Bilateral Renal Infarction, a Rare Consequence of Blunt Renal Artery Injury: A Case Report

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ABSTRACT

BACKGROUND: Renal infarction is an uncommon complication of Blunt renal artery injury (BRAI) following abdominal trauma. Diagnosis of infarction is difficult and mostly delayed due to non-specific symptoms. Early diagnosis can lead to appropriate and effective treatment, which prevents further complication.

CASE PRESENTATION: We report a case of 21-year-old man falling from a height of 9 m. A contrast-enhanced CT scan in the nephrogram phase showed no evidence of absorption in the right kidney and significantly decreased absorption in the left kidney. The pyelogram phase showed no secretion in the right kidney and decreased secretion in the left kidney suggesting segmental renal infarction. Subsequently, heparin infusion was initiated immediately. A follow-up contrast- enhanced abdominopelvic CT scan was performed after 1 month and showed no sign of infarction, and all laboratory tests were normal.

CONCLUSION: Contrast-enhanced abdominopelvic CT scan helps physicians diagnose the renal infarction immediately and start appropriate treatment. Treatment can vary from aggressive surgical procedures to observation and supportive care.

KEYWORDS: Renal infarction, blunt renal artery trauma, trauma

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Introduction

Blunt mechanisms, such as motor vehicle collision (MVC), falls, and assault are responsible for 80% to 95% of renal injury trauma.[1] Blunt renal artery injury (BRAI) is an uncommon complication of blunt abdominal trauma. The incidence of BRAI ranges from 0.05% to 0.08%.[2,3] Following blunt trauma, the renal artery is affected by forces that stretch the vessel or by direct compression of the artery against other structures, such as the vertebral column. Renal artery dissection, pseudoaneurysm, and thrombosis are some of the vascular event.[4]

Fortunately, BRAI are mostly low-grade injuries and are treated non-operatively in patients with stable hemodynamics. Management of BRAI depends on many factors including severity of injury, hemodynamic status, renal function, and available treatments. Available options for treatment of BRAI are observation, nephrectomy, surgical reconstruction, and endovascular stenting.[3,5]

Renal infarction is an uncommon ischemic event following the complete or partial occlusion of the main renal artery or its segmental branches, which may result in the necrosis of renal tissue Renal segmental arteries are end-arteries, so complete or partial reduction in vascular flow leads to renal ischemia and infarction.[6,7] Etiologies of renal infarction are categorized into the following groups: cardio-embolic, renal artery injury, hypercoagulability disorders, and idiopathic.[8] Renal trauma is attributed to approximately 31% of acute renal infarction cases.[9] Renal infarction following BRAI is a rare situation, which has been reported only in the form of case reports or case series. Diagnosis of infarction is difficult and mostly delayed due to non-specific symptoms, such as hematuria, nausea, and vomiting.[10,11] Beside radiologic findings, elevation in lactate dehydrogenase (LDH), C-reactive protein (CRP) and impairment of renal function are noted in patients based on the degree of parenchymal involvement.[12]

Herein we present a case report of renal infarction due to the BRAI in a male adult patient who fell from height.

Case Presentation

A 21-year-old-man with no relevant medical history was brought to the emergency department after falling from a height of 9 m. Upon arrival, patient was fully conscious and hemodynamically stable (pulse rate of 96 beats/minute, blood pressure of 116/98 mmHg, and o2 saturation of 100%). The patient complained of middle back pain and right groin. Initial evaluation and physical examination revealed nothing abnormal but tenderness in right femur and pain at the alignment of the T12 vertebra. A foley catheter was inserted with no evidence of gross hematuria. Laboratory analysis revealed a hemoglobin of 14.7 gr/dl (normal range: 14-18 gr/dl), platelet count of 209 000/mm^3 (normal range: 150 000-450 000/mm^3), WBC of 8500/µl (normal range: 4500-11 000/µl), and serum creatinine level of 1.2 mg/dl (normal range: 0.7-1.3 mg/dl). Urine analysis revealed a WBC of 1 to 2 (normal range: 0-2) and RBC of 4 to 6 (normal range: 0-3). Focused Assessment with Sonography in

Trauma (FAST) was performed by a radiologist and showed no sign of free fluid in pericardium, abdomen and pelvis.

