Delayed Presentation of the Traumatic Abdominal Wall Hernia; Dilemma in the Management – Review of Literature

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Abstract Traumatic abdominal wall hernia is a rare entity, and an uncommon type of abdominal wall hernia as far as the etiology is concerned. It is caused by blunt trauma and disrupts the fascial layers, but does not disrupt the elastic skin. In this study, we report the case of a 60-year-old female, diagnosed with traumatic abdominal wall hernia with delayed presentation. In this case, herniation of the bowels was present through the defect in the left iliac region. She was surgically well-managed. During the

follow-up of 1 year, there was no recurrence. In the Western medical literature, only a few cases have been reported, especially with intra-abdominal injuries. Confusion still exists in the management of such a disease as to whether to treat the condition at an early or later stage.

Keywords Abdominal wall · Blunt trauma · Herniation · Multidetector computed tomography · Management

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Introduction

Traumatic abdominal wall hernia (TAWH) is a rare clinical condition, and is rarely reported in the world literature because of its uncommon entity. A high index of suspicion must be sustained to identify patients with this injury, as delay in treatment may result in significant morbidity and mortality. Blunt traumatic abdominal hernia is defined as a herniation through disrupted musculature and fascia, without skin penetration, with no evidence of a prior hernial defect at the site of injury [1]. These types of hernias are unusual and have been described in some reviews [2–4]. Dimyan et al. [5] was the first to describe handlebar hernia, an example of anterior traumatic abdominal hernia, which resulted from a motorcycle handlebar injury. Only <50 cases of handlebar hernia have been reported in the worldwide literature and only 3–5 cases are from India [6, 7]. The increased abdominal pressure and shearing forces are likely to cause disruption of the abdominal wall muscles and fasciae leads to TAWH. These are generally categorized into three major types: (i) a small abdominal wall defect caused by low-energy trauma with small instruments; for example, bicycle handlebars, (ii) a larger abdominal wall defect caused by high-energy injuries, and (iii) rare intra-abdominal herniation of the bowel caused by deceleration injuries. The rise in the number of abdominal injuries because of blunt trauma is mainly caused by the progressive increase of traffic accidents.

It is essential to avoid complications by performing an early surgical repair for definitive treatment. Ultrasonography (USG) and contrast-enhanced computed tomography (CECT) help in the investigations to diagnose abdominal injuries. We describe the history and imaging of a patient with a TAWH and the operative treatment adopted.

Case Report

A 60-year-old female presented with a swelling in the left iliac region in the preceding 5 months. The patient had sustained a blunt trauma, by a wooden piece, in the abdomen without any penetrating injury. There was history of pain at the injury site, and off-and-on vomiting for 1 week. She did not complain of any other symptoms since trauma, except for the visible swelling. Swelling reduced when she was in a supine position.

Vital parameters were stable. She was moderately built and nourished. The abdomen was soft in nature, non-tender, and non-distended. A bulge was present over the left iliac region. Skin was normal in texture. On palpation, tenderness was present at the swelling region, which was firm in consistency and 7 × 10-cm in size at the left iliac region, which reduced when the patient lay down (Figs. 1 and 2).

Fig. 1 A swelling seen in the left iliac region

Cough impulse was present. Bowel sounds were present. Results of routine blood investigations were within normal limits. USG of the abdomen revealed a defect in the anterior abdominal wall above the left iliac crest with herniation of bowel loops along with avulsed muscle seen. There was minimal fluid in the pelvis.

Exploratory laparotomy was performed through an incision over the swelling in the line of crease. Operative findings revealed a defect in the aponeurotic part of the external oblique sheath and the contents were sigmoid colon, omentum, along with adhesions (Figs. 3 and 4). Adhesions were separated and the contents were reduced. The defect was repaired primarily with prolene and an on-lay prolene mesh was placed without any drain as the defect

Fig. 2 Swelling reduced on lying down

Figs. 3 and 4 Operative picture showing contents (omentum and sigmoid colon)

was totally clean. The patient was discharged in a satisfactory condition. On a follow-up after 1 year, the patient was doing well and asymptomatic.

