Traumatic Intrapericardial Diaphragmatic Hernia

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Abstract

This article describes the case of a 33-year-old male who sustained blunt trauma to his torso in a high-speed motor vehicle accident. He presented to the emergency room with abdominal pain, chest pain, dyspnea, distended neck veins, and shock. There was no history of pretraumatic chest symptoms or congenital abnormalities. Computed tomography (CT) of the chest showed bowel loops extending into the pericardium through a large rent in the diaphragm. A diagnosis of traumatic intrapericardial diaphragmatic hernia (TIPDH) was made. Hence, the patient was transferred to the theater where surgical mesh repair was done through an open laparotomy. TIPDHs are rare, forming about 0.9% of traumatic diaphragmatic hernias with only 96 cases reported in worldwide literature as at 2014. However, they are potentially life-threatening and require a high index of suspicion to diagnose. They often result from blunt abdominal trauma. Symptoms include chest pain, abdominal pain, and dyspnea, with or without features of cardiac tamponade or bowel obstruction. CT scan is the best diagnostic tool. Primary repair through open laparotomy is recommended in acute cases, with mesh reinforcement for large diaphragmatic tears to ensure the repair is tension-free.

Keywords: Diaphragmatic, hernia, intrapericardial, traumatic

INTRODUCTION

Most traumatic diaphragmatic hernias (TDH) tend to occur through the left hemidiaphragm due to, among other reasons, the relative protection of the right side by the liver.^[1] This article reports a case of a traumatic intrapericardial diaphragmatic hernia (TIPDH), a rare case of TDH due to blunt abdominal trauma with the hernia occurring through the central tendon into the pericardial sac.

CASE REPORT

A 33-year-old male involved in a high-speed motor vehicle accident presented with pain in his chest, abdomen, lower back, and lower limbs as well as insidiously progressing dyspnea. There was no loss of consciousness, vomiting, or significant medical history. His SpO₂ was 98%. His initial pulse rate was 138/min and blood pressure 86/56 mmHg, which both normalized after fluid resuscitation with 1.5 L of Ringer's lactate.

His chest was nontender. His lung fields were clear with good air entry bilaterally and resonant percussion notes. His heart sounds were audible. His trachea was central, and his neck veins were distended. His abdomen was flat, with moderate epigastric tenderness. There were no signs of peritonitis and no

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penetrating injury to his torso. Both thighs were deformed due to the underlying bilateral femoral fractures. The associated thigh swellings were diffuse, nonexpansile, and nonpulsatile. The popliteal pulses were normal.

His hemoglobin was 11.5 g/dL; electrocardiogram showed sinus tachycardia with no features of ischemia. Focused assessment sonography in trauma did not show any intra-abdominal or pericardial hemorrhage. Chest X-ray [Figure 1] revealed a globe-shaped hypodense shadow extending from the upper central abdomen into the chest and confined within the borders of the distal cardiac shadow. The bony rib cage was normal. Contrast computed tomography (CT) of the chest [Figures 2-4] showed bowel loops within the pericardium. X-ray of the thighs [Figure 5a and b] showed bilateral distal femoral fractures.

Consequently, the diagnosis of TIPDH was made. Hence, after initial resuscitation, the patient was transferred to the theater for an open exploratory laparotomy and diaphragmatic herniorrhaphy.

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Figure 1: Chest X-ray, anterio-posterior view



Figure 3: (a and b) Contrast computed tomography of the chest, sagittal view

The intraoperative findings were as follows: a thin central tendon of the diaphragm which had a large tear; minimal oozing of blood from the jagged edges of the tear; a loop of transverse colon and the fundus of the stomach had passed through the ruptured diaphragm into the pericardium. The left hemidiaphragm was intact. There was no hernia sac, surrounding adhesions, or intraperitoneal hemorrhage. The liver and spleen were uninjured. No other injuries were identified.

The herniated gut was manually reduced into the peritoneal cavity, and the diaphragm was repaired with an inert mesh. After recovery from the acute phase, internal fixation was done for the femoral fractures. He was subsequently discharged in good condition.

Brief discussion

TDH was first described by Sennertus in 1541 (Rekha).^[1] It is an uncommon entity seen in about 4%–6% of patients who undergo surgery for trauma.^[2] In TDH, intra-abdominal viscous pass into the thoracic cavity through a tear in the diaphragm,



Figure 2: Axial view of contrast computed tomography of the chest



Figure 4: (a and b) Contrast computed tomography of the chest, coronal view

usually the left hemidiaphragm (due to the increased strength of the right hemidiaphragm, hepatic protection of the right side, underdiagnosis of right-sided ruptures, and weakness of the left hemidiaphragm at points of embryonic fusion^[1]). However, it may also occur in the right diaphragm or the central tendon. A TIPDH occurs when there is a tear through the central tendon (to which the pericardium is attached), and abdominal viscous pass directly from the abdominal cavity, through the torn central tendon and into the pericardial sac.

TIPDHs are quite rare. As at April 2014, only 96 cases had been published in worldwide literature.^[3] In some studies, only 0.9% of TDH were intrapericardial.^[1] Table 1 shows the details of published TIPDHs over a period of 13 years.

