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Case Report

What We Know About Management of Traumatic Abdominal Wall Hernia: Review of the Literature and Case Report

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Traumatic abdominal wall hernia (TAWH) is an uncommon form of hernia caused by blunt traumatic disruption of the abdominal wall musculature/fascia and abdominal organ herniation. Diagnosis of TAWH is challenging and requires a high level of suspicion. This form of hernia seems to be underrepresented in the English-language medical literature. There is currently no consensus on the optimal management for TAWH. In this article, we discuss the management of a 36-year-old motorcycle driver who was involved in a road traffic accident. On evaluation at our trauma center, he was found to have TAWH. Diagnostic criteria, imaging modalities and different management options for TAWH will be discussed.

Key words: Trauma – Blunt trauma – Abdominal wall hernia – Management – Review – Traumatic abdominal wall hernia

Traumatic abdominal wall hernia (TAWH) is an extremely 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 Shelby[1] reported the first case of TAWH, around 140 cases of TAWH (including both case reports and case series) have been reported in the English-language medical literature. The fact that among the authors, Netto *et al*[2] (34 cases), Hickey *et al*[3] (15 cases), and Gupta *et al*[4] (11 cases) have published case series, each with

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more than 10 cases, is an indication that this pathologic phenomenon is more common than has been described previously, and that TAWH cases are majorly underreported.

A PubMed search of the English-language medical literature using the most broad spectrum possible key word of "Traumatic Abdominal wall hernia" in April 2013 retrieved only 62 published articles. A significant number of the papers (54 papers) in this search were case reports: 38 in adults and 16 in children. Among the published reports, there were a total of 7 case series,[2–8] all of which included 3 or more patients (patient characteristics, mechanism of trauma, location of the hernia, and management options used for these patients are summarized in Table 1). Here we present the case of a young man who presented to our trauma center following a road traffic accident and was found to have an internal abdominal wall herniation. The management of such injuries (TAWH) has not been well documented before and will be discussed in this article.

Case Presentation

A 36-year-old African American male with no significant past medical history had a motorcycle collision (driver), lost consciousness on the scene, and was brought to our trauma center. Upon arrival he was hemodynamically stable, and his Glasgow Coma Scale was 13 (E4, V4, M5). Although he had multiple facial lacerations, his mid-face was stable. He had right chest wall subcutaneous emphysema and anteroposterior compression of iliac crests, and symphysis pubis was tender with some instability. He had tenderness in the right lower abdominal field with no evidence of peritonitis. Focused assessment with sonography for trauma (FAST) in the emergency department was negative for any fluid in the pericardium, abdomen, and pelvis. He had computed tomography (CT) scans of the head, neck, chest, abdomen, and pelvis. He was found to have sulcal hyperdensity in the left frontal lobe, right-sided 5th through 11th rib fractures, and right hemopneumothorax with pulmonary contusions.

The abdominal CT scan showed some suspicious areas of blood in the right lower quadrant and paracolic gutter, a comminuted displaced right iliac wing fracture, and grade II liver laceration (mostly involving segments 6 and 7, with some involvement of segments 5 and 8). The abdominal CT scan also revealed a large right lateral abdominal wall disruption involving the transversus abdominis, internal and external oblique muscles, and the fascia, with internal organ (colon and small bowel) herniation through the defect (Figs. 1 and 2). The lumbar triangles (Grynfeltt and Petit) were normal. The skin covering the area was intact. CT cystogram did not show bladder injury.

The neurosurgery team evaluated the patient and determined that there was no need for neurosurgical intervention. He underwent an exploratory laparotomy through a classic midline incision after having a right-side chest tube insertion. Two small jejunal mesenteric lacerations were repaired and the large abdominal wall defect in the right lower quadrant was primary closed in the 2 layers of muscle and peritoneum. The patient was kept intubated and transferred to the surgical intensive care unit. The patient remained in the surgical intensive care unit (SICU) intubated and sedated.

On the second day after trauma the patient underwent an open reduction and internal fixation of his right iliac wing fracture. Subsequently, the patient was extubated and had an uneventful recovery from that point onward. He was discharged home 9 days after trauma, when he was able to mobilize with a walker and was tolerating a regular diet. During his last visit in the clinic, 6 weeks after trauma, his wounds were all well healed with no infection, and he did not have any evidence of abdominal wall hernia.

