Traumatic renal vein pseudoaneurysm

Eric J. Monroe, MD, Matthew J. Kogut, MD, and **Christopher R. Ingraham, MD,** *Seattle, Wash*

Traumatic renal injury is infrequent, occurring in ~1% to 3% of trauma cases, with major renal vein injury an even more rare traumatic entity. Conservative, operative, and endovascular management strategies have been infrequently reported in the literature. We report a patient with traumatic renal vein injury with pseudoaneurysm formation that was successfully treated with endovascular stenting. (J Vasc Surg Cases 2015;1:157-60.)

Traumatic renal vein injury is a rare traumatic entity. Approaches to management of this injury can include conservative, surgical, or endovascular treatments. However, these strategies have been infrequently described in the literature. In this case report, we present a case of successful endovascular treatment of a patient who sustained a traumatic renal vein pseudoaneurysm after blunt trauma. The patient consented to publication of this report.

CASE REPORT

A 40-year-old man was brought to a level I trauma center for evaluation after a motorcycle collision. When the patient arrived in the emergency department, he was neurologically intact and normotensive but with a heart rate in the 100 beats/min range. The patient complained of right hip pain at presentation.

A focused abdominal sonogram demonstrated no intraperitoneal hemorrhage. Computed tomography (CT) of the chest, abdomen, and pelvis with contrast demonstrated a grade II splenic laceration, lumbar spine fractures, a zone II sacral fracture, right acetabular and left pubic root fractures, suspected right renal arterial injury with right renal infarctions, and a large right renal vein pseudoaneurysm with an adjacent hematoma (Fig 1, *A*) with possible partial renal vein avulsion. No evidence of contrast blush was seen on CT to suggest active vascular injury in the splenic or pelvic beds. CT cystogram demonstrated no evidence of bladder injury. The patient was placed in right femoral traction for his pelvic injuries.

Six hours after arrival, the patient's hematocrit decreased to 25% from 40%, his systolic blood pressure reached a low of 98 mm Hg, his heart rate was persistently >140 beats/min, and his lactate increased from 6.0 mEq/L to 11.2 mEq/L. The patient received 4.5 L total of crystalloid and 1 unit of packed red blood cells for resuscitation since initial presentation. Because of the patient's clinical status despite resuscitation, the trauma team recommended angiographic evaluation of his solid organ and pelvic injuries.

Based on Eastern Association for the Surgery of Trauma guidelines and local practice patterns, a decision was made to conservatively manage this patient's grade II splenic injury.[1]

Arterial access was obtained via the right common femoral artery using standard technique. Selective right main renal artery arteriography demonstrated truncation of a second-order arterial branch supplying the superior pole of the right kidney (Fig 1, *B*). This vessel was selectively catheterized using a Direxion microcatheter (Boston Scientific, Natick, Mass), and a small amount of extravasation of contrast was visualized. This vessel was selectively embolized using Target detachable coils (Stryker Neurovascular, Kalamazoo, Mich). Renal arteriography failed to demonstrate an arteriovenous fistula or arterial pseudoaneurysm to account for the large pseudoaneurysm visualized on CT. In addition, pelvic arterial angiography was negative for major injury. Given the patient's clinical status, the decision was therefore made to evaluate the right renal vein.

Left common femoral venous access was obtained using standard technique. Given the difficulty accessing the right renal vein with a 5F catheter and 0.035-inch wire, a Direxion microcatheter and 0.014 Synchro standard microwire (Stryker Neurovascular) were used. Over this coaxial system, a 5F catheter was advanced into the right renal vein, and venography using standard digital subtraction angiography and C-arm CT venography was performed (Fig 2, *A* and *B*). Venography demonstrated the large venous pseudoaneurysm visualized on conventional CT, with only trace filling of the inferior vena cava through the small residual channel existing between the renal vein pseudoaneurysm and inferior vena cava, suggesting a partial avulsion injury of the renal vein. The catheter was exchanged for a long 7F sheath.

