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Traumatic Renal Artery Thrombosis with Concomitant High-Grade Liver Laceration in a Pediatric Patient: A Case Report and Imaging Review

S. Aouaq[1]*, FZ. Daoui[1], Z. Ait said[1], Y. Bouktib[1], A. El Hajjami[1], B. Boutakioute[1], M. Ouali Idrissi[1], N. Cherif Idrissi El Guennouni[1]

[1]Department of Radiology, Errazi Hospital, Mohammed VI University Hospital Center, Cadi Ayyad University

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***Corresponding author:** S. Aouaq
Department of Radiology, Errazi Hospital, Mohammed VI University Hospital Center, Cadi Ayyad University

Abstract | **Case Report**

***Background*:** Traumatic renal artery occlusion is a rare but severe complication of blunt abdominal trauma. Diagnosis is challenging due to non-specific clinical signs, often masked in polytrauma patients. The pivotal role of computed tomography (CT) angiography in enabling rapid and accurate diagnosis is well-established, though optimal management remains controversial, balanced between revascularization and conservative care. ***Case Report*:** A 6-year-old female presented after high-energy blunt thoraco-abdominal trauma as a pedestrian struck by a motorcycle. Initial contrast-enhanced CT revealed two major injuries: a Grade IV hepatic laceration and a thrombotic occlusion of the right renal artery, evidenced by a lack of arterial opacification and renal parenchymal enhancement. Given the patient's stability and a normal contralateral kidney, a non-operative strategy was adopted. Follow-up imaging confirmed complete right renal infarction with features of cortical necrosis (AAST Grade V injury) and showed favorable evolution of the hepatic lesion. ***Discussion and Conclusion*:** This case underscores the critical role of multiphasic CT angiography as the primary imaging modality for the definitive diagnosis and comprehensive staging of traumatic renal vascular injuries. The radiologist's interpretation is essential, not only for detection but also for guiding management by characterizing the injury, assessing the contralateral kidney, and identifying associated trauma. In cases of unilateral occlusion with a viable contralateral kidney, a conservative approach is a recognized and often preferred strategy, as attempts at revascularization are frequently unsuccessful due to prolonged ischemia and carry significant risk in polytrauma patients. This case exemplifies how precise imaging findings directly inform patient-specific therapeutic decisions, highlighting the radiologist's key consultative role within the multidisciplinary trauma team.

Keywords: Renal Artery Occlusion, Blunt Abdominal Trauma, Computed Tomography Angiography, Non-Operative Management, Renal Infarction, Case Report.

INTRODUCTION

Traumatic renal artery injury is a rare complication of blunt abdominal trauma [1, 2]. Diagnosis is challenging due to non-specific symptoms like hematuria or flank pain, which are often masked in polytrauma patients [1]. While typically unilateral, bilateral cases are exceptionally uncommon [3]. The advent of angiography, and particularly computed tomography (CT), has significantly improved detection, enabling rapid and accurate diagnosis [3].

CASE REPORT

1. History and Initial Presentation

A previously healthy 6-year-old female presented to the emergency department as a pedestrian struck by a motorcycle, sustaining high-energy blunt thoraco-abdominal trauma. On admission, she was hemodynamically stable and conscious (GCS 15). Physical examination was significant for generalized abdominal guarding, raising high suspicion for significant intra-abdominal injury.

2. Initial Imaging Findings

An urgent contrast-enhanced thoraco-abdomino-pelvic CT scan was performed. The study revealed two major, distinct injuries:

- **Hepatic Injury:** A complex liver injury featuring a contusion bridging segments V and VIII, alongside deep lacerations extending to the portal bifurcation and involving the right and left portal branches. No active extravasation was noted. This was classified as a Grade IV injury according to the American Association for the Surgery of Trauma (AAST) organ injury scale.
- **Renovascular Injury:** A complete absence of opacification of the right main renal artery at its pre-hilar segment and a concomitant lack of nephrographic enhancement of the right kidney (**Figure 1**).