He was referred to the imaging department for an emergency whole-body computed tomography (CT) scan. Spiral head CT scan showed subgaleal hematoma in right side. Spiral chest CT scan demonstrated mild right side pneumothorax, multifocal contusions in both lungs, a focal laceration in right upper lobe of the lung, Comminuted fracture in body of right scapula, and linear fractures in first rib anteriorly and seventh, eighth, and ninth rib posteriorly. At the spiral spine CT scan, compression fracture in T12 without retropulsion and suspicious linear fractures in right transverse process of T1 and T2 was noted.

Spiral abdominopelvic CT scan (Figure 1) revealed extensive infarction in the right kidney with focal infarcted areas in the middle and lower portion of the left kidney. The radiologist reported that the main renal arteries are intact and suggested that bilateral renal infarction could be secondary to the dissection of segmental arterial branches in both kidneys. Further assessment was carried out by contrast-enhanced CT scan (Figure 2). At the nephrogram phase, no evidence of absorption in right kidney, and significantly decreased absorption in left kidney was seen. Pyelogram phase showed no secretion in right kidney and decreased secretion in left kidney.

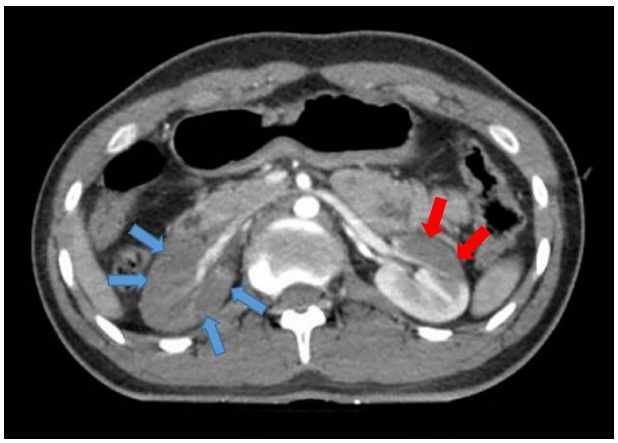


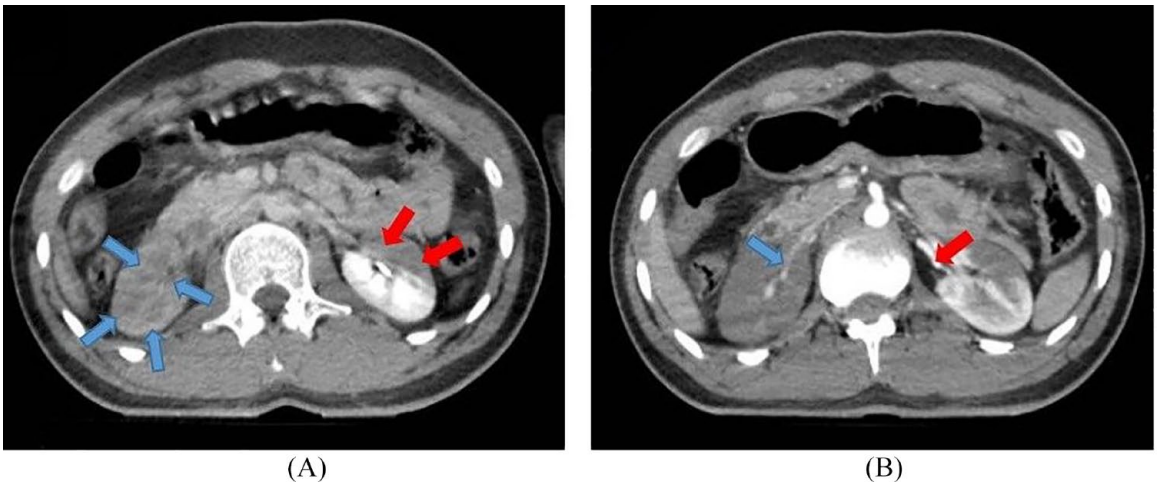
Figure 1. Spiral abdominopelvic CT scan performed on Day 1: extensive infarction in the right kidney (blue arrows) with focal infarcted areas in the middle and lower portion of the left kidney (red arrows).