Intravenous heparin (2000 U) was administered, and a 6-mm × 4-cm Atlas angioplasty balloon (Bard Medical, Murray Hill, NJ) was used to predilate the medial renal vein. On the basis of CT and venography measurements, a self-expanding, 14-mm × 4-cm SMART nitinol stent (Cordis, Bridgewater Township, NJ) was then deployed across the area of injury. The stent was postdilated with a 12-mm × 4-cm Atlas balloon. Venography showed a patent renal vein without filling of the pseudoaneurysm (Fig 2, *C*).

After this treatment, the patient's heart rate normalized, and his hematocrit did not decrease further. Imaging performed at the 3-month follow-up demonstrated patency of the renal artery and renal vein stent (Fig 3).

In polytrauma patients, knowing to what extent each injury is accounting for the patient's blood loss is often

From the Department of Interventional Radiology, University of Washington.

Author conflict of interest: none.

Reprint requests: Christopher R. Ingraham, MD, Department of Interventional Radiology, University of Washington, 1959 NE Pacific St, Box 357115, Seattle, WA 98195-7115 (e-mail: cringra@uw.edu).

The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2352-667X

http://dx.doi.org/10.1016/j.jvsc.2015.04.009

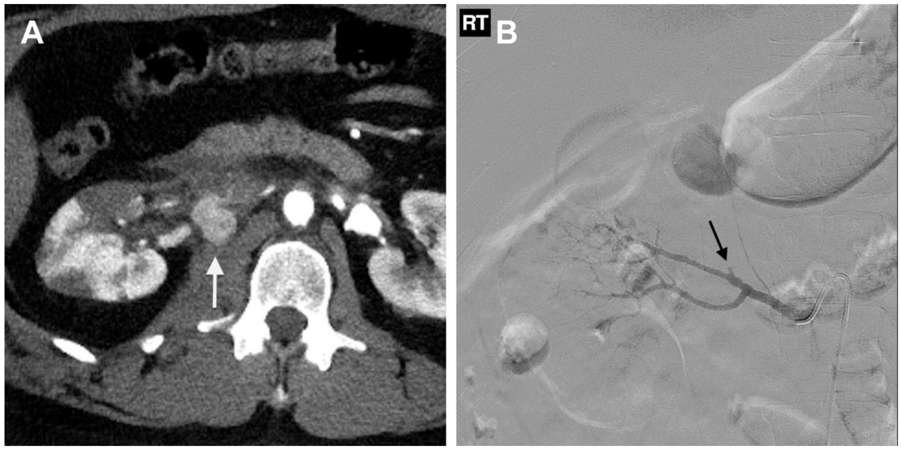

Fig 1. A, The initial computed tomography (CT) in arterial phase upon presentation demonstrates a right renal vein pseudoaneurysm (*arrow*) with surrounding hematoma. **B,** Renal arteriogram demonstrates injury to a second-order branch supplying the superior pole of the right kidney (*arrow*).