Discussion

TAWHs follow blunt trauma of various types and magnitude are extremely uncommon as far as the etiology is concerned, and the reported incidence being 1 case in 10,000 hernia cases and 2 in 3,522 accident cases [8]. The elastic nature of the abdominal wall and the associated serious intra-abdominal injuries, which divert attention from the hernia, have been proposed as factors contributing to its rarity [9, 10]. Also, an element of underreporting cannot be denied. There have been few reports in the literature of trans-rectus herniation. Most herniations are

diagnosed on presentation by physical examination or by an abdominal CECT, and most authors have advocated immediate laparotomy with repair of the defect because of the high incidence of associated intra-abdominal injury [11]. TAWH was first described by Selby [12] in 1906 with a number of classification schemes, criteria of diagnosis, and methods of evaluation. The criteria for TAWH which include immediate appearance of the hernia through the disrupted muscle and fascia after blunt abdominal trauma, and failure of the injury to penetrate the skin, were defined by Clain [13] and Damschen et al. [1]. It can occur as a result of blunt trauma abdomen which can be classified into low- or high-energy injuries. Low-energy injuries occur after the impact of a small blunt object. High-energy injuries are sustained during motor vehicle accidents or automobile versus pedestrian accidents [14].

The etiology of hernia is usually attributed to congenital, mechanical, and degenerative factors. Blunt traumatic hernias are sufficiently uncommon to preclude identification of specific anatomic patterns, except for the classically recognized pattern of acute diaphragmatic hernia [15–17]. The most common site of occurrence is the left lower quadrant (32%), although no quadrant has been spared. The site of impact may not necessarily coincide with the site of herniation [18]. A high index of suspicion is required in patients who present with an abdominal swelling and report a history of any of the above mode of injuries. A tender subcutaneous swelling in the abdominal wall is the most common clinical finding with bruising and ecchymosis of the skin. In this study, the patient ignored the disease, either because of asymptomatic reasons or because she was staying in a rural area where most of the patients were not receiving proper treatment, leading to a delay in presentation. On physical examination, a reducible hernia or swelling with underlying defects was detected.

The pathophysiology of TAWH involves the application of a blunt force to the abdomen over an area large enough to prevent penetration of the skin; by which the tangential forces result in a pressure-induced disruption of the abdominal wall muscles and fascia, allowing subcutaneous herniation of abdominal viscera through the defect. Ganchi and Orgill [19] classified TAWHs into focal and diffuse types, according to the mechanism of injury. Focal TAWHs usually result in small hernias and are rarely associated with intra-abdominal injury. The diffuse type, however, results from pressure and shearing injuries and has a high association with significant intra-abdominal injuries (up to two-thirds) [14, 19]. The overall incidence of associated intra-abdominal injuries in TAWH has been reported to be as high as 30% [19]. As the skin is more elastic than the other layers of the abdominal wall, it remains intact even though the underlying musculature and fascia are disrupted, which gives rise to TAWH [14, 20].

In particular, the forces directed tangentially to the abdominal wall can easily produce shearing stresses to the underlying muscles, fascia, and peritoneum. Associated intra-abdominal injuries are infrequent. Damschen et al. [1] found that 17 of 28 patients had no associated injury during their review. The other 11 patients had associated injuries, including five in the small intestine (45.5%), three in the colon (27.3%), two in the liver (18.2%), and one in the kidney (9.1%) [17]. Stomach rupture, mesocolon, mesenteric hematoma, and cecal deserosation have been reported by other authors [20]. The apparent explanation for the infrequency of associated injury is the commonly observed resistance of hollow viscera to blunt injury and the fact that the trauma delivered in most reported cases is in areas away from parenchymatous abdominal organs as reported by Yarbrough [21].

There is no conclusive classification system for TAWH. Nevertheless, categorization is generally based on either the defect size and location of the defect or the intensity and mechanism of injury force. TAWH is divided into three types according to the mechanism and size of injury as classified by Wood et al. [22–24]. Type I TAWHs are small defects caused by blunt trauma from a high-energy injury such as a motor vehicle accident or a fall from a height [24]. The fascial defect in such cases is generally large. Coexisting intra-abdominal visceral injury is common and depends on the location of the herniation. Larger defects occurring during motor vehicle crashes are classified as Type II. In this type of hernia, associated intra-abdominal injuries are relatively infrequent [18]. In Type III, there are abdominal wall defects with bowel loop herniation following deceleration injuries, which are extremely rare [19, 20].