Discussion

Because we are currently lacking a standardized management plan for TAWH, surgeons around the world are combining their knowledge on acute trauma management with elective nontraumatic hernia repair when dealing with a case of TAWH. The diagnosis of TAWH is a challenge, and cases of TAWH may go undiagnosed for a long period of time after trauma. As an extreme example, Holzheimer[9] reported a case of TAWH that was finally diagnosed 14 years after trauma. Different diagnostic criteria for TAWH have been proposed in the trauma literature. McWhorter,[10] Clain,[11] Malangoni and Condon,[12] and Damschen *et al*[13] proposed different diagnostic criteria for TAWH. The proposed diagnostic criteria were either complex or nonconclusive, and they were not adopted. Table 2 summarizes the definitions and historical diagnostic criteria proposed by different authors for diagnosis of TAWH.

The history of abdominal wall trauma and the absence of hernia prior to trauma are the only two

Table 1 Patient characteristics, mechanism of trauma, location of hernia, and management for the case series reported in the English-language medical literature[a]

Source, y (N)	Demographics	Mechanism of trauma	Hernia location	Management options
Netto *et al*,[2] 2006 (34)	Age, 39 ± 12 y; mean ISS, 31 ± 13; male (n = 19)	MVC (n = 24); MC (n = 6); falls (n = 4)	Anterior (n = 2); posterior (n = 32); complex (anterior + posterior (n = 3); right (n = 13); left (n = 17); bilateral (n = 4)	Urgent laparotomy/laparoscopy (n = 19); bowel resection (n = 15); TAWH repaired acutely (n = 8; NA mesh = 1, PR = 7); early (n = 6); delayed (n = 2); multiple operations (n = 3); NOM (n = 18)
Hickey *et al*,[3] 2002 (15)	Mean age, 33.5 y (range, 16–51 y); mean ISS, 29 (range, 9–50); male (n = 9)	MVC (n = 13; 11 of those were belted in); fall (n = 1); pedestrian hit by car (n = 1)	Left (n = 8); right (n = 6); bilateral (n = 1)	Not discussed in the paper
Gupta *et al*,[4] 2011 (11)	Mean age, 42.4 y (range, 12–70 y); male (n = 8)	Fall on blunt object (n = 4); MVC (n = 3); hit by cart (n = 3); hit by caw (n = 1)	Right LQ (n = 5); left LQ (n = 5); left UQ (n = 1)	Immediate laparotomy + PR (n = 8); delayed laparotomy + PR (n = 3) [fascia lata flap used for closure (n = 1)]
Singal *et al*,[5] 2011 (3)	Age (60, 45, and 45 y); male (n = 2)	Fall from bullock cart (n = 1); fall from height onto a blunt object (n = 1); gored by a cow (n = 1)	Right IF (n = 1); right LQ (n = 1); right flank (n = 1)	Laparotomy + repair of TAWH with NA mesh (n = 1); PR of TAWH (n = 2)
Hardcastle *et al*,[6] 2005 (4)	Age (34, 35, 36, and 38 y); male (n = 2)	MVC (n = 3); assaulted with large stone (n = 1)	Left IF (n = 1); left LQ (n = 2); right IF (n = 1)	Emergency laparotomy + PR (n = 2); delayed laparotomy + PR (n = 1); refused surgery (n = 1)
Gutteridge *et al*,[7] 2013 (5)	Age (20, 28, 30, 47, and 59 y); ISS (9, 9, 12, 14, and 29); male (n = 3)	MVC (n = 5)	Right IF (n = 1); left IF (n = 1); right UQ (n = 1); left UQ (n = 2)	Immediate repair (n = 1); delayed/staged repair (n = 3); NOM (n = 1). In 1 patient NA mesh was used
Lane *et al*,[8] 2003 (6)	Age (19, 22, 27, 34, 35, and 36 y); male (n = 3)	MVC (n = 5); struck by automobile (n = 1)	Right LQ (n = 3); left UQ (n = 1); left flank (n = 2)	Laparotomy + PR (n = 6)

IF, iliac fossa; ISS, injury severity score; LQ, lower quadrant; MC, motorcycle collision; MVC, motor vehicle collision; NA, nonabsorbable; NOM, nonoperative management; PR, primary repair; UQ, upper quadrant.

[a]All of the case series included 3 or more patients with traumatic abdominal wall hernia.