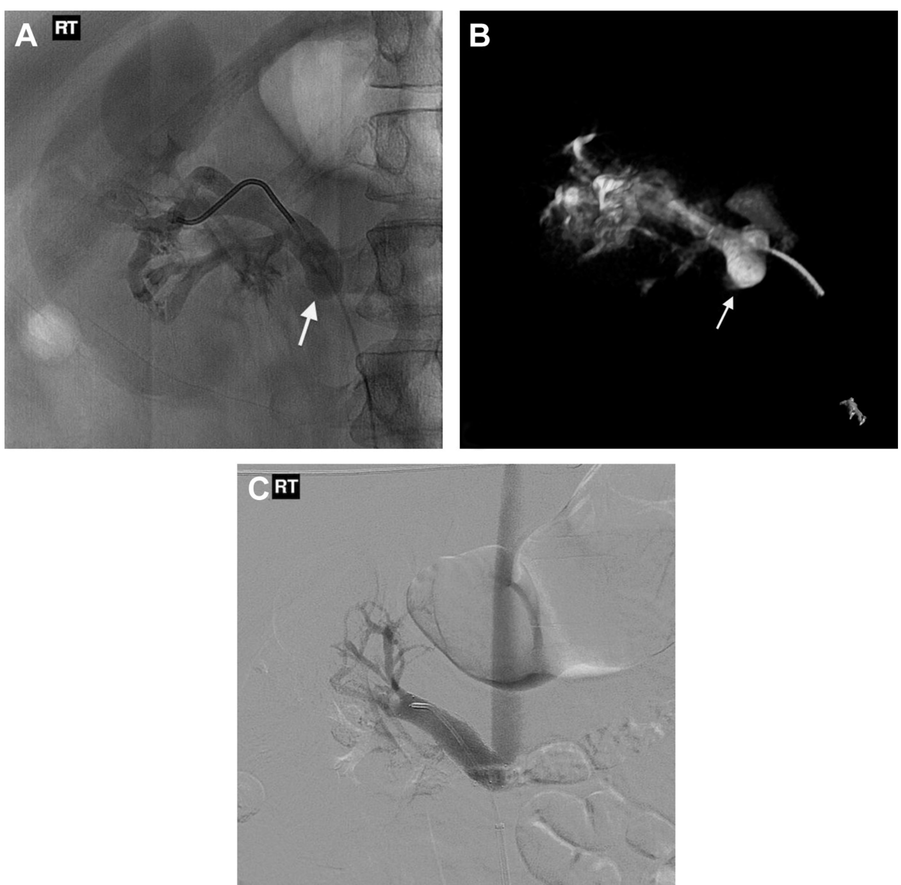

Fig 2. A, Digital venogram of the right renal vein demonstrates the pseudoaneurysm (*arrow*). **B,** A three-dimensional volume-rendered image of the right renal vein using C-arm computed tomography (CT) demonstrates the pseudoaneurysm (*arrow*). **C,** Digital subtraction venogram shows the right renal vein after stent placement.

impossible. We believed the arterial injuries did not account for the degree of hematocrit drop alone, which is why the renal vein was evaluated. However, management may have been warranted in any case given the risk for further blood loss or compromise of the kidney secondary to potential renal vein thrombosis.

