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Arterial embolization of retained kidney remnant following blunt traumatic injury: A case report



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ABSTRACT

INTRODUCTION: There has been a recent trend toward nonoperative management of solid organ injuries with arteriography and embolization as alternatives to surgical exploration. We examine the use of arterial embolization in the management of a post-subtotal nephrectomy urinoma in a patient with severe renal injury secondary to blunt trauma.

METHODS: This case report has been reported in line with the CARE criteria [13].

PRESENTATION OF CASE: A 35-year-old female patient presented with a persistent urinoma after an incomplete nephrectomy for blunt renal trauma. Computed tomography scan of the abdomen demonstrated a 47 × 68 × 101 mm³ collection superior to the remnant of the resected right kidney. With persistence of the urinoma after placement of an 8 French drainage catheter, the patient was taken for arterial embolization of the lower renal artery for ablation of the kidney remnant.

DISCUSSION: Most kidney injuries with urinoma formation are treated successfully with supportive measures, however refractory cases require intervention. Arterial embolization has been used successfully in the treatment of traumatic pseudoaneurysms, arteriovenous fistulas, and some renal tumors. In this patient, we extended the use of embolization to infarct vessels of the functioning kidney remnant as an alternative to surgery. Post-embolization the patient recovered well with permanent resolution of the urinoma and short-term side effects limited to short-lived fever and lumbar pain.

CONCLUSION: Arterial embolization should be considered as an alternative to surgery in cases of persistent urinoma following renal trauma with retained remnants.

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1. Introduction

There has been a recent trend towards nonoperative management of solid organ injuries [1]. Nonoperative management includes adjunctive therapy with arteriography and embolization as an alternative to open surgical exploration. This has been shown to be successful in splenic, hepatic, and renal injury due to trauma [2]. Arteriographic embolization procedures have also been used with success in benign and malignant tumors as well as in iatrogenic vascular injuries [3]. Here, we examine the use of arterial embolization in the management of a post-subtotal nephrectomy urinoma in a patient with severe renal injury secondary to trauma.

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2. Methods

This case report has been reported in line with the CARE criteria [13].

3. Case presentation

A 35-year-old helmeted female bicyclist with no past medical or surgical history was brought in by emergency medical services as a level 1 trauma code after being struck by a motor vehicle with loss of consciousness. On initial presentation her Glasgow Coma Scale (GCS) was 15 but was noted to be in severe respiratory distress with complaints of shortness of breath. Vitals at this time were significant for a pulse rate of 125 beats per minute, BP 67/20, and a respiratory rate of 45 breaths per minute. On exam she was noted to have ecchymoses around her left eye along with a facial laceration as well as decreased breath sounds on her right side, however there were no other obvious external signs of trauma. A Focused

Assessment with Sonography for trauma (FAST) was performed by the ED physician which was reported to be negative. She responded to one liter of isotonic fluid with normalization of her blood pressure. A chest X-ray was obtained and demonstrated a large right pneumothorax; successful re-expansion of the lung was accomplished with a chest tube. Her vitals normalized. She was intubated for agitation and brought to the Cat Scan (CT) for further workup.

A non-contrast CT head/C-spine, and CT Chest/Abdomen/Pelvis with IV contrast were obtained and significant for a grade 5 liver laceration, grade 5 right kidney laceration, grade 1 splenic laceration as well as a left clavicle fracture and bilateral small pneumothoraces. Shortly after completing CT scan, she became hypotensive and the decision was made to take her to the operating room.

Upon entering the abdomen a large amount of blood was encountered and evacuated followed by four-quadrant packing. A right medial visceral rotation was performed to reveal a large hematoma in the retroperitoneum. Exploration of the hematoma revealed a shattered inferior portion of the kidney. The superior portion of the kidney was noted to be bleeding significantly, at which time the renal vessels were doubly ligated with 2–0 silk suture and a nephrectomy was performed. Secondary to limited visibility in the surgical field and her hemodynamic instability, the right ureter was unable to be located for resection or ligation. Hemostasis of the spleen and liver was appreciated upon removal of the packs and other abdominal injuries were excluded. However, given the degree of injuries she sustained seen on imaging she was repacked, a Barker vac was placed and she was brought back to the Intensive Care Unit (ICU) for further resuscitation. Intraoperatively the patient had received 7 units of packed red blood cells, 3 units of fresh frozen plasma, and 4 l of crystalloid.

