

A Case of Traumatic Hepatothorax

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Abstract

Diaphragmatic injury from trauma is potentially fatal, and unfortunately initial diagnosis of traumatic diaphragmatic rupture is often missed in the acute setting. Radiographs may not show immediate herniation of abdominal contents indicating a defect in the diaphragm, and computed tomography is not always performed on trauma patients presenting without signs of abdominal pathology. Right-sided rupture occurs much less frequently than left-sided injuries, which is attributed to relative protection of the right hemi-diaphragm by the liver. The incidence of herniation of intra-abdominal contents is low, but when present can lead to severe morbidity from obstruction or strangulation of viscera. Because of the delay between diaphragmatic injury and diagnosis, patients often present with nonspecific symptoms, making identifying the correct diagnosis challenging. Definitive treatment involves surgical repair of the diaphragm, either through a thoracic or abdominal approach. We present the case of a patient found to have right-sided diaphragmatic rupture and hepatothorax two years after the inciting trauma.

Keywords: Trauma; Diaphragm; Rupture; Herniation; Hepatothorax; Blunt injury

Introduction

Diaphragmatic injury from trauma is potentially fatal. Rupture of the diaphragm occurs in 0.8-5% of patients who suffer thoraco-abdominal trauma [1]. However, initial diagnosis is often missed in the acute setting due to the presence of severe co-existing injuries and the asymptomatic nature of diaphragmatic injuries. Up to 30% of diaphragmatic hernias present late [2]. We present a case of a patient found to have right-sided diaphragmatic rupture and hepatothorax two years after the inciting trauma.

Case Presentation

The patient is a 37-year-old male who presented to the Emergency Department complaining of worsening right "rib pain" for four months.



Figure 1: Chest radiograph showing a soft tissue mass occupying the right hemithorax.

The patient had sustained right-sided rib fractures two years prior in a high-velocity motor vehicle collision. The physical examination

revealed mild tenderness over the right lateral thorax without any obvious swelling or deformity. The patient's vital signs in the Emergency Department included a temperature of 97.2, heart rate of 68, blood pressure of 129/76, respiratory rate of 20, and oxygen saturation of 99% on room air. A chest x-ray did not show any displaced rib fractures but did reveal a soft tissue mass in the lower right hemithorax measuring 63 x 51 mm (Figure 1).

Computed tomography of the chest with contrast confirmed the mass to be a liver segment herniated through the right diaphragm (Figure 2).

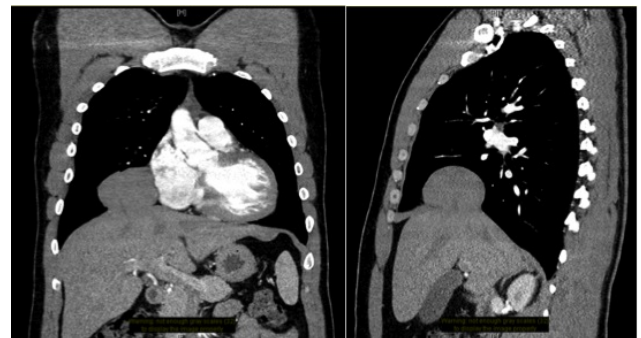


Figure 2: Coronal and midsagittal CT scan showing herniated liver segment.

The patient was evaluated by the Trauma Surgery service, which discussed conservative management versus surgical management options. It was explained that repair of the diaphragmatic rupture and hernia would require a thoracotomy to replace intra-abdominal contents and repair the defect. At the time this case was written, the patient had elected to pursue conservative management, and had not followed up again with the Trauma Surgery Clinic.

Discussion

High velocity blunt trauma to the thorax and abdomen causes a sudden increase in intra-abdominal pressure, which increases the trans-diaphragmatic pressure gradient between the abdominal and thoracic cavities [3]. This results in increased stretch and force and eventual tearing of the diaphragm and visceral herniation [4]. Penetrating trauma to the abdomen or thorax can cause direct injury to the diaphragm. While penetrating wounds tend to result in smaller initial injuries, they may enlarge over time and cause visceral herniation [1,5,6].

Diaphragmatic hernias can be classified into two categories: congenital and acquired. Blunt injury to the abdomen or thorax accounts for 74% of acquired hernias, with penetrating injury responsible for the rest [1]. The majority of diaphragmatic hernias occur on the left side. One study found that 75% of diaphragmatic hernias occur on the left side [7], while another study reports that as high as 88-95% of diaphragmatic ruptures occur are left-sided [8]. This is likely secondary to the relative protection of the right diaphragm by the liver [9-12]. Right-sided injuries are often associated with ipsilateral high velocity impacts and therefore have a higher morbidity and mortality [11].

