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Abdominal wall hernia and aortic injury secondary to blunt trauma: Case report and review of the literature



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ABSTRACT

INTRODUCTION: Traumatic abdominal wall hernia (TAWH) and traumatic abdominal aortic injury (TAAI) are two uncommon complications secondary to blunt trauma. In both TAWH and TAAI, reported cases are often associated with poly-trauma. TAWH may be initially missed if more pressing issues are identified during the patient's primary survey. TAAI may be an incidental finding on imaging or, if severe, a cause of an acute abdomen and hemodynamic abnormality.

PRESENTATION OF CASE: A 54-year-old white male suffered a TAWH and TAAI (pseudoaneurysm) due to severe blunt trauma. TAWH was apparent on physical exam and the TAAI was suspected on computed tomography (CT). The patient's TAWH was managed with a series of abdominal explorations and the TAAI was repaired with endovascular stenting.

DISCUSSION: TAWH and TAAI are commonly due to severe blunt trauma from motor vehicle collisions. Diagnosis is made through physical exam, imaging studies, or surgical exploration. A variety of surgical techniques achieve technical success.

CONCLUSION: The patient with blunt trauma to the abdomen is at risk for TAWH and TAAI, which are often associated with other injuries. Investigations should include thorough clinical exam through secondary survey and radiologic imaging in the hemodynamically normal patient.

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1. Introduction

Traumatic abdominal wall hernia (TAWH) is an uncommon form of hernia that is caused by protrusion of the bowel or intraabdominal organs through disrupted abdominal musculature and fascia following a blunt trauma. There are a number of effective surgical approaches to manage TAWH. Most trauma surgeons combine their knowledge of trauma surgery and non-traumatic hernia repair for management of these cases.¹ Traumatic abdominal aortic injury (TAAI) is an uncommon complication secondary to blunt trauma. TAAI may manifest as an aneurysm, pseudoaneurysm, dissection, rupture or combination of the above. Endovascular repair of TAAI is safe and feasible if the patient does not require urgent abdominal exploration.² The following case outlines a patient who suffered

blunt trauma resulting in a TAWH and an abdominal aortic pseudoaneurysm.

2. Presentation of case

A 54-year-old white male was brought to the regional trauma center by emergency medical services (EMS) after sustaining severe blunt abdominal trauma when a tree fell on his bulldozer and trapped him inside for 2 h. Upon arrival, the patient had a patent airway, normal respiratory effort, and was hemodynamically normal. He complained of generalized abdominal pain. Physical examination revealed contusions and ecchymosis of the anterior abdominal wall and a large subcutaneous non-reducible bulge that was tender to palpation. Focused assessment with sonography for trauma (FAST) scan was negative. A computed tomography (CT) scan with intravenous contrast was performed and revealed a large herniation of bowel through the right lower quadrant (Fig. 1) and a suspected pseudoaneurysm of the abdominal aorta.

The patient was emergently taken to the operating room and underwent debridement of nonviable skin, subcutaneous tissue,

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Fig. 1. Contrast-enhanced computed tomography scan shows traumatic ventral herniation of small bowel, cecum, and mesentery through the anterolateral abdominal wall. The cecum is partially included in the hernia sac, while the terminal ileum (solid arrow) and appendix (dashed arrow) remain intra-abdominal (E, external oblique; I, internal oblique; T, transversus abdominis).

and fascia, leaving a 10 cm × 8 cm defect. The wound was extended by a midline incision and the abdomen was fully explored, revealing a loop of contused but viable small bowel. The abdomen was left open and negative pressure dressings were used for temporary closure. In this post-operative interval, a CT angiogram confirmed the abdominal aortic pseudoaneurysm (Fig. 2). Two days following the abdominal exploration, the patient underwent endovascular stenting of the abdominal aorta for the pseudoaneurysm repair. Subsequently, the patient was taken to the operating room for closure of his open abdomen. Intraoperatively, the abdomen was re-explored, revealing healthy bowel. The fascial defect was partially closed. Following wound therapy with negative pressure dressings on an outpatient basis, the patient received a split-thickness skin graft to cover the wound.