The patient was taken to Interventional Radiology several hours later at which time no active extravasation was appreciated from the hepatic or splenic artery. She returned to the OR post-operative day (POD) #2 for re-exploration at which time she was found to have active bleeding over the dome of the liver once packs were removed. She was repacked with subsequent hemostasis. She continued to be monitored in the ICU and returned again to the OR three days later on POD#5 for her third laparotomy at which time the packs were again removed without any bleeding noted. At this time a right ureterectomy was performed, her abdomen was closed primarily and she was brought back to the ICU. The patient was successfully extubated two days later on POD#7.

During her hospital course, her labs were significant for a persistently elevated WBC prompting further workup including a CT abdomen/pelvis with IV contrast on POD#13 which revealed a right kidney remnant isolated from the collecting system with a large, well-defined rim-enhancing collection (47 × 68 × 101 mm) posterior and superior to the residual lower pole fragment of right kidney with contrast visualized in the collection suggestive of a urinoma (Fig. 1). On POD#16 she underwent ultrasound-guided drainage of the collection with placement of an 8 French drainage catheter. Cultures sent from the collection were without growth.

Over the next few days secondary to persistent drainage, options for management including IR angioembolization of the remnant right kidney versus completion nephrectomy were discussed. The decision was made to proceed with angioembolization as her recent history of multiple abdominal surgeries placed her at high risk. Interventional radiology performed embolization of the right kidney remnant on POD#19. Two traumatic pseudoaneurysms were found in segmental arteries and these were embolized with 300–500 micron embospheres. The lower renal artery was completely occluded with a 2 × 3 mm tornado microcoil. Completion arteriogram demonstrated successful occlusion and zero blood flow within the kidney remnant (Fig. 2).

Post-embolization the patient was febrile with complaints of severe flank pain and was kept on antibiotics for another 24 h. She

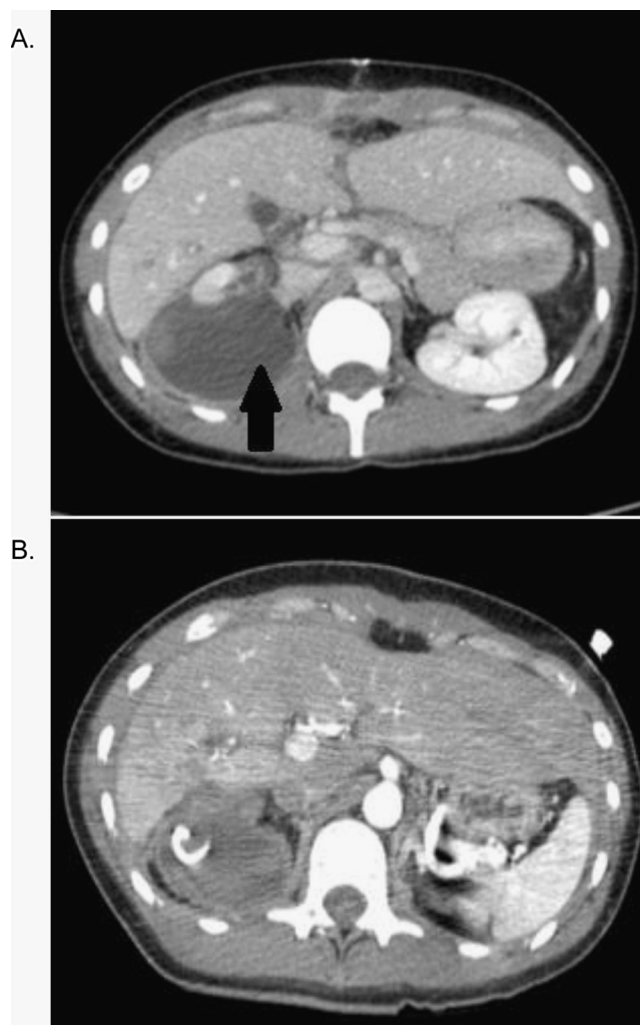


Fig. 1. (A) Contrast enhanced CT scan shows a large, well-defined fluid collection (black arrow) measuring 47 × 68 × 101 mm posterosuperior to the residual lower pole fragment of the right kidney. (B) CT scan after placement of an 8 French percutaneous drainage catheter with a slight interval decrease in the size of the urinoma/hematoma.

was subsequently afebrile with resolution of her pain. Her drain was removed on POD#25 and she was stable for discharge home on POD#26 with no residual functional deficits. A follow-up BUN/Cr was 17/1.16.

