

LAPAROSCOPIC RESOLUTION OF A LEFT-SIDED STAB WOUND WITH DIAPHRAGM LESION - A CASE REPORT

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CASE REPORT

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Abstract

Traumatic diaphragm injuries (TDI) are infrequent but can have profound implications for respiratory function. Penetrating chest trauma, particularly stab wounds, poses unique challenges due to small lesion sizes. The incidence of TDI, ranging from 1% to 8%, is higher in penetrating trauma. Left-sided diaphragmatic injuries predominate, potentially linked to assailants being predominantly right-handed. Imaging for TDI is challenging, with contrast-enhanced computed tomography being the gold standard, though limitations persist. We present a case of a 45-year-old woman with a left chest stab wound, illustrating the importance of timely diagnosis and intervention. Clinical presentation included pain on inspiration and signs of ethanol intoxication, but no signs of respiratory distress. Imaging revealed a diaphragmatic injury, prompting exploratory laparoscopy, confirming a two-centimeter laceration that was repaired with nonabsorbable sutures. No other incidents were reported during hospitalization.

TDI mortality rates vary (1%-30%), influenced by associated injuries. Minimally invasive approaches are recommended in stable patients, with thoracoscopy preferred. Prompt diagnosis and intervention are essential, given the risk of complications if treatment is delayed. This case underscores the importance of a high index of suspicion in penetrating chest trauma, ensuring rapid surgical intervention for improved patient outcomes.

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Introduction

Traumatic diaphragm injuries (TDI), though relatively uncommon, can have significant implications for respiratory function and overall patient well-being. Penetrating chest trauma, such as stab wounds, presents a unique set of challenges, due to the small size of lesions and the lack of an associated hernia [1].

The incidence rate of TDI ranges from 1 to 8% [2], [3], higher in penetrating trauma than in blunt trauma, but the real incidence is higher due to the missed injuries and prehospital deaths [1], [4]. Sometimes TDI can be missed during exploratory laparotomy when the index of suspicion is not high and the visualization is difficult. The left side of the diaphragm is more frequently injured, 75% of all TDI are on the left [1], [5], probably related to the fact that

most assailants are right-handed, but the right side lesions are harder to diagnose. Bilateral lesions are not impossible, but they are sporadic, and almost exclusively associated with blunt mechanisms [1].

One of the challenges associated with TDI is that there are no imaging studies to identify or exclude a lesion without viscera herniating through it [6]. The gold standard to detect TDI is a contrast-enhanced computed tomography (CT) with a multiplanar reconstruction with a specificity of 78 to 100%. However, some associated injuries, such as a hemothorax, could reduce the appropriate visualization of the defect [6].

When TDI are suspected, a prompt surgical repair is recommended to prevent herniation with possible strangulation, enlargement of the defect, or respiratory distress [1], [6], [7]. A laparoscopic approach is preferred in stab wound injuries with a suspicion of TDI and no other major injuries, the feasibility of a laparoscopic diaphragmatic repair has been demonstrated in hemodynamically stable patients [7].

Case presentation

Mrs. E.P., a 45-year-old otherwise healthy female, presented to the emergency department after a stab wound to the left chest during an altercation approximately two hours before arrival. On admission, she complained of increasing pain on inspiration but no signs of respiratory distress.

Upon examination, the patient appeared anxious and in moderate distress, with signs of acute ethanol intoxication. Her vital signs included a heart rate of 110 beats per minute and oxygen saturation of 97% on room air. Auscultation revealed decreased breath sounds on the lower part of the left side of the chest, and tenderness was noted upon palpation of the left chest wall. There were no signs of external bleeding, and the entry site was about 4 cm wide, above the 8th left rib (Figure 1).



Figure 1 - A 4 cm stab wound can be seen above the 8th left rib

A focused assessment with sonography for trauma (FAST) test was carried out which showed a small quantity of free fluid in the left pleural cavity, with no other pathological findings. Chest X-ray showed no signs of pneumothorax, with blunting of the left costophrenic angle. A contrast-enhanced computed tomography (CT) scan of the chest and abdomen was performed, revealing images resembling pneumatoceles in the left upper part of the abdominal cavity and left hemithorax, pneumoperitoneum, with no other injuries, no signs of contrast extravasation of free fluid in the peritoneal cavity.

Based on clinical presentation and imaging findings, a TDI secondary to the left chest stab wound was suspected. An exploratory laparoscopy was performed to explore the possibility of the diaphragmatic injury and address associated complications. Intraoperatively, the surgeon confirmed a two-centimeter laceration in the left diaphragm (Figure 3a), which was repaired with interrupted nonabsorbable sutures (Figure 3b), and a chest drain was inserted.

