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Case Report

Isolated Right Adrenal Hemorrhage in a Pediatric Pedestrian–Vehicle Collision: A Rare Injury Pattern and Review of Mechanisms

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Abstract

Isolated adrenal trauma in the pediatric population is rare due to the gland's deep retroperitoneal location and surrounding protective structures. We present a case of a 17-year-old male who sustained an isolated right adrenal hemorrhage following a high-energy pedestrian–vehicle collision. Despite a significant mechanism of injury, the patient remained hemodynamically stable, and diagnosis was established with contrast-enhanced computed tomography (CT) after a negative Focused Assessment with Sonography for Trauma (FAST) examination. This case highlights the unique vulnerability of the right adrenal gland, limitations of ultrasound in detecting retroperitoneal injuries, and the importance of maintaining a high index of suspicion. The pathophysiology of adrenal injury is multifactorial, involving venous hypertension, compressive forces, and vascular shearing. Conservative management remains the standard of care in stable patients, with excellent outcomes.

Keywords: *Pediatric Trauma, Adrenal Hemorrhage, Blunt Abdominal Trauma, Retroperitoneal Injury, Isolated Adrenal Injury*

Introduction

Adrenal gland injury is an uncommon finding after blunt abdominal trauma, occurring in approximately 2–3% of trauma patients undergoing computed tomography (CT) evaluation [1,5]. In the pediatric population, isolated adrenal hemorrhage is particularly rare because of the gland's deep retroperitoneal location and surrounding protective structures [3,4]. The right adrenal gland is more frequently affected due to its short venous drainage directly into the inferior vena cava, predisposing it to venous hypertension and hemorrhage during high-energy trauma [1,2].

Clinical presentation is often nonspecific and may include flank, back, or abdominal pain [1,12]. Focused Assessment with Sonography for Trauma (FAST) has limited sensitivity for isolated retroperitoneal injuries, making contrast-enhanced CT the diagnostic modality of choice [6,12,13]. Most unilateral adrenal injuries in hemodynamically stable patients are managed conservatively with favorable outcomes [2,7,9].

We present a rare case of isolated right adrenal hemorrhage in a 17-year-old male following a pedestrian–vehicle collision, highlighting the diagnostic challenges and mechanisms underlying this uncommon injury pattern.

Case Presentation

A 17-year-old male with a history of schizophrenia was brought to the Emergency Department after being struck by a city bus as a pedestrian. The impact occurred on the right side of his body and head. On arrival, he was alert and hemodynamically stable.

Primary survey findings, including FAST examination, were negative. Secondary survey revealed superficial abrasions to the right forehead, right forearm, and bilateral knees. The patient denied loss of consciousness, nausea, vomiting, neurologic deficits, or genitourinary symptoms. His only complaint was deep right-sided abdominal pain radiating to the back.

Initial laboratory evaluation demonstrated:

- Hemoglobin: 14.5 g/dL
- Hematocrit: 44%
- Platelets: 217 ×10⁹/L
- INR: 1.0
- Electrolytes: within normal limits

On physical examination, mild tenderness was noted in the right upper quadrant without peritoneal signs.

Given the high-energy mechanism, contrast-enhanced CT of the abdomen and pelvis was obtained, demonstrating enlargement and hyperattenuation of the right adrenal gland with adjacent small-volume retroperitoneal hematoma, consistent with acute adrenal hemorrhage.

The patient was admitted for close monitoring, including:

- Hourly vital sign monitoring
- Serial abdominal examinations
- Complete blood count every 6 hours

He was kept nil per os with intravenous fluid support. Serial hemoglobin levels demonstrated a mild downward trend that stabilized without transfusion requirement.

Time	Hemoglobin	Hematocrit	Platelets
Initial	14.4	44	217
6 hr	12.9	38	205
12 hr	12.8	38	185
18 hr	12.4	38	191
24 hr	12.8	38	192
30 hr	12.2	36	188
36 hr	12.0	37	172

Follow-up CT angiography demonstrated a stable enlarged right adrenal gland with a small-volume retroperitoneal hematoma and no evidence of active contrast extravasation.

The patient remained hemodynamically stable throughout hospitalization. His diet was gradually advanced, and he was discharged without complications.