TAWH can occasionally elude an inexperienced clinician, as the classical signs of hernia (i.e., cough impulse, and reducibility) are present in only 50% of the patients; thus, it can be confused with a hematoma, as was evidenced in 12% of cases. Spontaneous rectus abdominal hematomas have also been reported to mimic a TAWH [25–27]. That a hematoma in the rectus muscle is limited to the confines of the sheath and does not cross the midline may not hold true in cases seen after external trauma. A detailed inquiry regarding the mechanism of injury, close observation of the patient with repeated examinations, and lessons from a previous experience can prove beneficial in arriving at the correct diagnosis.

USG and CECT scan of the abdomen are the investigations of choice [1, 21, 28]. Delay in diagnosis, till features of strangulation or obstruction manifest, is avoidable, and one should not hesitate to avail of the modern imaging techniques whenever one is in doubt. The role of conventional radiography, that is, lateral tomograms barium and USG, is debatable with the availability of an emergency CT scan, as they are unreliable [16, 29–32]. USG, though

readily available, may fail to distinguish hematoma from an underlying bowel loop, as both may appear hyperechoic, as was seen in this case. The only added advantage of a USG is its ready availability at bedside [7]. A CT scan helps in differentiating traumatic hernia from an abdominal wall hematoma accurately, in all cases with no false negative reports in the reviewed series, which corroborates the report of Hickey et al. [33].

TAWHs are mostly unrecognized in patients with multiple injuries because of abdominal wall tenderness and ecchymosis. For other reasons, the diagnosis has been made with laparotomy in TAWH and the overall incidence of additional intra-abdominal injuries in such cases is approximately 30% [28]. With the invention of CT scan, the detection of abdominal injuries has become easy and has reduced the complication rates. Because bowel incarceration and strangulation can occur in up to 25% of patients, it is crucial that intra-abdominal injuries are recognized [28].

Tonsi et al. [34] treated a case of TAWH surgically, with the help of CECT, which revealed intestinal loops protruding through the abdominal wall defect with free air in the peritoneum suggesting hollow viscus perforation. Matsuo et al. [35] have also reported successful conservative management of abdominal hernia caused by handlebar injury, using a cloth corset with the help of a CT scan which did not reveal any intra-abdominal injury. But conservative treatment again depends on an individual clinical findings, and the studies have concluded that traumatic hernias diagnosed by a CT scan, and without any abdominal injuries requiring immediate laparotomy, may be addressed expectantly and repair can be delayed until the patient stabilizes clinically. Another reason for delayed repairing is that, the muscular edge can be found comfortably as the hernia sack develops properly [36]. The CT signs suggestive of blunt bowel or mesenteric injury are extravasated oral contrast material, although this is rarely observed, pneumoperitoneum, bowel wall thickening, mesenteric hematoma, mesenteric fat streaking, free intraperitoneal fluid, and wall enhancement with intravenous contrast [37].

But sometimes, associated hollow visceral injuries and vascularisation of the herniated bowel loops can be overlooked on a CT scan. Nowadays, multidetector computed tomography (MDCT) is the new imaging technique employed in blunt trauma patients of abdomen and pelvis. It easily detects the solid organ injuries with associated bowel or mesenteric injuries and decreases the morbidity and mortality. But challenges still continue in abdominal and pelvic CT images of trauma cases. Moreover, with the help of the advance technology such as MDCT, new CT features of bowel or mesenteric injuries have been identified [38]. One of the latest features of the mesenteric

tear on MDCT is beading and termination of mesenteric vessels indicating requirement of surgery. MDCT also detects small or trace amounts of isolated intraperitoneal fluid in trauma cases, although the technique of management is still controversial. This pictorial essay illustrates the spectrum of typical, atypical, and newly reported MDCT features of bowel and mesenteric injuries due to blunt trauma. The features that help to differentiate these injuries from pitfalls are emphasized in these proven cases [38].

The presence of extraluminal air or fluid on MDCT is significantly correlated with blunt hollow viscus injury. Extraluminal air had the highest specificity (98.1%), but low sensitivity (62.5%), extraluminal fluid had the highest sensitivity (95.8%), but low specificity (36.2%). By comparison, unexplained fluid in the absence of solid organ injury had a higher specificity than the unspecified extraluminal fluid had (73.3% vs. 36.2%) [39].