Following contrast-enhanced CT scan, the patient underwent pelvic ultrasonography and color Doppler ultrasonography. Normal size, normal parenchymal thickness, and slightly decreased parenchymal echogenicity were seen in both kidneys via ultrasonography. Color Doppler ultrasonography revealed segmental arterial branches vascularity was normal in upper pole for both kidneys, but in evaluation of the middle and lower parts, the vascularity was not clearly seen.

Patient was admitted to the urology ward and received 1000 units of heparin as a bolus dose and continued with heparin infusion 1000 units/hour. Pelvic ultrasonography and color Doppler ultrasonography were repeated on the third day of admission, and showed the same findings, but slightly increased parenchymal echogenicity in upper pole of right kidney. Another abdominopelvic CT scan was performed 10 days after admission and revealed similar findings comparing the first one (Figure 3). Serial laboratory test was taken due to observation and monitoring the patient's condition. Creatinine levels were reported 1.25, 1.44, 1.57, 1.72, 1.64, 1.46, 1.28, 1.3 mg/dl respectively (Table 1). After 10 days of heparin infusion, patient was discharged with instruction to administer heparin subcutaneously. Patient was seen 1 month after discharge. A follow up Spiral contrast-enhanced abdominopelvic CT scan showed no sign of infarction and all laboratory test were normal.

Discussion

Renal arterial injury resulting from blunt abdominal trauma is a rare condition, first described by von Recklinghausen.[13] Despite its low incidence, the detection rate of BRAI has risen due to the increasing use of CT scan in patients management.[9] These types of injuries usually occur following deceleration/



(A) (B)

Figure 2. Contrast-enhanced CT scan performed on Day. (A) No evidence of absorption in right kidney (blue arrows), and significantly decreased absorption in left kidney (red arrows) was seen in nephrogram phase. (B) Pyelogram phase showed no secretion in right kidney (blue arrow) and decreased secretion in left kidney (red arrow).

acceleration events that lead to intimal tears, followed by subintimal dissection and thrombosis. Anatomically, the left renal artery is shorter and has a more acute angle than right, which is further protected and stabilized by the inferior vena cava and duodenum. These anatomical differences make left renal artery more susceptible to injuries.[2,14] Diagnosis of BRAI might be delayed due to the nonspecific signs or symptoms. Abdominal pain, flank pain, proteinuria, and hematuria are some of symptoms, which may not be reliable indicators. Hemorrhagic shock can occur following renal artery avulsions and laerations; However, many intimal injuries and minor lacerations are remain asymptomatic.[15,16]

There are few case reports of bilateral infarction following blunt trauma (Table 2), and both diagnosis and management are remain challenging (Table 2). Early diagnosis of renal infarction is mandatory for initiating effective therapeutic intervention (such as thrombolysis, embolectomy, or percutaneous transluminal renal angioplasty) to minimize the adverse effects on renal function.[17,18] The treatment of choice typically involves anticoagulation or antiplatelet agents. Anticoagulation therapy using intravenous heparin and subsequently warfarin (target INR of 2-3) for at least 6 months leads to acceptable outcomes. Heparinization alone was also shown to be effective for renal salvage with minimal morbidity.[6,19]

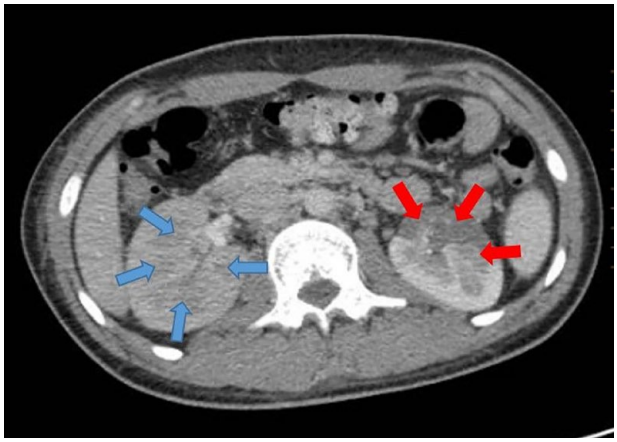


Figure 3. Spiral abdominopelvic CT scan performed on Day 10: showing segmental renal infarction in both kidneys.