Discussion

Rarity of Isolated Pediatric Adrenal Trauma

Adrenal injury is uncommon, identified in approximately 2–3% of patients undergoing CT evaluation after blunt abdominal trauma [1,5]. Isolated adrenal injury without associated solid organ damage is exceedingly rare, particularly in the pediatric population, where high-energy mechanisms more commonly produce multisystem injury [3,4,9].

The rarity of adrenal trauma is attributed to:

- Deep retroperitoneal location
- Protection by surrounding organs including the liver, kidneys, and spine
- Small size and mobility of the adrenal glands [1,3]

In pediatric patients, the adrenal glands are proportionally larger and relatively more vascular, theoretically increasing susceptibility to hemorrhage [3,13]. Nevertheless, isolated adrenal injury remains uncommon because significant blunt trauma in children frequently results in concomitant injuries [4].

Mechanisms of Adrenal Injury

The pathophysiology of adrenal trauma is complex and likely multifactorial [1,2,12]. Several mechanisms have been proposed.

1. Sudden Venous Hypertension (IVC Compression Theory)

Blunt abdominal compression can acutely elevate inferior vena cava (IVC) pressure, which is transmitted directly to the adrenal veins. The right adrenal vein is short and drains directly into the IVC, rendering it particularly vulnerable to abrupt pressure changes [1,2]. This may result in rupture of the adrenal microvasculature and subsequent hemorrhage.

2. Direct Compression and Deceleration Forces

High-energy trauma may compress the adrenal gland between rigid posterior structures such as the spine and anterior structures including the liver [2,12]. In pedestrian–vehicle collisions, rapid deceleration further amplifies these compressive forces, producing adrenal contusion or intraglandular bleeding.

3. Shearing of Microvasculature

Deceleration forces may additionally cause shearing injury to small adrenal arterial branches. The adrenal gland possesses a rich arterial supply derived from the inferior phrenic artery, aorta, and renal artery, making its vascular network susceptible to disruption during blunt trauma [1,12].

Right-Sided Predominance

Right adrenal injuries occur approximately 3–4 times more frequently than left-sided injuries [2,5,12]. Several anatomical factors likely contribute:

- Direct drainage into the IVC through a short adrenal vein
- Compression between the liver and vertebral column
- Enhanced transmission of venous pressure from the IVC [1,2]

By contrast, the left adrenal vein drains into the left renal vein, which may partially buffer abrupt caval pressure transmission [1]. Our case demonstrates this classic injury pattern, with isolated right adrenal hemorrhage following lateral blunt impact.

Clinical Presentation and Diagnostic Challenges

Adrenal injuries are frequently clinically silent or present with nonspecific symptoms such as flank pain, back pain, or mild abdominal tenderness [1,2,12]. In this patient, the isolated complaint of deep right-sided abdominal pain corresponded to retroperitoneal pathology.

FAST examination has limited sensitivity for isolated retroperitoneal injuries because retroperitoneal hemorrhage may not communicate with dependent intraperitoneal spaces [6,13]. Accordingly, the patient's FAST examination was negative despite confirmed adrenal hemorrhage.

Contrast-enhanced CT remains the diagnostic gold standard [12,13]. Typical findings include:

- Adrenal enlargement
- Hyperattenuation within the gland
- Periadrenal fat stranding
- Retroperitoneal hematoma [12]

CT angiography is valuable in assessing active hemorrhage through identification of contrast extravasation [7,12].

Management

Management of adrenal trauma depends primarily on hemodynamic status [1,2,7].

Hemodynamically Stable Patients

Stable patients are generally managed conservatively with:

- Close clinical monitoring
- Serial hemoglobin measurements
- Repeat imaging when clinically indicated [2,7]

Hemodynamically Unstable Patients

Patients with active bleeding or instability may require:

- Angiographic embolization
- Surgical exploration, although operative intervention is uncommon [1,2]

Most unilateral adrenal injuries are self-limited and resolve without intervention [2,9]. Adrenal insufficiency is uncommon in unilateral hemorrhage but should be considered in bilateral adrenal injury or unexplained hypotension [1,11].

Conclusion

This case highlights the rarity of isolated adrenal trauma in the pediatric population following high-energy blunt injury. The unique vascular anatomy of the adrenal gland, particularly on the right side, predisposes it to hemorrhage through mechanisms involving venous hypertension, compression, and vascular shearing [1,2].