Once the diagnosis of TAWH is made, some authors advocate early repair both to assess the associated intra-abdominal injuries and to shorten the period of hospitalization and disability. Early repair is considered technically easier. Prompt surgery is required to avoid the complications such as incarceration or strangulation and subsequent morbidity. The incision should be made directly over the traumatic swelling for proper enforcement of the herniated contents and the defect [20, 22]. The repair of small defects with clear borders is straightforward. In contrast, more prominent disruptions require a variety of factors to be considered, such as the patient's overall condition, associated intra-abdominal injuries, the defect's size and site, and available surgical expertise [28, 40–42]. Primary approximation of the traumatic defect can be done by non-absorbable sutures, with or without mesh, as most case reports indicate [1, 19]. Mesh repair is contraindicated in the contaminated wall defects, because of the high risk of mesh infection. TAWHs are uncommon, and it the solution to it remains controversial, that is, whether such patients require immediate laparotomy or not.

Although a primary repair usually suffices, it is prudent to base the judgment on the degree of local trauma, and liberal use of mesh is justified in those patients in whom the defect is large and the muscles are torn perpendicular to its fibres. Small defects along the muscle fibres can be closed primarily without using a mesh. Though reports exist on the use of mesh in such cases [9, 17, 43, 44], 84% of authors had completed the closure procedure successfully without using a mesh. We use the mesh for repairing the defect in the muscle when it is along its fibres.

Netto et al. [45] carried out a retrospective review of 34 patients with TAWH, and made three recommendations. They are (i) the mechanism of injury should be a deciding factor, whether a patient with TAWH requires an immediate laparotomy or not; (ii) if clinically apparent anterior

abdominal hernias appear to have a high rate of associated injuries and need urgent laparotomy; and (iii) occult TAWH is diagnosed only by a CT scan and may help in delaying immediate laparotomy or hernia repair [45]. CECT is the modality of choice in evaluation of blunt abdominal trauma cases especially in hemodynamically stable cases [28, 35, 46, 47]. It can accurately show the anatomy of the disrupted musculature layers and is also useful for identification of the associated injuries.

A high index of clinical suspicion is essential, as an accompanying hematoma often confounds the diagnosis [48]. During investigation, care should be taken to look for any abdominal wall defects, since there are reports of missed hernia during the first instance of examination [49]. Bleeding from torn muscle fibres can be troublesome, leading to large postoperative hematomas; hence, meticulous hemostasis is paramount. Attempts of laparoscopic repair of traumatic abdominal wall hernia have also been published recently [38, 49]. Information regarding follow-up was not available in 69% of the reports. Of the rest, three cases of recurrence have been reported, all of which had undergone primary closure of the defect. The chance of spontaneous closure of such a defect is not known, although a complete healing of the defect has been reported [26]. Most authors advocate an early operation in such cases. Of the 90% of surgeons who operated on these patients, 66% did so immediately and the rest 24% after a period of conservative management. Only 10% were successful in managing it conservatively. Reasons for conservative management or a delayed operation, other than the surgeon's preference, include delay in diagnosis, medical unfitness, or other potentially serious injuries, which precluded an early investigation, onset of complications, and the patient's reluctance for operation [6, 50–57]. Singal et al. [15] reported three cases, diagnosed as TAWH in which herniation of the bowel loops were present along with associated injury in two cases. Of the three cases, one case had ileal perforation which was overlooked on CECT and discovered on laparotomy. All the cases were operated upon immediately and success was achieved without any recurrence in follow-up.

To achieve both the aims of intra-abdominal injury evaluation and adequate exposure for hernia repair, laparoscopy can be adopted, as illustrated in the second case report. The use of laparoscopy in the trauma setting has previously been evaluated as a safe method for assessing patients with both blunt and penetrating abdominal trauma, thus reducing the number of negative or non-therapeutic diagnosis [17]. Diagnostic laparoscopy seems to be an excellent adjunct in the management of TAWHs. In the event of a negative diagnostic laparoscopy, one can repair the hernia by the local approach and avoid unnecessary general abdominal exploration [32, 56].

There are also controversies regarding the timing of exploration: immediate versus delayed exploration. Delayed exploration, as well as delays in diagnosis, can lead to some problems such as a bowel strangulation and excessive tension in the primary closure of the defect [4, 9, 25, 29]. Some authors have suggested that reconstruction of the abdominal wall defect can be delayed and repaired on an elective basis, especially in the focal type TAWH [20]. Immediate exploration and repair, however, has generally been accepted as a more favorable choice in the treatment of TAWH [14, 15, 19, 24]. Moreover, early repair, through midline exploration, has been advocated even in the absence of intra-abdominal injuries [24]. In our case, early resuscitation took a few hours and the general condition of the patient became stable enough for surgical exploration. In our experience, we would suggest that early exploration could give a better chance of successful primary closure without any tension, even in cases where the hernia defects are very large/associated/or missed injuries.