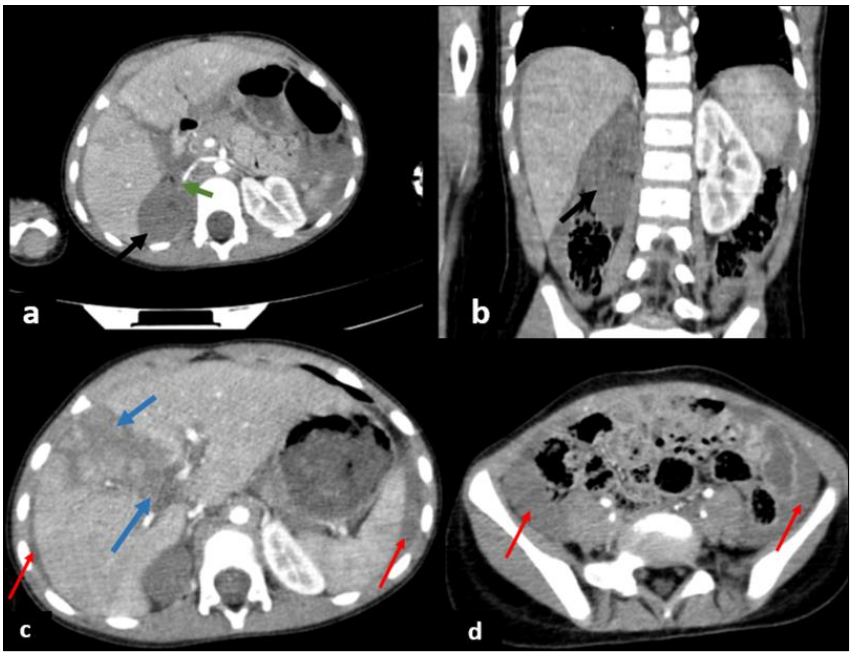

Figure 1: Contrast-enhanced CT findings of traumatic hepatic and renovascular injuries

The scan demonstrates a complex liver injury featuring a contusion bridging segments V and VIII (blue arrows), alongside deep lacerations extending to the portal bifurcation and involving the right and left portal branches. There is no evidence of active extravasation.

Concomitant renovascular injury is evidenced by a complete lack of opacification of the right main renal artery at its pre-hilar segment (green arrow) and an absence of nephrographic enhancement of the right kidney (black arrows).
Associated hemoperitoneum is present (red arrows).

3. Treatment and Follow-Up Imaging

The patient was initially managed conservatively for the liver injury. Several days post-admission, a renal Doppler ultrasound was performed, which revealed markedly reduced intraparenchymal vascular flow compared to the contralateral kidney.

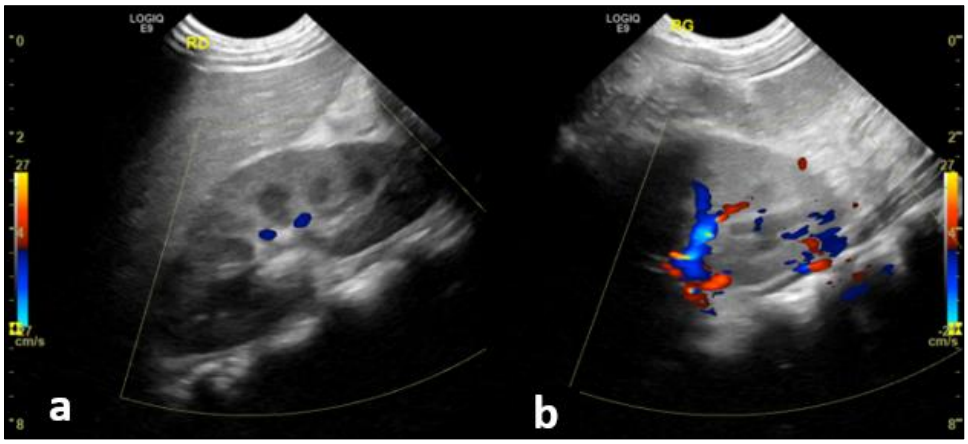

Figure 2: Renal Doppler ultrasound demonstrating markedly reduced intraparenchymal vascular flow in the affected kidney (a), compared to the normal flow in the contralateral kidney (b)

A follow-up abdominal CT angiography was subsequently obtained to fully assess the evolution of the injuries:

- Liver: The hepatic laceration showed favorable evolution with a clear reduction in the size of the contusion and stable, non-expanding lacerations without contrast extravasation. It remained a AAST Grade IV injury in resolution.
- Right Kidney:
- Right Renal Artery: Lack of opacification with slight reperfusion at the level of the segmental arteries.

The kidney was of normal size but demonstrated a complete absence of contrast enhancement and excretion. Crucially, there was a loss of corticomedullary differentiation, a key imaging hallmark of cortical necrosis (Figure 3). These features are diagnostic of a non-viable kidney and are classified as a AAST Grade V renal injury.

