

# Immediate Exploration of The Traumatic Abdominal Wall Disruption in Children: A Case Report

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## Abstract

**Background:** Traumatic abdominal wall disruption in children is a rare but severe diagnosis resulting from blunt abdominal trauma (BAT). The clinical diagnosis is not usually straightforward, and the hernia is often discovered at the time of the surgical exploration for intra-abdominal injuries or by imaging studies.

**Presentation of Case:** A 13-year-old boy, a restrained male patient, was the victim of a high-speed road traffic accident. Among other injuries, he showed bruising over the lower abdomen and localized right-side peritonitis upon presentation. A contrast-enhanced computed tomography scan of the chest and abdomen demonstrated abdominal wall muscular disruption over the right lower quadrant with herniation of the large bowel. The patients had immediate exploratory laparotomy with hernia repair.

**Discussion:** Traumatic abdominal wall disruption is a rare form of hernia caused by abdominal wall musculature and fascia disruption. The diagnostic criteria and classification of traumatic abdominal wall disruption are still unclear; furthermore, the ideal timing and method of surgical treatment are still unclear. Herein, we report a case of traumatic abdominal wall disruption and describe the surgical approach used.

**Conclusion:** Children with traumatic abdominal wall disruption have high rates of concomitant abdominal organ injury requiring operative repair. CT scans have low sensitivity and specificity for detecting associated injuries. A high suspicion of injury and low threshold for exploration must be maintained in traumatic abdominal wall disruption cases.

**Keywords:** Traumatic abdominal wall injury, Abdominal wall hernia, Pediatric

## INTRODUCTION

Traumatic abdominal wall disruption is a highly uncommon form of the hernia that is caused by disruption of the abdominal wall musculature and fascia (while the skin is still intact) and bowel and abdominal organ herniation following blunt abdominal trauma. Since 1906, when Selby<sup>1</sup> reported the first case of traumatic abdominal wall hernia (TAWH), around 140 cases of TAWH (including both case reports and case series) have been reported in the English-language medical literature.

The incidence of acute posttraumatic hernia, which is rarely encountered in clinical practice, has been estimated at 0.07%.<sup>2</sup> This is despite the high incidence of

abdominal trauma as presented to the emergency department. Historically, there is a low threshold for urgent explorative laparotomy for the management of TAWH because of its strong association with intraabdominal injury.<sup>3</sup> However, with the increasing accuracy of modern computed tomography (CT) in diagnosing visceral injuries and increasing practice for conservative management of solid organ injuries, there is an argument for managing traumatic abdominal wall disruption conservatively. With few cases reported, the literature has not established a consensus on diagnosis and management. We also report our experience with a case of traumatic abdominal wall disruption and discuss a clinical approach in light of

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the literature findings. Associations were made between diagnostic findings and grading of traumatic abdominal wall disruption, with the need for urgent surgery.

### CASE REPORT

A 13-year-old boy was transferred to our hospital after sustaining a motorcycle accident. He arrived at the emergency department at our hospital, with the paramedics, in a stable condition. He was assessed along the lines of the Advanced Trauma Life Support (ATLS) protocol. The patient sustained multiple injuries. The Glasgow Coma Scale (GCS) was 15 at presentation and tachycardia (heart rate 112 beats per minute). He showed, upon assessment, the following positive signs: left periorbital swelling, tenderness over the right thigh, and shortening limb of the right lower extremities. During examination of his abdomen, patchy ecchymoses, bruises, and skin maceration over the right lower abdomen and pelvis. The examination, otherwise, showed a soft abdomen with moderate lower abdominal tenderness and bilateral, mildly tender, being more prominent on the right side (Figure 1). The focused assessment with sonography in trauma (FAST) exam showed positive at hepatorenal and cul-de-sac regions (Figure 2).



Figure 1 Abdominal wall contusion



Figure 2 Positive FAST at the hepatorenal region

A contrast-enhanced CT scan of the abdomen shows disrupting all the layers of muscular defects involving the anterior abdominal wall, being more marked on the right lower abdomen associated with subcutaneous visceral herniation with the ileocecal area being present in the defect. Subcutaneous fat stranding and bleeding could be identified over the anterior sheath. Present intraperitoneal free fluid at the perihepatic, pelvic cavity and inter-bowel loop were detected on a CT scan. No free peritoneal air could be found. The liver and spleen were unremarkable (Figure 3-4).