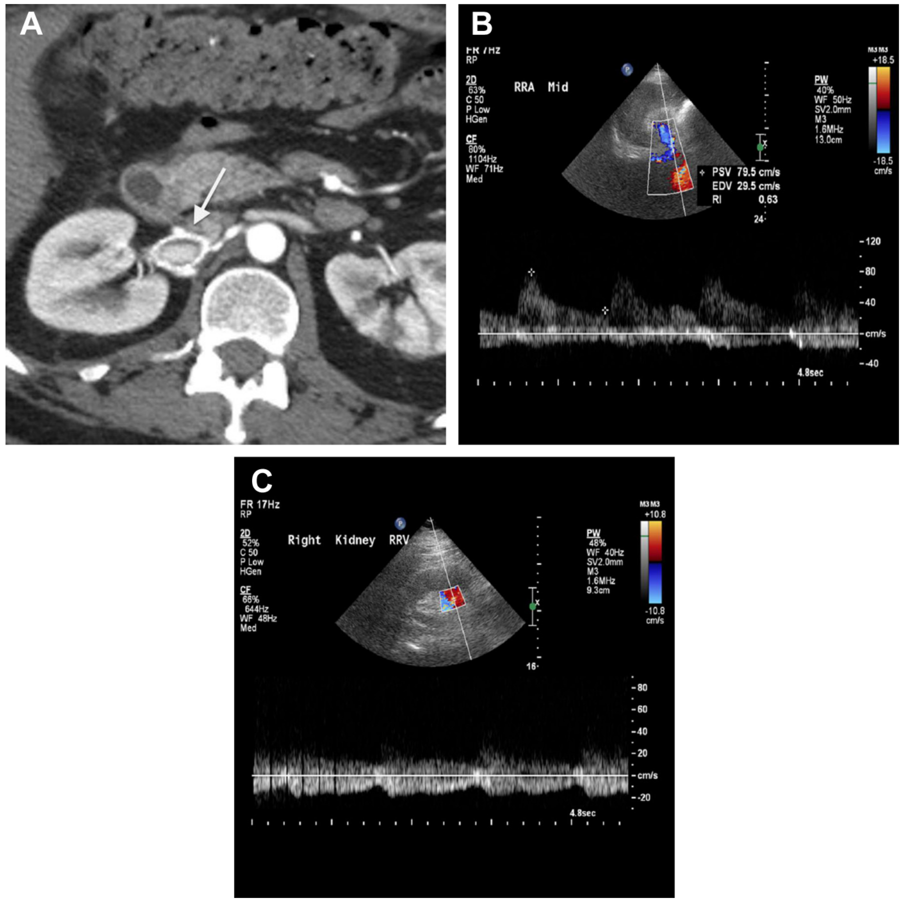

Fig 3. A, Computed tomography (CT) image in arterial phase obtained 3 months after stent placement demonstrates a patent stent (*arrow*). **B,** Renal arterial duplex image at the 2-month follow-up shows a patent right renal artery with a normal resistive index. **C,** Renal venous duplex image at the 2-month follow-up shows a patent right renal vein.

DISCUSSION

Traumatic renal vein injury is infrequent, occurring in ~1% to 3% of trauma cases, rarely in isolation.[2] Major injury to the central renal vasculature causes significant morbidity and mortality.[3] Surviving patients are at risk for renal necrosis with abscess, acute or chronic renal failure, and renovascular hypertension.[4-6]

Management of renal trauma remains controversial but has generally moved toward expectant measures for hemodynamically stable patients, both for avoidance of unnecessary nephrectomy and maximal preservation of renal function.[7-9] Although there is consensus that renovascular injury with hemodynamic instability necessitates intervention,[9] indications for particular management strategies are less clear. Surgical exploration provides expedient detection of bleeding and hemodynamic control but frequently results in nephrectomy.[2,8,10] Percutaneous arterial embolization for high-grade injuries can be performed with excellent technical and clinical success, with few complications at intermediate-term follow-up.[11,12]

Isolated major renal vein injury is rare and can be treated conservatively in the stable patient.[6,13] Operative and endovascular management strategies for this entity are sparsely reported in the literature. Sameulson et al[14] described a patient with traumatic right renal vein avulsion that was successfully repaired surgically with end-to-side anastomosis. Mejia et al[15] described a traumatic renal vein pseudoaneurysm similar in morphology to our case, but it was not accompanied by hemodynamic instability and was successfully managed conservatively.

Stenting for mesoaortic compression of the left renal vein (nutcracker syndrome) has been shown to be safe and effective.[16] Although all patients in that series were anticoagulated with antiplatelet agents for at least 3 months, low rates of thrombosis were also attributed to relatively high venous blood flow and endogenous urokinase.

Endovascular stenting interventions in the polytrauma patient create the dilemma of whether to anticoagulate and, if so, to what degree. There is a paucity of literature on this topic, and there are no established guidelines, particularly in regards to venous stenting. A recent review of stents placed in the setting of carotid injury[17] shows promising results for patency after a regimen of antiplatelet therapy. However, these data are difficult to extrapolate to the venous system or in our particular patient.

Our patient was initially maintained on anticoagulation with intravenous heparin because of the presumed risk of bleeding from his other injuries at presentation and for imminent pelvic fracture reduction surgeries. The patient was transitioned to and maintained on aspirin once these surgeries were complete.