Clinicians should maintain a high index of suspicion for adrenal injury in pediatric trauma patients presenting with flank or back pain, even in the setting of a negative FAST examination [6,13]. Early contrast-enhanced CT facilitates prompt diagnosis and supports successful nonoperative management in hemodynamically stable patients [7,12].

Conflict of Interest

The authors declare that they have no conflicts of interest.

References

1. Approach to the patient with adrenal hemorrhage Elhassan YS. Approach to the patient with adrenal hemorrhage. *J Clin Endocrinol Metab.* 2023;108(4):857-867. doi:10.1210/clinem/dgac702

2. Isolated unilateral adrenal gland hemorrhage following motor vehicle accident: a case report Lehrberg A, Kharbutli B. Isolated unilateral adrenal gland hemorrhage following motor vehicle accident: a case report. *J Med Case Rep.* 2017;11:1-4. doi:10.1186/s13256-017-1222-0

3. Blunt adrenal gland trauma in the pediatric population Roupakias S, Papoutsakis M. Blunt adrenal gland trauma in the pediatric population. *Asian J Surg.* 2011;34(3):142-146. doi:10.1016/j.asjsur.2011.09.011

4. Pediatric adrenal trauma in the 21st century: a national analysis Figler BD, et al. Pediatric adrenal trauma in the 21st century: a national analysis. *J Pediatr Surg.* 2019;54(6):1168-1173. doi:10.1016/j.jpedsurg.2018.07.021

5. Blunt adrenal gland injury: the impact of extra-abdominal organ injuries Tanizaki S, et al. Blunt adrenal gland injury: the impact of extra-abdominal organ injuries. *Injury.* 2021;52(11):3271-3277. doi:10.1016/j.injury.2021.07.023

6. Diagnosis and management of pediatric blunt abdominal trauma Bašković M, et al. Diagnosis and management of pediatric blunt abdominal trauma. *Diagnostics (Basel).* 2021;11(1):67. doi:10.3390/diagnostics11010067

7. Re-imaging in the management of blunt abdominal trauma Ben Youssef S, et al. Re-imaging in the management of blunt abdominal trauma. *F1000Res.* 2022;11:10. doi:10.12688/f1000research.108146.1

8. Spontaneous adrenal hemorrhage in a newborn: a case report Lodhia J, et al. Spontaneous adrenal hemorrhage in a newborn: a case report. *Pediatr Neonatol.* 2020;61(4):419-422. doi:10.1016/j.pedneo.2020.02.007

9. Blunt adrenal injury does not affect outcomes in pediatric trauma Duncan AJ, et al. Blunt adrenal injury does not affect outcomes in pediatric trauma: analysis of the National Trauma Data Bank. *Am J Surg.* 2024;228(1):52-58. doi:10.1016/j.amjsurg.2023.05.012

10. Adrenal gland injury in trauma patients and its impact on outcomes Sengün B, et al. Adrenal gland injury in trauma patients and its impact on outcomes. *Ulus Travma Acil Cerrahi Derg.* 2024;30(2):111-118.

11. Adrenal gland haemorrhages following motor vehicle accident with resultant adrenal insufficiency Alruwaili AM, Abumelha S, Alahmadi H, et al. Adrenal gland haemorrhages following motor vehicle accident with resultant adrenal insufficiency: a case report and literature review. *Cureus.* 2022;14(5):e24871. doi:10.7759/cureus.24871

12. Multidetector computed tomography in adrenal injury diagnosis and follow-up Addeo G, et al. Multidetector computed tomography in adrenal injury diagnosis and follow-up. *Eur J Radiol.* 2021;140:109732. doi:10.1016/j.ejrad.2021.109732

13. Posttraumatic adrenal hemorrhage in children: imaging features and clinical significance Sivit CJ, Taylor GA, Bulas DI, et al. Posttraumatic adrenal hemorrhage in children: imaging features and clinical significance. *AJR Am J Roentgenol.* 1992;158(6):1273-1276. doi:10.2214/ajr.158.6.1590124

14. Isolated adrenal gland hematoma after blunt trauma Mavridis G, et al. Isolated adrenal gland hematoma after blunt trauma: a case report and review of the literature. *Hellenic Urol.* 2019;31(2):85-89.