

Isolated right diaphragmatic rupture following blunt trauma

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Abstract Blunt diaphragmatic injuries are usually caused by blunt trauma or penetrating injuries. The diagnosis may be delayed or missed because of the confusing clinical and radiographic findings and the presence of multiple associated injuries. We report the case of an isolated right diaphragm rupture in a 56-year-old man who sustained blunt thoracic trauma after car accident 2 weeks before presentation. No other injuries were detected, and he was subjected to laparotomy. Diaphragmatic rupture is perceived as an emergency entity. The late appearance of such an injury, without other accompanying injuries, is rare and should be in mind by clinicians treating trauma patients who have a delayed presentation after the injury.

Key words Diaphragmatic rupture · Delayed · Hepatic hernia · Isolated

Introduction

Diaphragmatic injury (DI) is an infrequent, although not rare, entity following injuries mainly of the chest or abdomen.^{1–3} The diagnosis of DI may be delayed due to confusing clinical and imaging findings or because it is usually accompanied by multiple other injuries. Although it is considered an emergency entity, rare cases of this

injury appearing many years later have been published.^{4,6}

We herein present the case of a 56-year-old man who had sustained isolated right diaphragm rupture after blunt thoracic trauma that was diagnosed 2 weeks after the injury when he eventually presented to a medical facility.

Case presentation

A 56-year-old man presented to the Accident and Emergency Department (A&E) of our institution complaining of right-side thoracic pain and dyspnea. He had been in a high-energy road traffic accident 2 weeks previously, for which he did not seek any medical help. The injury mechanism was a front to lateral impact, with the patient being hit on his right side by another car at high velocity. He was the driver of his vehicle and he did not have his seat belt fastened.

The patient reported that at the beginning of the interval between the impact and his presentation he had had right hypochondrium and hemithorax pain. Later, before his presentation, he also experienced breathlessness and dyspnea, which were worsened whenever he lay supine. It was these symptoms that eventually forced him to seek medical help.

The first impression was that he had suffered blunt right thoracic trauma. His vital signs were as follows: heart rate 100 beats/min, blood pressure 160/80 mmHg, oxygen saturation (SPO₂) 93% on air. Mild tenderness, dullness at percussion, and lowered auscultation breathing sounds of the lower right hemithorax were noted. Chest radiography performed at the A&E revealed an elevation of the right hemidiaphragm and possible

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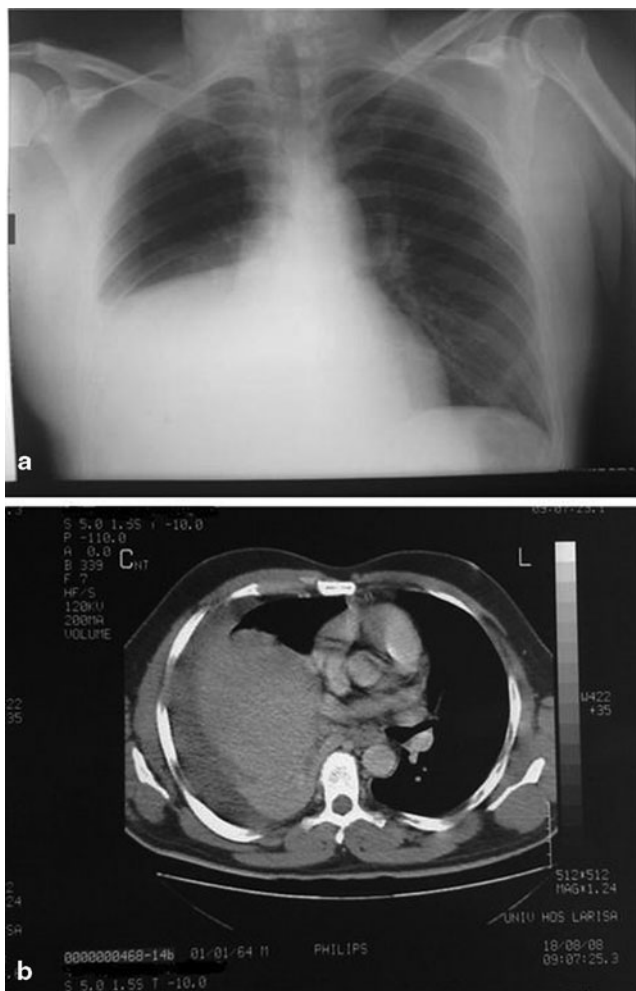


