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## Endovascular treatment of renal arterial perforation after blunt trauma: Case report

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## ABSTRACT

**INTRODUCTION:** Isolated renal arterial perforation is a rare consequence of blunt abdominal trauma. Meticulous surgical control of retroperitoneal active bleeding is difficult due to oozing of soft connective tissue, the deep position of operative field, and the presence of friable vascular tissue. Therefore, endovascular treatment is often preferred.

**PRESENTATION OF CASE:** An 83-year-old man was transferred to our trauma center due to retroperitoneal active bleeding after a car accident, in which his right upper abdomen struck the steering wheel. Contrast-enhanced abdominal computed tomography (CT) showed a retroperitoneal hematoma behind the inferior vena cava and contrast medium extravasation on the medial side of the right kidney. Selective right renal arteriography confirmed a perforation in the proximal right main renal artery, approximately 3 cm from the ostium. We successfully placed a covered stent across the perforation site.

**DISCUSSION:** Endovascular management may reduce the likelihood of extensive abdominal surgery, surrounding organ damage, risk of bleeding, and postoperative morbidity. We regarded embolization as inappropriate for kidney salvage in our patient, and therefore used a self-expanding covered stent to treat the perforation.

**CONCLUSION:** Endovascular management of a traumatic renal arterial injury is the best approach to preserve renal function in hemodynamically stable patients who cannot tolerate laparotomy, due to risks associated with general anesthesia, and who can tolerate anticoagulation therapy.

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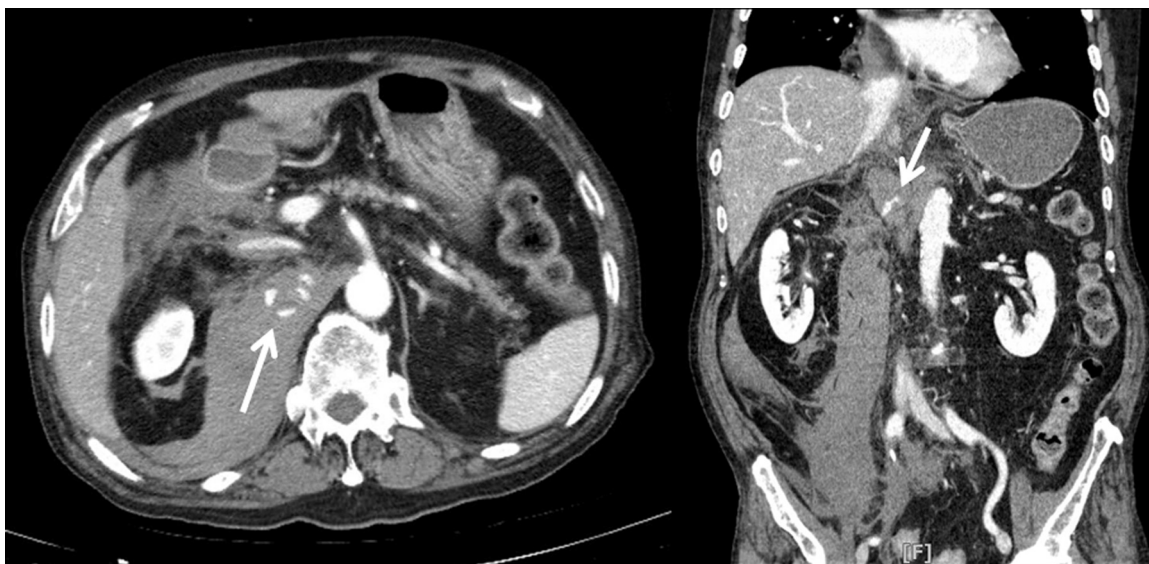
## 1. Introduction

Renal arterial injury is a rare consequence of blunt abdominal trauma, with a reported incidence of 0.08% among all patients with blunt abdominal traumas and 1%–4% in patients with renal injuries [1–4]. Optimal management strategies for renal arterial perforation are mainly surgical treatments such as simple repair of the injured artery, use of an interposition graft, and nephrectomy. However, meticulous surgical control of retroperitoneal active bleeding is difficult due to oozing through the soft connective tissue, the deep position of the operative fields, and the presence of friable vascular tissue. Therefore, endovascular treatment is often a superior approach. Some case reports have described endovascular management of the blunt renal arterial occlusion with thrombosis or intimal dissection [4–9]. The present report describes a patient with an isolated renal arterial perforation and retroperitoneal bleeding who was successfully treated using an endovascular approach. This case report has been reported in line with the SCARE criteria [10].