There are some reports in which mesh repairs have yielded good results [41]. Although no prosthetic materials are required for small defects, it may be safer to apply mesh in large hernias, even in cases where primary closure may be done without it. However, primary mesh repair should be considered only in cases with no hollow viscous injuries, relatively large defects, and the presence of tension for direct closure [17]. Interestingly, primary closure of the fascial defects might be a possible option even though TAWH has been associated with concomitant bowel gangrenes or strangulations [4, 14, 25]. We performed the primary repair safely using mesh and with no tension despite the fact that the defect size was large. Primary repair without mesh seems to be adaptable in large-sized TAWHs if there is no excessive tension and if precise layer-by-layer approximation is technically possible. It is clear that prosthetic mesh augments the strength and reduces the possibility of recurrence after ventral hernia repair [57]. The need for prosthetic mesh, therefore, must be evaluated on a case-by-case basis and by the surgeon's preference.

Debate regarding the local wound exploration versus midline exploratory laparotomy to rule out the intra-abdominal injuries still exists. Repair of the traumatic hernia should be performed by careful primary approximation of the defect edges, using strong, non-absorbable sutures, as most case reports indicate [5, 17, 19, 28]. Prosthetic mesh can be applied to large defects arising from denuded or unhealthy tissues or in other instances, where repair has been delayed and the fascial edges have retracted. However, mesh repair is contraindicated in the presence of hollow viscus injury and a contaminated abdomen because of the high risk of mesh infection. The mesh can also be used to reinforce a sutured repair when applied as an on-lay graft, lying over the external oblique aponeurosis. However,

the recurrence rate for such repairs, whether sutured or repaired by mesh, is not known.

The repair of small defects with clear borders is straightforward. In contrast, more prominent disruptions require a variety of factors to be considered, such as the patient's overall condition, associated intra-abdominal injuries, the defect's size and site, and available surgical expertise. Associated intra-abdominal injury, as in this study, would necessitate exploratory laparotomy or extensive local incision. If all the indicators of intra-abdominal injury are negative, local wound exploration provides the best anatomic layered repair with subsequent minimal residual defect and improved long-term cosmesis [16]. After dealing with all associated intra-abdominal injuries, definitive treatment of these hernias mandates surgical exploration and prompt repair to prevent incarceration or strangulation. This repair can be performed with primary closure if the tissue allows, or with prosthetic material if the defect is too large. The use of prosthetics produce tension-free repair and provide superior long-term results in such cases [17]. If all the indicators of intra-abdominal injury are negative, local wound exploration provides the best anatomic layered repair with subsequent minimal residual defect and improved long-term cosmesis [16].

The choice of prosthesis for abdominal wall repair affects the risk for fistula formation. Intestinal adhesion and erosion result from close opposition of adjacent intestines with the prosthetic graft, with ePTFE being the single exception. Despite its microporous structure, believed to be the main factor for improved tissue compatibility, the material does not eliminate adhesions completely; nevertheless it is currently the material of choice when a tissue-impervious barrier over the intestines is needed [7]. A dual-sided material (Dual Mesh, W.L. Gore and Associates, Flagstaff, AZ, USA) provides improved tissue incorporation on the side placed toward the defect, while preserving the low risk of visceral erosion. Composites containing ePTFE on the ventral side of the prosthesis include polypropylene film and sub-micronic pore size ePTFE (Preclude® pericardial membrane and Preclude® dura substitute, WL Gore Co), and polypropylene mesh lined with ePTFE (Composix, Davol Co, Cranston, RI, USA) [40].

Conclusions

Surgeons should have a good knowledge of TAWH and of concomitant complications, although the disease entity is very rare. The incidence of TAWH should be suspected in a patient with tender, localized swelling of the abdominal wall following blunt trauma. USG and MDCT are investigations which help to diagnose the hernia and also the

associated intra-abdominal injuries in blunt abdominal trauma cases, but we recommend clinical correlation to be necessary with a close monitoring of the vital parameters, since, at times, some findings can be overlooked in unstable patients. Mesh repair is desirable in the elderly with weak anterior abdominal wall so as to prevent the long-term complications of recurrences.

“Bear the helmet to save the head; Bear the belt to save the abdomen, slow the bicycle race to save the life” by Rikki Singal.

Conflict of Interest None.

Competing Interest None to declare.

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