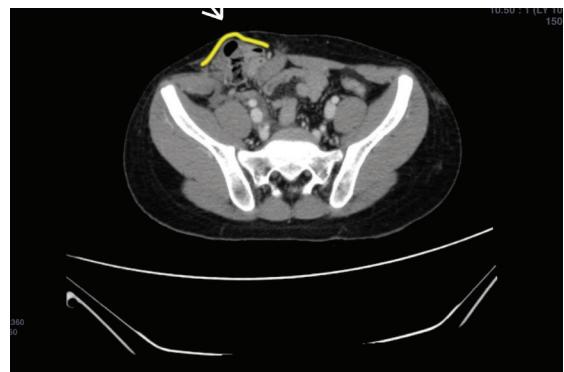


Figure 3 Abdominal wall defect (Axial)



Figure 4 Abdominal wall defect (Sagittal)

The patient immediately underwent exploratory laparotomy through an upper to mid-midline incision. Inferior to the umbilicus, a moderate amount of hemoperitoneum was encountered; however, no enteric contents were appreciated. Duodenal hematoma and non-expanding right retroperitoneal hematoma were detected during abdominal exploration. The cecal serosal split was closed with an interrupted 4-0 absorbable suture (Figure 5). Appendectomy was performed by standard double ligate technique (due to the difficult diagnosis of appendicitis in the future).

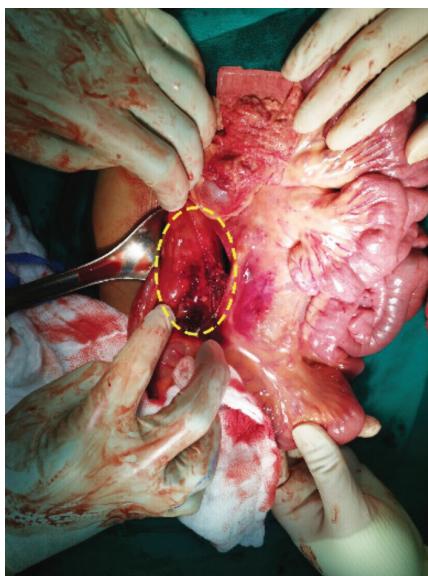


Figure 5 Mesenteric defect

Due to the risk of abdominal cavity infection during abdominal wall repair, the double-layer repair technique treated the abdominal disruption (Figure 6).



Figure 6 Repair external oblique aponeurosis

The patient remained extubated and monitored in the intensive care unit for 3 days. He was discharged 7 days after the initial trauma. We designed the following patient one year after operation (Figure 7).



Figure 7 No detect abdominal wall defect during follow-up in the first year

The outline of management, which would include diagnosis, management, and long-term complications, was discussed with the patient.

## DISCUSSION

The mechanism of injury for traumatic abdominal wall disruption usually involves a sudden application of a large force to a small area of the abdomen, resulting in the disruption of the deeper tissue of the muscle and fascia with or without skin involvement.<sup>4</sup> The tangential shearing stresses associated with a sudden elevation in intra-abdominal pressure are thought to be the basic injury mechanism.

The disruptions tend to occur more commonly at anatomic weak points, such as the lateral border of the rectus, lower abdomen, inguinal region, or natural ori-fices.<sup>5</sup> In our case, the abdominal wall defect was located vertically over the lower abdomen, in the region of the linear semilunaris—an area of weakness where the posterior rectus sheath is deficient. Traumatic disruptions are dramatic injuries that may dominate clinicians' attention in the emergency room. However, there are often associated injuries due to the significant force that is imparted. Associated injuries may be present in up to 30% of cases.<sup>6</sup> These injuries require prompt surgical attention. While resuscitation proceeds, a rapid secondary survey should be performed to identify polytrauma injuries. After stabilization, these patients should be taken to the operating room.