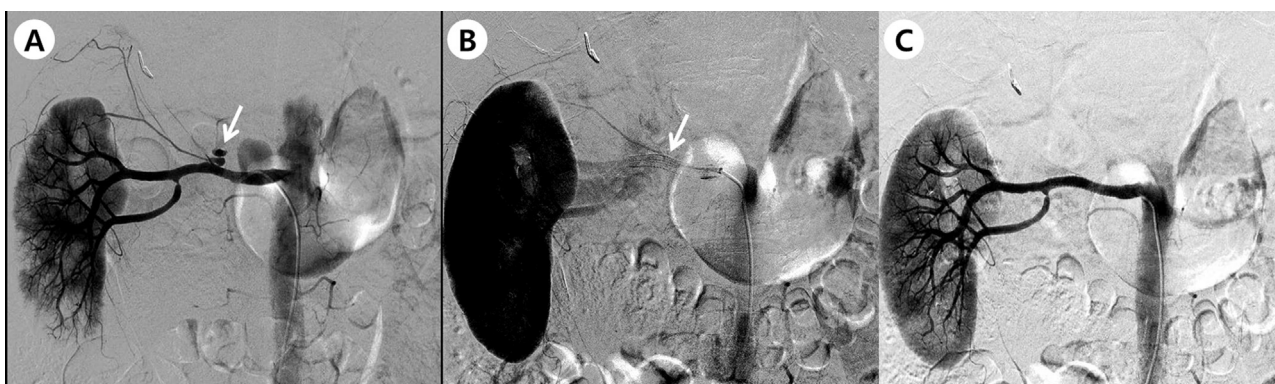
## 2. Presentation of case

An 83-year-old man with no relevant medical history was transferred to our trauma center due to retroperitoneal active bleeding after a car accident, in which his right upper abdomen struck the steering wheel. Upon arrival, 4 h after the accident, he was fully conscious and had a pulse rate of 105 beats/min, blood pressure of 66/46 mmHg, hemoglobin of 13.2 g/dL, platelet count of 317,000/mm<sup>3</sup>, and serum creatinine level of 0.96 mg/dL. After resuscitation with 1000 mL crystalloid fluid, his hemodynamics improved, with a blood pressure of 114/52 mmHg and a pulse rate of 104 beats/min. A physical examination indicated right upper abdominal tenderness without distension. A contrast-enhanced abdominal computed tomography (CT) scan showed a retroperitoneal hematoma behind the inferior vena cava, and contrast medium extravasation on the medial side of the right kidney (Fig. 1). Because the origin of retroperitoneal bleeding was unclear and the advanced age of the patient, which increased the risk for adverse effects from general anesthesia, angiography was performed by an experienced interventional radiologist. Selective right renal arteriography confirmed a perforation in the proximal right main renal artery, approximately 3 cm from the ostium (Fig. 2A).

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**Fig. 1.** Initial contrast-enhanced abdominal CT scan, showing contrast medium extravasation medial to the right kidney.



**Fig. 2.** Selective right renal arteriography, showing (A) a perforation in the proximal right main renal artery approximately 3 cm from the ostium, (B) successful implantation of a covered stent under the perforated site, and (C) satisfactory restoration of distal flow.

Review by an interventional radiologist and a vascular surgeon suggested the feasibility of endovascular repair using a right transfemoral approach. Thus, a 6 × 50 mm covered stent (nitinol metal stent covered with polytetrafluoroethylene, VIABAHN® endoprosthesis; W.L. Gore & Associates, Flagstaff, AZ) was placed across the perforation site in the right renal artery (Fig. 2B). The time from injury to stent placement was 5 h. Subsequent angiography showed good blood flow across the stented segment and restoration of distal flow (Fig. 2C). Thus, the patient was transferred to the surgical intensive care unit for close monitoring. Beginning on the third day of hospitalization, the patient initiated aspirin at 100 mg/day. He was discharged 12 days after admission, with instructions to take 100 mg/day aspirin to prevent thrombotic occlusion of the stent graft. He reported being satisfied that he did not need a laparotomy. A follow-up abdominal CT scan 3 months later showed that the covered stent was patent, and the hematoma had completely resolved (Fig. 3). After 1 year, the patient was normotensive and had a normal serum creatinine level.

### 3. Discussion

Renal arterial injury due to blunt abdominal trauma is rare, and an intimal tear is the most likely cause of the vascular occlusion. Despite the low incidence of this type of injury, the rate of detection has increased due to the increasing use of CT scans to evaluate

and manage patients with blunt abdominal trauma. Injuries to the left kidney are slightly more common (ratio of 1.4–2:1), because the right renal artery is protected and stabilized by the inferior vena cava and duodenum, whereas the left renal artery is shorter and more acutely angled, and therefore more susceptible to stretch injury. Children may also be more susceptible to renal artery injury following blunt trauma because of their relatively larger kidneys, their greater mobility, and their more limited surrounding protective tissues [2,8,11].

Penetrating or blunt trauma can cause isolated renal artery injury. A blunt trauma may cause renal artery injury due to sudden acceleration-deceleration forces that stretch the vessel wall, or due to direct impact that compresses the renal vessel against the vertebral column. These forces can lead to intimal tearing, dissection, thrombosis, pseudoaneurysm, and complete or incomplete transection of the renal artery. Because the kidneys are fixed in place only by the vascular pedicle and ureter, injuries usually occur at the proximal part of the artery, about 2–4 cm from the origin of the main renal artery [4,12,13].

A diagnosis of blunt renal artery injury may be delayed due to the absence of specific symptoms and signs. Hematuria is not present in 36% of patients who sustain renal vascular injury [14], so gross hematuria may be unreliable indicator. Patients with renal artery avulsions and lacerations may present with hemorrhagic shock. However, most intimal injuries and minor lacerations are

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