Besides, the patient was actively treated to avoid shock and used antibiotics to fight infections. He got operated to collect hematoma and stitched to repair renal parenchymal tear through the incision at the diagonal line of the outer abdominal wall. The patient was treated stably and was discharged from the hospital after 10 days. The patient was followed up after 2 months, and then he was fully recovered.

## Discussion

AVFs were found in about 70% to 80% of renal arteriovenous abnormalities. Renal AVF is a pathological process that involves renal arteries and veins including congenital and

acquired AVFs.<sup>3,5</sup> Acquired AVF is more common than congenital AVF and is usually caused by surgery, percutaneous biopsy, penetrating trauma, inflammation, or malignancy. Injury-related renal AVF is an acquired form of vascular abnormalities. Iatrogenic injury is the most prevalent cause of renal AVFs, especially percutaneous biopsy of kidney.<sup>6,7</sup> AVF caused by trauma is less common. It usually appears individually, which concerns with a single direct connection between the renal artery and vein. Pseudoaneurysms can sometimes occur simultaneously with traumatic renal AVFs.<sup>2</sup> In AVF, there is a connection directly between arteries and veins to bypass a capillary bed inserted. High blood flow from the artery flows directly into the vein. They can cause complications including thrombosis, infection, aneurysm, ischemic steal syndrome, and venous hypertension.<sup>8,9</sup>

Clinical manifestations of AVFs depend on their localization and size. Patients usually have symptoms as flank pain and hematuria, though most would be nonsymptomatic. The lesions can manifest with a varied range of signs

and symptoms such as hypertension or renal masses.<sup>10</sup> The features of Doppler ultrasound are decreased resistive index of the feeding artery and the appearance of arterial waveforms in the outflow vein. Renal veins are frequently dilated if the shunt is large.<sup>11</sup> Renal AVFs on CT angiography images show a solitary dilated feeding artery and a dilated draining vein with early enhancement. The noncontrast CT images may display renal hemorrhage and hematoma.<sup>8-11</sup>

Sometimes, AVF mimics kidney tumors with mass effect, enhancement, and washout in contrast-enhanced phases. The key to differential diagnosis is the enhancement of lesions in parallel with the enhancement of the aorta and other major blood vessels, reflecting AVF lesions. Especially in the context of kidney injury, AVFs should be considered.<sup>4,6,10</sup> In our case, the enhancement areas of this lesion matched the attenuation of the appropriate vessels (blood pool) at all phases. That means in the arterial phase, the enhancement of AVF has almost the same attenuation value as the enhancement of aorta, while in the venous phase, it matches the enhancement of the vein. These signs suggest AVF and confirmed in DSA images.<sup>9</sup>

Another circumstance that can be posed is congenital AVF, but this instance is rare. Because our patient is aged and if congenital AVF exists, hemodynamically status may be affected. However, our patient has a stable hemodynamic parameter, so the happening of congenital AVF is excluded. Another possible hypothesis is that the patient has a kidney aneurysm, after the trauma that progresses to the shunt of artery and venous. This occurrence is less pondered about because if a kidney aneurysm has existed before, the patient will often have hypertension. Moreover, if an aneurysm exists for a long time, its wall will be calcified. Blocking AVF with vascular intervention is an effective treatment method.<sup>7-11</sup>

## Conclusion

Posttraumatic AVF is a rare condition. Nevertheless, it needs diagnosing carefully when a patient has a state of flank pain after blunt abdominal trauma with the present image suspected of the existence of AVF. Arteriography should be carried out to confirm the diagnosis and vascular intervention should be implemented to resolve.

## Author Contributions

VTH, NTTP, and HQN: conception and design of the manuscript, data acquisition, and writing the initial draft. VTH, HATV, and CTT: critical revision of the manuscript. TTTN, MTTV, and VC: supported revision and critically reviewed the paper. All authors participated in the approval of the final version.

## Declaration of Conflicting Interests

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## Ethics Approval

Institutions of authors do not require ethics committee approval for a case report or case series containing information of fewer than 3 patients.

## Informed consent

Informed consent was obtained from the patient in this case report.

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