3. Discussion

3.1. Traumatic abdominal wall hernia

A study with 3947 blunt trauma patients reported a 0.9% rate of TAWH.³ The most common mechanisms of this injury are handlebar injuries in the pediatric population and motor vehicle collisions in adults.⁴ TAWH may be caused by an acute increase in intra-abdominal pressure or acceleration-deceleration shear forces impacting with a compressive seatbelt.⁵ These hernias are typically located in the lower abdomen, likely due to the mitigated protection in areas around natural orifices such as the inguinal canal.¹ The patient described in this case suffered a crush injury to the anterior abdominal wall that led to the development of a TAWH in the right lower quadrant.

Clinically, patients with TAWH may present with localized tenderness and ecchymoses. TAWH is generally apparent on physical exam with a visible bulge and pain on palpation of the abdomen. CT is a sensitive radiologic modality (sensitivity of 100% in one series with 34 TAWH patients³) that should be considered in the hemodynamically stable patient when TAWH is suspected. CT may even detect occult TAWH that was missed on physical examination.^{1,3} In the unstable patient for whom immediate surgical exploration is indicated, TAWH is discovered through exploration.¹ When TAWH is missed on the initial survey, patients may later present with complications such as incarcerated or strangulated abdominal contents. While TAWH has been reported as an isolated phenomenon, it usually occurs in conjunction with other intra- and or extra-abdominal injuries to include pelvic fractures, liver laceration, splenic rupture, and bowel perforation. While there are no reported CT findings of TAWH that distinguish it from pre-existing abdominal wall hernias, CT is useful in detecting associated injuries and signs of incarceration.^{6,7} The patient may also serve as a source of information to determine whether an abdominal bulge indicative of a potential hernia was present prior to the trauma.

While the concomitant injuries may warrant priority, TAWH repair may be considered in patients who remain stable during the primary surgical intervention. Timing of the surgical intervention depends on the nature and severity of other injuries, general condition of the patient, size of the hernia, and risk of incarceration as well as the vital organs protruded through the hernia sac. The surgical approach can be accomplished through exploration using the

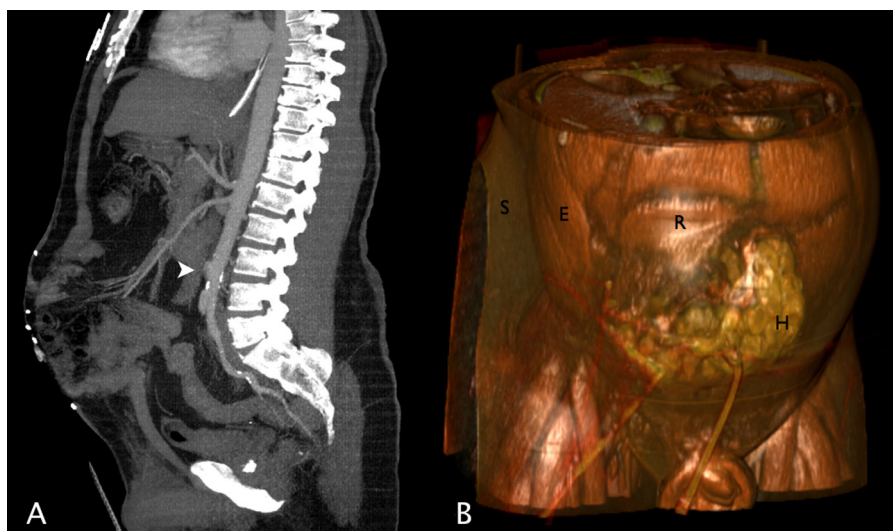


Fig. 2. (A) Computed tomography angiogram (CTA) shows the bowel herniation and the abdominal aortic pseudoaneurysm (arrowhead). (B) 3D volume rendering of this CTA reveals the post-operative open abdomen (S, skin; E, external oblique; R, rectus abdominis; H, hernia sac).