There are three phases used to describe the presentation of acquired diaphragmatic rupture: acute, latent, and obstructive [13]. The acute phase occurs during the recovery time from the initial injury. This is when most diaphragmatic injuries are missed, often due to masking from other severe, co-existing injuries. The diagnosis may also be delayed in patients receiving positive pressure ventilation, as this will eliminate the natural pressure gradient between the pleural and peritoneal cavities [14]. The latent phase refers to an asymptomatic period, where herniations are found incidentally on radiologic imaging performed for other reasons. Patients presenting during the obstructive phase are symptomatic often from GI obstruction or perforation, or from cardiovascular compromise secondary to worsening herniation of abdominal contents into the thorax [15].

Symptomatic patients presenting during the obstructive phase may experience nausea, vomiting, dyspnea, or vague abdominal or chest pain [1]. Patients may also present with signs or symptoms of shock, either from bowel strangulation or cardiovascular collapse secondary to compression from the herniated organs [16].

The initial diagnostic study for evaluation of diaphragmatic injury is a plain chest radiograph. While chest x-ray is indicated for all patients with major trauma, it has poor sensitivity for the detection of diaphragmatic rupture. Sensitivity ranges from 27-62% for left sided injuries and 18-33% for right-sided injuries [15]. The decreased sensitivity of diagnosing right-sided rupture is likely due to obscuring of the right hemi-diaphragm by the liver [17].

The pathognomonic finding for diaphragmatic injury on plain chest radiograph is visualization of a hollow viscus above the diaphragm, with or without an area of constriction at the level of the diaphragm. Identification of herniated stomach through a tear in the diaphragm is often facilitated by abnormal placement of an NG or OG tube as seen on chest radiograph [15]. Nonspecific findings that may suggest injury to the diaphragm include loss of the smooth contour of the diaphragm, ipsilateral pleural effusion, ipsilateral elevation of the diaphragm, and mediastinal shift [15].

Computed Tomography (CT) is the preferred imaging study for the evaluation of patients with severe blunt abdominal trauma. Sensitivity

for the detection of diaphragmatic rupture improves to 71-100% with the use of CT [18]. Findings on CT consistent with diaphragmatic rupture include: direct visualization of the defect; segmental non-visualization of the diaphragm; herniation of viscera; constriction of a herniated viscus, or a "collar sign"; dependent viscera sign or contact of intra-abdominal organs with the posterior chest wall; thickening of the diaphragm; and active extravasation of contrast at the level of the diaphragm [15].

The goal of surgical repair of a diaphragmatic rupture is to reduce the herniated viscera back into the abdominal cavity and to close the defect to prevent recurrence. Exploratory laparotomy is the preferred approach for repair of an injured diaphragm in the acute setting, given the high rate of associated abdominal injuries [19-21]. Chronic diaphragmatic hernias can be repaired either with a trans-thoracic or trans-abdominal approach. However, a thoracotomy is preferred for large post-traumatic hernias to allow for visualization and lysis of adhesions to thoracic structures [15]. A trans-thoracic approach also avoids potential dense intra-abdominal adhesions from prior trauma or surgery [15]. Breakdown of repairs is relatively uncommon given the excellent blood supply to the diaphragm. The use of mesh or other synthetic materials for larger defects with significant diaphragmatic tissue loss is associated with increased complications, such as fistula formation, migration of the mesh, or infection.

Mortality from diaphragmatic injury is dependent on the severity of the associated injuries [19]. Mortality rates therefore range from 18-40%, depending on whether the initial injury was blunt or penetrating [19,22]. In the latent or obstructive phases, the presence of GI obstruction, perforation, or ischemia significantly increases post-operative morbidity and mortality. It is therefore important to maintain a high level of suspicion for diaphragmatic injuries.

This report discusses the case of a patient with right-sided diaphragmatic rupture and hepatothorax, who presented two years after the initial trauma. Right-sided diaphragmatic rupture and subsequent herniation of viscera is uncommon, and is associated with a higher morbidity and mortality than left-sided hernias because of the high velocity impact required to cause such an injury. Maintaining a high level of suspicion for post-traumatic diaphragmatic injury may help to reduce morbidity and mortality for patients who develop chronic hernias that carry a risk of cardiovascular compromise and bowel obstruction, perforation, and ischemia.

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