The severity of renal infarction can lead to complication such as hypertension, chronic kidney disease (CKD), and end-stage renal disease (ESRD), raising the importance of rapid diagnosis and treatment.[24] Diagnosing renal infarction can be complicated as it may mimic many other condition, including pyelonephritis, renal colic, acute abdomen, pulmonary embolus, and rupture of an aortic aneurysm.[25] CT scan can provide essential anatomic and physiologic information for managing injuries sustained during blunt abdominal trauma. The diagnosis is certainly improved by the systematic quantification of LDH and increased use of contrast-enhanced CT scan in patients presenting with nephritic colitis symptoms. It can help evaluating the type and severity of parenchymal injury, extension of perirenal hemorrhage and parenchymal devascularization, and urinary extravasation. CT can help confirm the presence of major injuries to the vascular pedicle and represent occult renal pathologic conditions. Suggestive findings in CT scan are delayed or diminished enhancement of kidney, non-opacification of the pyelocaliceal system, renal artery irregularity, filling defect, contrast medium extravasation, or complete vessel occlusion.[15,26-28]

Main purpose of treatment is to preserve or re-establish blood flow as early as possible.[2] Treatment is chosen based on hemodynamic status, renal function, and the feasibility of treatment modality. Formerly, high-grade renal injuries were treated aggressively with surgical exploration or nephrectomy. However, with advances in CT imaging and minimally invasive techniques make non-operative management the standard of care. Management of renal artery avulsions and lacerations usually requires immediate exploration. Treatment options for renal infarction are categorized into 3 categories: anticoagulation, percutaneous endovascular treatment, and open surgery. The approach has changed over time from more aggressive intervention to more conservative observational or endovascular management. In case of normal renal function and vital

Table1. Patient creatinine levels in the admission period.

CREATININE TREND THROUGH ADMISSION (MG/DL)										
UPON ARRIVAL	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	DAY 8	DAY 9	DAY 10
1.2	1.25	1.44	1.57	1.72	1.64	—	1.46	—	1028	1.3

Table 2. Previous case reports: Bilateral renal infarction after blunt trauma.

YEAR	AUTHORS	TITLE OF ARTICLE
1986	Jetley et al[20]	Bilateral renal artery injury after blunt abdominal trauma
1997	Frassinelli et al[21]	Bilateral renal artery thrombosis secondary to blunt trauma: case report and review of the literature
2014	Saritas et al[22]	A rare consequence of blunt abdominal trauma: bilateral renal infarction
2023	Basavanagowda et al[23]	Blunt trauma abdomen leading to bilateral renal segmental infarction: resolving the enigma

signs, medical treatment alone with strict blood pressure control is as effective as surgical management.[24,29-32]

Renal infarction was diagnosed in our patient using a contrast-enhanced CT scan. Conservative approach—including anticoagulant therapy—was chosen for our patient considering the patient's stable vital signs and normal renal function. Follow-up CT scan revealed that the infarcted area of both kidneys was recovered while the patient's blood pressure and renal function remained normal.

Short-time follow-up was one of our study's limitations. Longer follow-up would be beneficial to evaluate the long-term effect of bilateral renal infarction in our patient. Larger studies are needed to evaluate the outcomes of different therapeutic strategies, to help physicians make optimal decisions regarding bilateral renal infarction following abdominal blunt trauma.

Conclusion

Renal infarction following blunt renal artery injury is an infrequent condition, that commonly occurs following deceleration/acceleration events. Using imaging techniques, especially computed tomography scan helps physicians diagnose the infarction immediately and start appropriate treatment. Management of renal infarction is still controversial and depends on the patient's situation and available treatment. Treatment can vary from aggressive surgical procedures to observation and supportive care. This case report demonstrates the importance of rapid diagnosis in suspected patients, which is possible today due to the widespread use of computed tomography scan, which leads to the immediate start of treatment and appropriate management.

Author Contributions

AT: conceptualization; AS: writing the manuscript; SMKA: editing and reviewing the manuscript and supervising the project.

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