4. Discussion

Blunt or penetrating trauma is the most common cause of urine extravasation from the urinary system [4] and the kidney is the most commonly injured organ of the genitourinary system [5]. Extravasation can be frank or result in formation of an encapsulated urinoma or tract within the retroperitoneum. Initially, many cases of urinomas are occult and present insidiously and non-specifically with flank pain, fever or ileus. The diagnostic test of choice is CT Abdomen/Pelvis with IV contrast and delayed imaging which allows detection of contrast accumulation within the urinoma. If there is uncertainty about the origin of the fluid collection, percutaneous drainage can be performed with fluid analysis and confirmation. Urinary fluid will have elevated creatinine and decreased glucose as compared to serum levels [4].

Ninety percent of kidney injuries with urinoma formation can be treated conservatively with continued observation and supportive measures [6]. Refractory cases that demonstrate enlargement

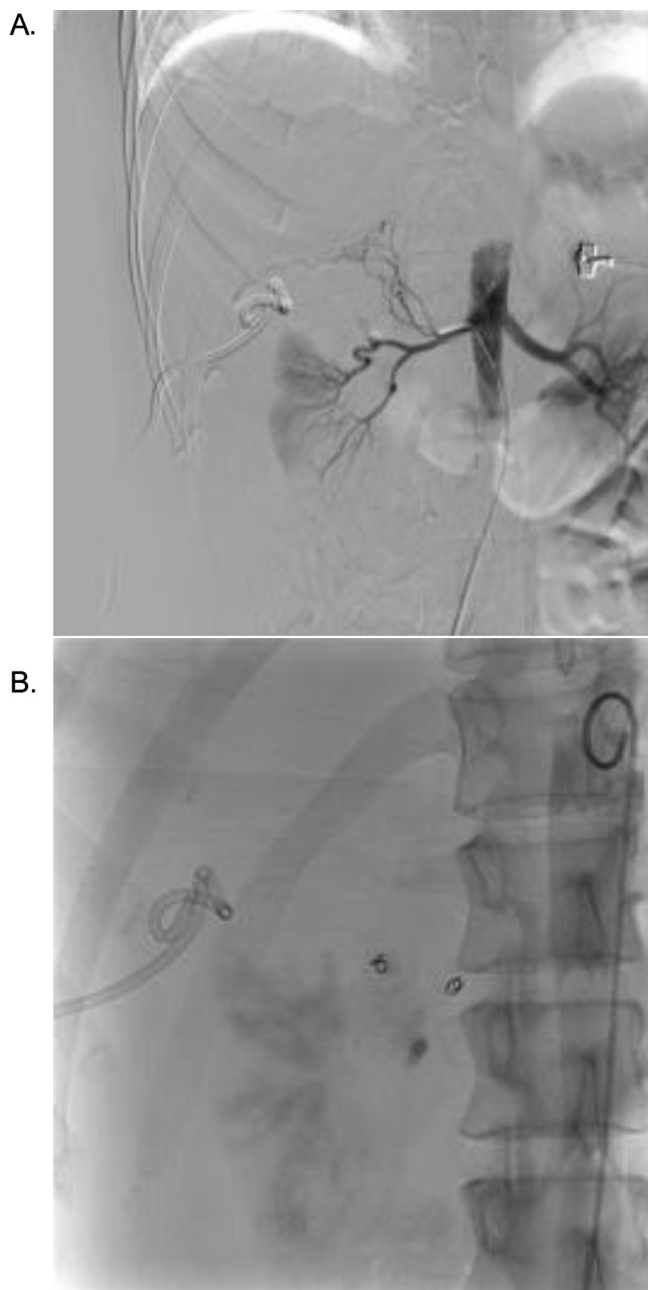


Fig. 2. (A) Arterial supply to kidney remnant. (B) Arterial supply to the kidney remnant is completely occluded with deployment of a 2 × 3 mm tornado microcoil. Two segmental arteries with traumatic pseudoaneurysms were embolized with 300–500 micron embospheres. Embolization left no residual blood flow within the right kidney fragment.

of the fluid collection or development of fever with suspected sepsis require immediate drainage of the fluid. Continuous drainage may be necessary to relieve the pressure on the damaged endothelium and promote healing of the collecting system [4]. The unique circumstances of our case precluded our ability to re-establish continuity of the collecting system and thus the likelihood of resolution of the urinoma from a functional retained kidney remnant was low, leading us to consider nonsurgical management as a viable alternative to a surgical approach.