The patient's postoperative course was uneventful, with a gradual improvement in respiratory function. She was discharged after a week with a good general status, no abdominal complaints, resumed intestinal transit and food tolerance, and oxygen saturation of 99% on room air after the chest drain removal on the 5th day postoperatively.



Figure 3a - Left diaphragm laceration with herniating colon that has been reduced

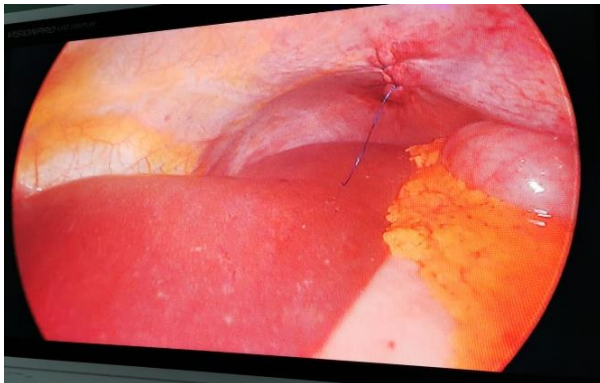


Figure 3b - Sutured laceration with nonabsorbable sutures

Discussions

The diaphragm is a dome-shaped, musculotendinous structure separating the thoracic cavity from the abdominal cavity, but its function is more than just a structural one, playing a key role in the breathing mechanism, increasing the negative pressure in the thoracic cavity during its contractions [8]. Besides the inspiration role, the diaphragm is also a muscle of abdominal straining, assisting the muscles of the anterior abdominal wall in increasing the intra-abdominal pressure for processes like defecation, micturition, parturition, proper venous return to the heart or for weight lifting [8]. An injury of the diaphragm can produce an alteration of all these natural mechanisms, with herniation of the abdominal viscera into

the thoracic cavity, respiratory failure, or cardiovascular collapse [4], [9].

The anatomy of the diaphragm also makes it difficult to assess possible injuries due to the vicinity of structures of similar attenuation, like the spleen or the liver [10]. Advancements in modern CT scans have elevated diagnostic precision, despite the persistence of relatively high false-negative rates and CT scans seem to serve as the primary method for diagnosing blunt TDI, with the "dependent viscera sign" being the most frequently referenced CT indicator [6]. A recent meta-analysis by Hassankhanl et al. [11] revealed moderate to high diagnostic accuracy, with a pooled sensitivity of 74% and specificity of 92% for multidetector CT scan.

Traumatic diaphragmatic injuries are usually caused by closed thoracoabdominal trauma and only in 25% of cases in penetrating trauma [4], [12]. Mariadason et al. [13] segmented the thoracoabdominal area into 12 zones, revealing that the greatest frequency of transdiaphragmatic perforations happened in stab wounds located in the left anterior lower thoracic zone (22%). This incidence was more pronounced in lower thoracic stab wounds when compared to subcostal wounds, and it was also higher in left-sided wounds in contrast to those on the right side. Another study by Leppäniemi et al. [14] showed that occult diaphragmatic lesions after penetrating trauma were diagnosed in 7% of patients, with an increase to 17% when only the cases with left-side wounds were analyzed.

In general, mortality rates for traumatic diaphragmatic injuries have been reported to range from 1% to 30%, with significantly lower mortality for penetrating TDI [1], [4]. The variability in mortality rates is largely influenced by the nature and extent of associated injuries, rarely related to the TDI itself [15].

Traditionally, all patients with penetrating wounds had to undergo open surgical exploration to identify all the injuries to abdominal organs [16], leading to high rates

of morbidity and mortality related to unnecessary surgery [1]. Current guidelines recommend the minimally invasive approach in hemodynamically stable patients with no other indication for laparotomy [7], with thoracoscopy preferred over laparoscopy for lowering the risk of precipitating an ipsilateral tension pneumothorax [17]. Due to the progression of diaphragmatic laceration toward complications, all defects should be closed, either by primary repair with non-absorbable sutures for defects smaller than 8 cm in size or by using prosthetic materials or autologous tissue [17], [18].

Conclusions

This case emphasizes the role of prompt diagnosis and surgical intervention in the management of TDI. Early recognition of diaphragmatic injuries is crucial, as delayed intervention can lead to complications such as respiratory compromise and herniation of abdominal contents. Surgeons should remain vigilant in cases of penetrating chest trauma, even when radiological findings are not specific. A high index of suspicion must be maintained due to the high rates of morbidity and mortality if the diagnosis is delayed or the patient is badly managed. All TDI should undergo surgery, as minimally invasive as possible.

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