C-arm CT can be a valuable tool during angiography to delineate vascular injuries. In our patient, this technique was valuable to evaluate the renal vein injury and to plan for endovascular treatment.

CONCLUSIONS

In our experience, renal vein stenting achieved the primary objective of hemodynamic stabilization while also maximally preserving viable parenchyma. Although the ultimate durability of this intervention remains unknown, findings at short-term follow-up are encouraging.

REFERENCES

1. Stassen NA, Bhullar I, Cheng JD, Crandall ML, Friese RS, Guillamondegui OD, et al. The selective nonoperative management of blunt splenic injury: an Eastern Association for the Surgery of Trauma practice management guideline. J Trauma Acute Care Surg 2012;73(5 Suppl 4):S294-300.
2. Wright JL, Nathens AB, Rivara FP, Wessells H. Renal and extrarenal predictors of nephrectomy from the national trauma data bank. J Urol 2006;175:970-5.
3. Brown MF, Graham JM, Mattox KL, Feliciano DV, DeBakey ME. Renovascular trauma. Am J Surg 1980;140:802-5.
4. Peterson NE. Complications of renal trauma. Urol Clin North Am 1989;16:221-36.
5. Knudson MM, Harrison PB, Hoyt DB, Shatz DV, Zietlow SP, Bergstein JM, et al. Outcome after major renovascular injuries: a Western Trauma Association multicenter report. J Trauma 2000;49:1116-22.
6. Tillou A, Romero J, Asensio JA, Best CD, Petrone P, Roldan G, et al. Renal vascular injuries. Surg Clin North Am 2001;81:1417-30.
7. Santucci RA, Fisher MB. The literature increasingly supports expectant (conservative) management of renal trauma—a systematic review. J Trauma 2005;59:493.
8. McGuire J, Bultitude MF, Davis P, Koukounaras J, Royce PL, Corcoran NM. Predictors of outcome for blunt high-grade renal injury treated with conservative intent. J Urol 2011;185:187-91.
9. Morey AF, Brandes S, Dugi DD, Armstrong JH, Breyer BN, Broghammer JA, et al. Urotrauma: AUA guideline. J Urol 2014;192:327-35.
10. Bruce LM, Croce MA, Santaniello JM, Miller PR, Lyden SP, Fabian TC. Blunt renal artery injury: incidence, diagnosis, and management. Am Surg 2001;67:550-4.
11. Brewer ME Jr, Strnad BT, Daley BJ, Currier RP, Klein FA, Mobley JD, et al. Percutaneous embolization for the management of grade 5 renal trauma in hemodynamically unstable patients: initial experience. J Urol 2009;181:1737-41.
12. Stewart AF, Brewer ME Jr, Daley BJ, Klein FA, Kim ED. Intermediate-term follow-up of patients treated with percutaneous embolization for grade 5 blunt renal trauma. J Trauma 2010;69:468-70.
13. Bittenbinder EN, Reed AB. Advances in renal intervention for trauma. Semin Vasc Surg 2013;26:165-9.
14. Samuelson AL, Koyle MA, Strain JD. Repair of right renal vein avulsion after auto-pedestrian crash. J Trauma 2007;63:432-4.
15. Mejia JC, Myers JG, Stewart RM, Dent DL, Connaughton JC. A right renal vein pseudoaneurysm secondary to blunt abdominal trauma: a case report and review of the literature. J Trauma 2006;60:1124-8.
16. Chen S, Zhang H, Shi H, Tian L, Jin W, Li M. Endovascular stenting for treatment of nutcracker syndrome: report of 61 cases with long-term follow-up. J Urol 2011;186:570-5.
17. Edwards NM, Fabian TC, Claridge JA, Timmons SD, Fischer PE, Croce MA. Antithrombotic therapy and endovascular stents are effective treatment for blunt carotid injuries: results from long-term follow-up. J Am Coll Surg 2007;204:1007-15.

Submitted Feb 2, 2015; accepted Apr 16, 2015.