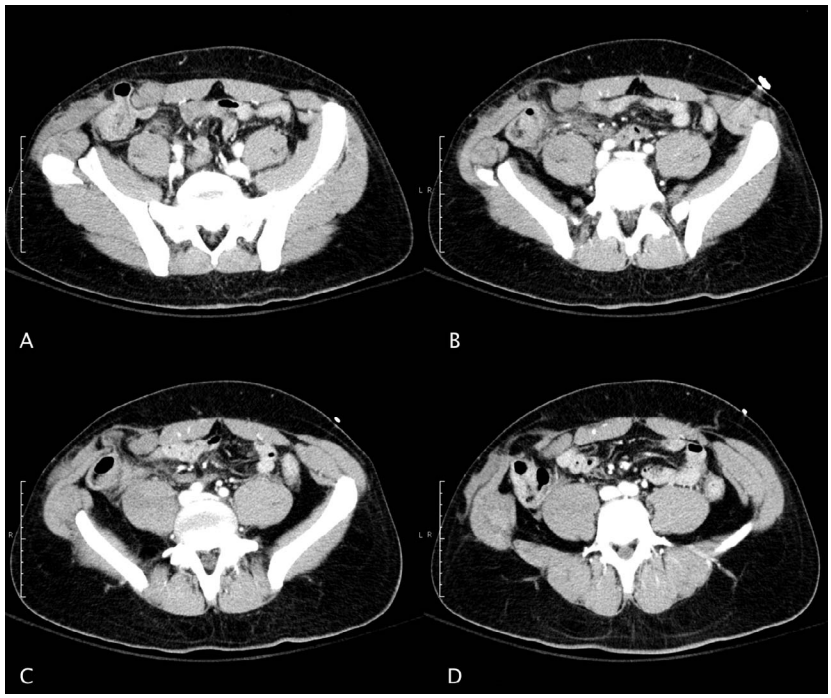

Fig. 1 Multiple axial contrast-enhanced CT images oriented cephalad (A) to caudad (D) showing traumatic anterolateral abdominal wall hernia in the right lower quadrant. The hernia sac penetrates through a defect in the internal oblique muscle and is contained by the lower portion of the external oblique aponeurosis. It contains a loop of distal ileum (A), fat (B and D), and mesentery (C).

factors that all of the above-mentioned diagnostic criteria and the reported cases in literature have in common; however, documentation of the absence of abdominal wall hernia prior to trauma is not always possible.[14] Early appearance after trauma, persistence of severe pain in the injured area, presentation within the first 24 hours, and absence of peritoneal sac are examples of the proposed criteria that are not always shared in the cases.[14]

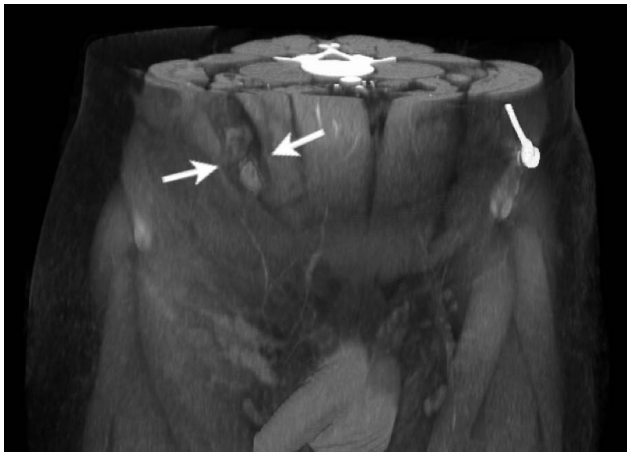

Fig. 2 Volume-rendered CT image with the skin and subcutaneous fat removed shows herniation through a large, vertically oriented defect in the internal oblique muscle caused by blunt abdominal trauma.

TAWH has been reported in pediatric patients as well. A common mechanism of trauma in this group of patients is bicycle handlebar injury, so much so that some authors have chosen to call this type of TAWH a "Handlebar hernia."[15] A unique feature of TAWH in the pediatric patient is the fact that in the absence of internal organ injuries, and depending on the size of the hernia, it can successfully be managed conservatively (nonoperative management).[16,17]

Because of the presence of natural orifices in the lower abdomen (inguinal canal), the general weakness of the abdominal wall around this area, and increased intra-abdominal pressure during injuries, TAWH has been mostly reported in the lower abdomen rather than the upper abdomen.[14] The superior and inferior lumbar triangles are also prone to herniation. Abdominal CT scan is widely used in the initial assessment of trauma patients, and most of the cases with TAWH are diagnosed using this modality. FAST has become an essential part of the initial evaluation for trauma patients. Although FAST is only designed to evaluate trauma patients for the presence of free fluid (blood) in the pelvis, pericardium, and abdomen (perihepatic and perisplenic spaces), it is possible that during the FAST examination a TAWH may become apparent.