Given the rarity of traumatic abdominal wall disruption, accurate diagnosis of both the abdominal wall hernia and associated injuries is challenging. CT scan has gained popularity as the diagnostic modality of choice due to its perceived ability to detect the defect as well as associated intrabdominal injury.

Our studies found that CT scans detected most traumatic abdominal wall disruptions where physical examination fell short, yet operative intervention was more likely dependent on clinical factors, such as worsening examination despite otherwise nonspecific or negative CT scan findings. This supports the need to keep a high index of suspicion for injury requiring operative intervention, with serial examination and monitoring with special attention to concern for the evolution of intraabdominal organ injury.

While the presence of this traumatic abdominal wall disruption was highly associated with a concurrent intrabdominal injury needing intervention, we found that CT scans were poor predictors of concomitant abdominal organ injury despite the presence of traumatic abdominal wall disruption and nonspecific findings such as abdominal free fluid.

With the combination of poor predictability and high incidence of concomitant abdominal organ injury, we advocate for early exploration, within the first 2 to 24 hours of arrival, in children suffering traumatic abdominal wall hernia in order to evaluate for a concomitant abdominal organ injury that may warrant urgent operative attention while also managing the hernia.

A careful search should be carried out for associated injuries at exploratory laparotomy. The abdominal wall laceration should be debrided and then repaired in layers. However, when there is marked edema, significant tissue injury, and/or an unstable patient, abdominal wall closure becomes less important, and a staged closure would be more appropriate.<sup>7</sup> We did not believe this was required in the index case as there was little tissue loss after debridement, and the abdominal wall tissues were healthy. Therefore, we could achieve a tension-free fascial closure, and the skin closed primarily.

As for the treatment of this hernia type, this could be emergent or elective. Concerning the timing of repair, there was no significant difference between repair at initial trauma laparotomy or in an elective setting during hospitalization. Factors affecting the timing (early or delayed) and the type (primary or prosthetic, open

or laparoscopic) of the repair include the following: the extent of concomitant findings, presence of associated intra- and extra-abdominal lesions, size of the abdominal wall defect, the timing of its diagnosis.<sup>8</sup>

In case the trauma patient is stable and the size of the hernia is small, with the visceral organs protruding through the defect, exploratory laparotomy/laparoscopy should be performed on an urgent basis to prevent possible visceral incarceration.<sup>9</sup>

In cases when the traumatic abdominal wall disruption is discovered during abdominal exploration for visceral injury repair, the decision to repair the hernia may be more challenging and depends on multiple factors, including the physiological stability of the trauma patient to withstand such a procedure in an emergency setting, the size of the orifice and the risk of incarceration, the presence of abdominal contamination from hollow viscus injury, the ability to perform a tension-free primary repair or alternatively the possible need of prosthetic material with the risk of surgical infection.<sup>9</sup> Noting that the use of biological mesh in the case of contamination may prove to be a good alternative despite less favorable long-term durability.<sup>10</sup> In cases where the abdominal wall defect is large and urgent surgical exploration of the abdomen is not indicated, the repair can be delayed, giving appropriate time for the skin to heal and for any associated injuries to recover. However, this delay would be at the expense of the hernia itself, which will enlarge due to muscle retraction and atrophy, resulting in a more challenging repair, making primary repair more difficult, and increasing the chances of resultant abdominal compartment syndrome.<sup>11</sup>

## CONCLUSION

Children with traumatic abdominal wall hernia confirm the rare incidence of this diagnosis. In our studies, these hernias are most commonly due to motor vehicle accidents followed by blunt abdominal trauma and are associated with high rates of concurrent intrabdominal injuries that necessitate operative management. While traumatic abdominal wall disruption is detected readily on CT scans, there is a low sensitivity and specificity in detecting these concurrent injuries. The presence of a traumatic abdominal wall disruption should key the clinician to the coexistence of commonly missed diagnoses, such as injuries to the bowel, mesentery, and pancreas. Therefore, a high index of suspicion for associated intrabdominal injury should be maintained, with a low threshold for

operative exploration and careful ongoing monitoring for evidence of delayed progression of additional injuries.

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