Recently nonsurgical management with angiography and arterial embolization has played a larger role in the treatment of solid abdominal injuries, particularly of the liver and spleen [2,3]. Successful treatment of traumatic pseudoaneurysms and arteri-

ovenous fistulas with selective embolization is well established [4]. Literature has widely supported its use in stable patients with abdominal organ injury and recent case reports detail instances of successful implementation in hemodynamically unstable patients [6].

Renal arterial embolization techniques have been used with superior results since the 1970s for an increasing number of clinical scenarios using a range of methods including resorbable materials, coils, inert particles, and sclerosants [10]. In angiomyolipoma, a highly vascular benign tumor of the kidney, arterial embolization has also been applied to prevent hemorrhagic complications without loss of renal function [7]. With respect to renal cell carcinoma, these techniques have been used to reduce the blood supply to the tumor pre-operatively resulting in improved outcomes. Complete occlusion with embolization has also been used as a nonsurgical approach in those patients who are poor surgical candidates.

Similarly, endovascular approaches have been used as an accepted first-line management of arteriovenous fistulas typically diagnosed post-nephrectomy by its manifestation as refractory hypertension and/or high-output heart failure [11]. However, their success may be limited in high-flow fistulas secondary to the potential for embolization agents to cause pulmonary or systemic embolisms as well as renal infarction [12]. Angiographic embolization has also been found useful in the treatment of renal artery pseudoaneurysms following nephron-sparing surgeries, which have a reported occurrence of 0.43–0.6% and 1.7–2.6% for laparoscopic and open surgeries, respectively [10]. These reported successes have been described both in the immediate and delayed post-operative period.

In this patient, we extend the use of embolization of select renal vessels to iatrogenically infarct the functioning kidney remnant as an alternative to surgery. Comparison of pre- and post-embolization angiography showed complete occlusion of the feeding vessels and no perfusion of the remaining kidney. Of note, it was our shortcoming in this case of failing to identify the retained right kidney remnant on subsequent re-explorations that fortuitously led us to this particular application of arterial embolization with success.

Patients undergoing similar procedures for treatment of renal tumors have been shown to experience characteristic post-procedure lumbar pain and fever due to the ischemic effect on the kidney [6]. Other short term post-procedure complications include hypertension and abscess formation. Long term complications may consist of hypertension and renal hyperperfusion with subsequent kidney failure [4,6]. However, the current literature is limited on the long-term effects of kidney embolization. Large, multicenter studies are necessary to assess the success and complication rates associated with this procedure.

5. Conclusion

Renal arterial embolization is successful in patients with benign and malignant renal cell carcinoma, traumatic pseudoaneurysm or arteriovenous fistula formation, and for iatrogenic renal vascular damage. This case report demonstrates a scenario in which these techniques were successfully applied to the treatment of a patient with persistent urinoma associated with a functioning kidney remnant after traumatic partial nephrectomy. Other than a short-lived immediate post-embolization syndrome, this patient did not have any other short-term adverse effects that have been reported and she continues to do well 6 months later. Additional research is necessary to assess the long-term prognosis of these patients and the rate of incidence of complications, including hypertension and hyperperfusion of the remaining kidney.

Conflicts of interest

None.

Funding

None.

Ethical Approval

This was a retrospective case report and ethical approval was not needed.

Author contribution

Natalie Pozzi, MD collected patient information and authored the manuscript.

Sarah Koblick, MD collected patient information and authored the manuscript.

Patricia Leung, MD edited the manuscript and assured its accuracy.

Leon Boudourakis, MD edited the manuscript and assured its accuracy. He also was the surgeon of record for the patient.

Consent

Written consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Guarantor

Leon Boudourakis, MD.

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