TIPDHs occur directly into the pericardium^[4] through the central tendon. The mechanism in blunt abdominal trauma involves a sudden rise in intra-abdominal pressure, leading to rupture along the right or left side of the diaphragm, extending into the pericardium.^[5] There is often an associated preexisting weakness or congenital defect of the central tendon, which acts as a predisposing factor. It often involves the transverse

colon, the stomach, and the greater omentum.^[5] The presenting symptoms range from asymptomatic^[6,7] to gastrointestinal symptoms, including the features of intestinal obstruction and cardiac tamponade.^[5] Whenever a tamponade occurs, it is usually fatal.^[5]

In general, TDHs (of which TIPDH is a variety) are one of the common causes of missed abdominal injuries and are



Figure 5: (a) X-ray femur (R). (b) X-ray femur (L)

often diagnosed late or discovered accidentally (for instance during a postmortem). However, a focus on the mechanism of injury and a high index of suspicion (in conjunction with CT scan and magnetic resonance imaging [MRI]) are useful diagnostic aids.

Treatment

The recommended definitive treatment of TIPDH after initial resuscitation is surgical repair.^[3] This may be done through a transabdominal or transthoracic approach.

The transabdominal approach is the preferred route^[5] for acute traumatic cases. It gives better access to the diaphragmatic tear. This, in turn, may be done laparoscopically^[8] (which is the preferred method^[3]) or by a routine open laparotomy, depending on the clinical condition of the patient and the availability of resources. The first successful transabdominal laparoscopic repair was published in 2014.^[3]

On the other hand, the transthoracic route is more often used for long-standing intrapericardial diaphragmatic hernias (IPDHs) such as congenital IDPHs and missed TIPDHs, where extensive adhesions usually occur.^[6]

Intraoperative surgical repair options include primary closure for small defects in the diaphragm and mesh repair for larger defects using inert mesh such as polytetrafluoroethylene.

Table 1: Intrapericardial diaphragmatic hernia case reports, 1999-2012 ⁽³⁾								
Author	Mechanism	Time to diagnosis	Presenting symptoms	Imaging	Defect size	Associated injuries	Treatment	
Sharma, 1999	Head-on collision, airbag	Day 0	Chest pain	Chest CT, CXR	$6 \text{ cm} \times 2 \text{ cm}$	None	Laparotomy, primary repair	
Sharma, 1999	Head-on collision	Day 0	Acute abdomen	CXR	Not described	None	Laparotomy (repair not described)	
Sharma, 1999	Head-on collision	Day 0	Acute abdomen	CXR	Not described	None	Laparotomy (repair not described)	
Sharma, 1999	Car crash, unrestrained	Day 0	Hypotension	None	2 cm	Spleen, liver, left the diaphragm	Laparotomy, primary repair	
Wenzel and Hamilton, 2001	Exact mechanism unknown	38 years	Dyspnea	CXR, chest CT	Not described	Rib fractures	Hospice for metastatic malignancy	
Wright et al., 2005	Pedestrian struck by car	7 years	Dyspnea, chest pain	CXR, chest CT	16 cm × 10 cm	TBI, orthopedic injuries	Laparotomy, primary closure + ePTFE patch for reinforcement	
Barrett and Satz, 2006	Pedestrian struck by car	Day 2	Dyspnea, abdominal, chest and back pain, pericarditis	CXR, chest CT	Not described	Pubic ramus fracture	Not described	
McCutcheon et al., 2010	Car crash	4 months or 2 years	Chest pain	Chest CT	$6 \text{ cm} \times 5 \text{ cm}$	Pubic ramus fracture	Laparoscopy, ePTFE patch	
Bini <i>et al.</i> , 2010	Car crash	15 years	Discovered incidentally when operating for adhesive small bowel obstruction	Barium study	Not described	Rib fractures	Laparotomy, primary repair	
Scheepers et al., 2011	Car crash	10 years	Dyspepsia, chest pain	CXR, chest CT	Not described	None	Laparotomy, primary repair	
Joyeux <i>et al.</i> , 2011	Fall	3 weeks	Dysphagia, weight loss	Chest CT	10 cm	Left diaphragm hernia	Left thoracotomy, PTFE patch	
Current case, 2012	Car crash, unrestrained	2 months	Chest discomfort	Abdomen CT	8 cm × 4.5 cm	Grade 4 renal injury, rib fractures	Laparoscopy, primary repair	

CXR: Chest X-ray, CT: Computed tomography, PTFE: Polytetrafluoroethylene, ePTFE: Expanded PTFE, TBI: Traumatic brain injury

Intercostal or anterior abdominal muscle flaps may also be used in place of a mesh.^[9]

CONCLUSION

TIPDHs are rare and can pose strong diagnostic challenges. A high index of suspicion, meticulous attention to the mechanism of injury, and the thorough assessment of trauma patients are required, especially when patients present with features of cardiac tamponade in the absence of penetrating chest injuries. CT scan and MRI are useful diagnostic tools.^[3,10] Early transabdominal surgical repair is recommended.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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