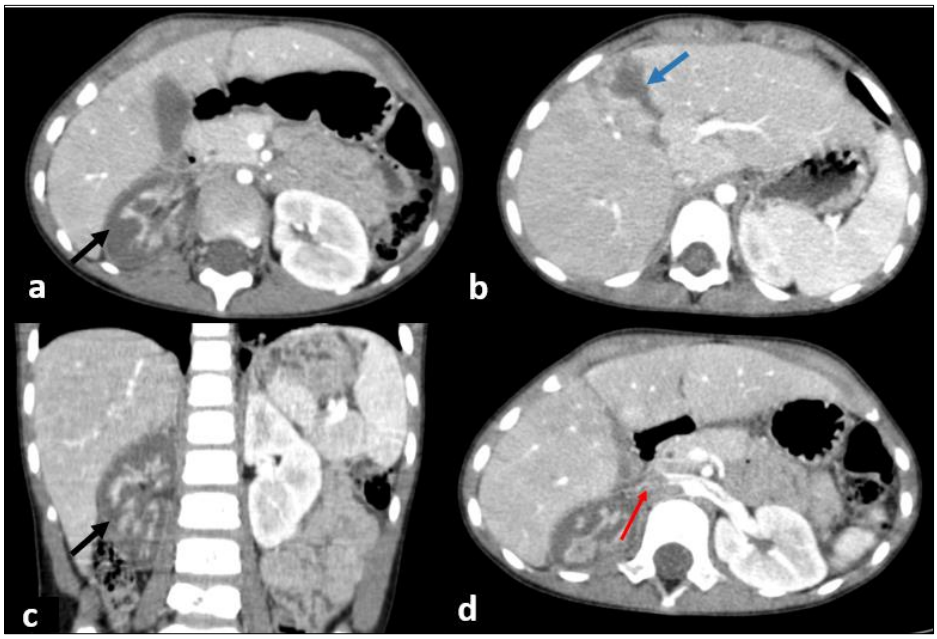

Figure 3: Follow-up abdominal CT angiography demonstrating:

The liver laceration shows favorable evolution, with a significant reduction in the size of the contusion area and stable, non-expanding lacerations without contrast extravasation (blue arrows).

Regarding the right kidney:

- The right renal artery remains non-opacified, with slight reperfusion noted at the level of the segmental arteries (red arrows).
- The kidney is of normal size but shows a complete absence of contrast enhancement and excretion. The loss of corticomedullary differentiation (black arrows) is a key imaging hallmark of global cortical necrosis.

DISCUSSION

Renal vascular trauma represents a rare nosological entity, complicating approximately 1 to 4% of severe abdominal traumas. Its reported incidence has increased over recent decades, primarily attributable to the systematic and effective use of computed tomography (CT) in the diagnostic workup of polytrauma patients [4]. From a pathophysiological perspective, two main mechanisms are implicated: deceleration/acceleration phenomena, which generate intimal injuries that can lead to dissection or thrombosis, and direct compression of the renal artery against the vertebral column [5].

Due to the non-specific nature of biological markers and the lack of sensitivity of clinical examination, diagnosis relies entirely on imaging. Multiphasic contrast-enhanced helical CT is the imaging modality of choice, allowing not only for a definitive diagnosis with high accuracy [6], but also for a comprehensive assessment of associated injuries.

The therapeutic strategy, however, is the subject of significant controversy, oscillating between urgent surgical revascularization and non-operative management. Several factors complicate this decision: (1) the exceptional nature of these injuries, (2) the often poor renal functional prognosis following revascularization, even when performed early, largely due to diagnostic delays exceeding the therapeutic window for salvage (potentially less than 3 hours) [7] – as evidenced by published series where recovery is unpredictable despite varying durations of warm ischemia [8], and (3) the high prevalence of concomitant life-threatening and destabilizing injuries, often

associated with a lethal triad (acidosis, hypothermia, coagulopathy) that contraindicates major surgical intervention [9]. Consequently, management is tailored to the patient's clinical status. A non-interventional approach is generally adopted in cases of unilateral occlusion with a normal contralateral kidney, whereas aggressive revascularization is indicated without regard to time delay in cases of bilateral involvement or occlusion in a solitary functioning kidney [10, 11].

CONCLUSION

In conclusion, multiphasic computed tomography angiography is the undisputed cornerstone for the diagnosis and staging of traumatic renal vascular injuries. It provides an accurate and rapid assessment that is critical for triage. However, the radiologist's role extends beyond mere detection; it is integral to guiding management.

The imaging findings—precisely characterizing the injury, confirming the presence of a functional contralateral kidney, and identifying concomitant trauma—provide the essential data that inform the therapeutic dilemma between revascularization and conservative management. Thus, the radiologist is a key consultant in the multidisciplinary team, and their detailed interpretation is fundamental to formulating a patient-specific treatment strategy that optimizes outcomes.

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