In the presence of injuries that warrant immediate exploratory laparotomy, intraoperative evaluation of the abdominal wall would be the most

Table 2 The definitions and historical diagnostic criteria proposed by different authors for diagnosis of TAWH in the English-language medical literature

Source, y	Proposed diagnostic criteria	Critical viewpoints
McWhorter,[10] 1939	Absence of hernia before trauma	Apart from history taking, it is difficult to prove
	History of adequate trauma that could have caused the hernia	—
	Early appearance of hernia after trauma	Delayed presentation of TAWH has been reported[9]
	Presence of severe enough symptoms and persistence of pain at the hernia site causing patient to present within the first 24 h after trauma	Delayed presentation of TAWH has been reported, and some cases may have a subtle subclinical initial presentation[9]
	Presence and degree of prostration	—
Clain,[11] 1964	Hernia follows localized blunt trauma	—
	Immediate appearance	—
	Absence of skin penetration	Some authors argue that it is not necessary[14]
	Persisting signs of trauma when presenting	Delayed presentation of TAWH has been reported[9]
Malangoni and Condon,[12] 1983	Bowel herniation through disruption of musculature and fascia	—
	Absence of skin penetration	Skin integrity may not stay intact depending on mechanism
	No evidence of previous hernia defect	—
	Absence of peritoneal sac	Some authors have reported presence of peritoneal sac[14]
Damschen *et al*[13] 1994	Bowel herniation through disruption of musculature and fascia	—
	Absence of skin penetration	Skin integrity may not stay intact, depending on mechanism
	No evidence of previous hernia defect	Apart from history taking, it is difficult to prove
Liasis *et al*[14] 2013; Moreno-Egea *et al*[27] 2007	History of injury to the abdominal wall	—
	Absence of hernia in the injured area before trauma	Apart from history taking, it is difficult to prove

accurate way to evaluate for a possible TAWH. In cases of delayed presentation, multi–detector row CT and magnetic resonance imaging of the abdominal wall have a high accuracy for the evaluation of the abdominal wall.[18,19]

Timing of the surgical repair of TAWH is very much dependent on the presence of associated injuries. Stabilization of the patient is the priority in the trauma setting and is an indication for a delay in TAWH repair. In the setting where the trauma patient is stable and the size of the abdominal wall defect based on the CT evaluation seems to be small, with the visceral organs protruding through the abdominal wall (*i.e.*, the current case), exploratory laparotomy and exploration of the TAWH should be done as soon as possible to prevent any possible visceral incarceration.

In cases where concurrent abdominal visceral injuries coexist with TAWH, the decision for a simultaneous hernia repair depends on the size of the orifice and the risk of incarceration; the presence of abdominal contamination and hollow viscus injuries; the ability to perform a tension-free primary repair; the requirement for use of the mesh; and the availability of the biologic meshes.[14] Repair of TAWH in the setting of the initial exploratory laparotomy spares the patient from having a second surgery, but because of the trauma and the surgical stress, it may increase the risk of surgical infection and hernia recurrence.[12,14] Although usage of mesh and creation of tension-free repair are recommended for all delayed TAWH repairs, use of mesh in the emergency setting of initial exploratory laparotomy is a double-edged sword and is controversial.

In the emergency setting, the increased risk of infection by using mesh should be weighed against the benefits of reduced recurrence rate in such cases. In the current case we elected to repair the defect primarily without using mesh. The size of the defect was not large and it was feasible to do a primary repair without tension on the suture line and significant increase in abdominal wall tension. In cases with a large abdominal wall defect, the risk of

bowel incarceration is minimal. In such cases primary TAWH repair without the use of mesh is impossible (because of large defect size) and the repair procedure can be postponed for an elective delayed setting. In this condition, biologic mesh could be an acceptable option. Although the presence of a hollow viscus injury and contaminated surgical field was once considered an absolute contraindication for using mesh, there are more recent publications advocating the use of biologic mesh as a good alternative in such cases.[20,21] Despite the safety of biologic mesh in these situations, the long-term durability seems to be less favorable.[21]

Although midline incision for an exploratory laparotomy in the immediate posttrauma setting is the universal approach because it warrants good exposure for assessment and possible repair of the intra-abdominal injuries, in the delayed repair of the TAWH and in the absence of concurrent intra-abdominal injuries, local incision and exploration can also be performed. Successful laparoscopic repair of the TAWH has been reported both in adult (3 cases)[22–24] and pediatric (2 cases)[25,26] trauma patients in the literature. The patient's instability seems to be a relative contraindication for laparoscopic approach.[14] In the absence of instability, the laparoscopic approach is a matter of surgeon's preference and requires diagnostic and interventional laparoscopic skills.

Conclusion

Traumatic abdominal wall hernia is uncommon and seems to be underrepresented in the English-language medical literature. Diagnosis of TAWH is challenging and requires a high level of suspicion. There are reported cases where the diagnosis of TAWH has been delayed for several years. There is currently no consensus on the optimal management of TAWH. Optimal management of TAWH should be individualized based on time of presentation, injury severity score, patient's condition and hemodynamic stability, associated abdominal visceral injuries, size of the abdominal wall defect and the risk of incarceration, and presence of abdominal contamination and concurrent hollow viscus injuries.

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