midline incision as well as repair through local incision in patients with no other intra-abdominal injuries.¹ Tension-free repair is the consensus. The use of mesh in the setting of emergency exploration remains controversial, especially in the presence of other injuries, and the surgeon must consider the risk of infection.¹ However, mesh application is widely recommended in delayed TAWH repair in the absence of other injuries.¹ Some authors have recently advocated use of the biologic mesh in cases with concurrent hollow viscous injuries, or abdominal contamination and abdominal wall hernia, although this condition has historically been considered a contraindication for usage of mesh.^{8,9} Although use of biologic mesh in such cases seem to be safe with good immediate and short-term results, the long-term durability is less favorable, with some series citing a hernia recurrence rate of 40% in a mean follow up period of 21 months.⁹

A laparoscopic approach may be utilized for delayed TAWH repair or TAWH repair without concomitant intra-abdominal injuries.⁴ Laparoscopy is an option that may also be considered for TAWH repair in the emergency setting.¹⁰

3.2. Blunt abdominal aortic injury

Injuries of the abdominal aorta secondary to blunt trauma are rare; they are reported to occur in less than 1% of blunt traumas.^{2,11} The most common inciting trauma is motor vehicle collisions. Seat belts in deceleration collisions can contribute to TAAI (“seat belt aorta”). TAAI may manifest as aneurysms, pseudoaneurysms, dissections, or ruptures. TAAI are often concurrent with other blunt trauma-associated injuries (e.g., visceral injuries, fractures).^{2,11}

Diagnosis of TAAI is made by CT, CTA, or surgical exploration. The clinical presentation of TAAI depends on the type of injury and its severity. In severe TAAI, patients may present with an acute

abdomen and hemodynamic abnormality. In these cases, physical exam may reveal signs of peritonitis on abdominal palpation and weak, delayed, or absent lower extremity pulses. In less severe TAAI, there may be no abnormalities on clinical presentation and TAAI may be discovered incidentally on imaging.^{11,12} In the trauma setting, endovascular repair of TAAI is a safe and feasible surgical technique for repair of TAAI in hemodynamically normal patients who do not require open exploration.²

3.3. Concurrent TAWH and TAAI

As with the case at hand, concurrent TAWH and TAAI have been reported previously.² In that case the patient suffered a rollover motor vehicle accident and presented with a TAAI (dissection and pseudoaneurysm), TAWH, humeral head dislocation, free intraperitoneal fluid, and a pulmonary contusion. The patient had an exploratory laparotomy with bowel excision and, due to initial instability, delayed endovascular repair of TAAI.

4. Conclusion

TAWH and TAAI should be considered as a possibility in the workup of patients with blunt abdominal trauma when performing a thorough primary and secondary survey. A high index of suspicion is essential. While physical exam findings often raise suspicion for TAWH, CT is a more sensitive modality to detect missed, minor, or delayed TAWH. Surgical repair of TAWH is accomplished using both open and laparoscopic techniques. As only severe TAAI will have positive physical exam findings, imaging techniques, surgical exploration, or on-table angiogram may aid in diagnosis. TAAI can be managed effectively with open surgery or endovascular repair/stenting.

Key learning points

- Traumatic abdominal wall hernias (TAWHs) and traumatic abdominal aortic injuries (TAAIs) are complications of severe blunt trauma.
- CT is a sensitive imaging modality to detect TAWHs.
- Traumatic abdominal aortic injuries (TAAIs) are complications of severe blunt trauma that may only have positive physical exam findings in severe cases.
- As only severe TAAI will have positive physical exam findings, imaging techniques, surgical exploration, or on-table angiogram may aid in diagnosis.

Conflict of interest

None declared.

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Ethical approval

Written informed 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.

Author contributions

All authors contributed to the manuscript's preparation in writing, preparing images, and literature review. All authors approved the final manuscript.

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