Fig. 1 **a** Chest radiography shows elevation of the right hemidiaphragm, suggesting the presence of a pleural effusion. **b** Thoracoabdominal computed tomography shows the liver in a high position in relation to the right hilum. Pleural effusion is also identified. The loss of the peripheral air between the posterior ribs and the upper part of the liver indicates diaphragmatic rupture

pleural effusion, without notable rib fractures (Fig. 1a). Abdominal ultrasonography (US), also performed at the A&E, did not reveal solid organ injuries or free fluid in the abdomen. Thoracoabdominal computed tomography (CT) was performed after sedation and anesthetic consultation, as he could not lay supine due to shortness of breath and pain. It showed rupture of the right hemidiaphragm and herniation of the liver in the right thoracic cavity with possible small ruptures (Fig. 1b).

The patient was subjected to laparotomy where a huge right diaphragm rupture was identified. A small amount of pleural fluid was noted alongside with a small amount of perihepatic fluid. Most of the right hepatic lobe along with part of the hepatoduodenal ligament and a huge part of the omentum was found in the pleural



Fig. 2 Intraoperative findings. Right hepatic lobe with a bile cyst along with a part of the hepatoduodenal ligament is within the thorax. Part of the omentum is herniating through the open diaphragm on the right of the image. Diaphragmatic margins, shown with Atson's clamp, are free-standing and easily reapproximated

cavity (Fig. 2). Small liver ruptures were also identified and sutured. The abdominal contents were reduced into the abdomen, and the rupture was sutured with noncontinuous nonabsorbable sutures without reinforcement measures such as pledgets or mesh as the diaphragm edges could be reapproximated without tension.

His recovery was uneventful thereafter, and he was discharged after 7 days. His follow-up is also uneventful 6 months after his injury.

Discussion

Traumatic DI is an uncommon entity, with an incidence of 0.8%–7.0% among blunt trauma cases and 10%–15% among cases of penetrating trauma of the chest and abdomen.^{1–3} Many studies agree that it is more common in young men and on the left side usually following blunt trauma of the chest or abdomen.^{3,7} Early diagnosis of DI remains a challenge for radiologists and surgeons. Because of its low incidence and the presence of multiple associated injuries in 94%–100% of patients, early diagnosis is difficult and is often delayed or missed.¹ In our case, despite the severity of the accident, the diaphragmatic rupture was isolated with no accompanying injuries.

Traumatic DI may present acutely or late, with the injury being unnoticed whatsoever. Cases of traumatic DI appearing up to 20 years after the injury have been published with some of them diagnosed accidentally.^{4–8} Patients may present with nonspecific symptoms and may complain of chest pain, abdominal pain, dyspnea,

tachypnea, or cough symptoms and signs due to the herniation of abdominal contents into the thorax. In our case, the patient, although sustaining a high-energy road traffic accident, did not ask for any medical assistance for 2 weeks and eventually appeared complaining of thoracic pain and dyspnea. Therefore, doctors who treat trauma should be aware of the fact that patients who present after a long interval from their injury may still have suffered important injuries.

Most authors agree on the need to maintain a high level of suspicion to diagnose this lesion. Chest radiography, peritoneal lavage, diagnostic pneumoperitoneum, fluoroscopy, gastrointestinal contrast studies, US, CT scans, magnetic resonance imaging, and liver and spleen scintigraphy are the methods generally used to diagnose DI.^{3,9,10} However, none has high sensitivity or specificity, and there is no gold standard diagnostic test.

Plain chest radiography is currently the most valuable simple test, although it is diagnostic or suggestive of DI in only 28%–70%¹⁰ of cases. Its diagnostic value may be increased by 8.3%–25.0% if sequential chest radiography is performed within the first 24 h.¹

Ultrasonography can also be diagnostic if focused abdominal sonography for trauma (FAST) can be extended above the diaphragm to assess diaphragmatic motions.⁹ In our case, paradoxical diaphragmatic movement was suggested, which can also be caused by phrenic nerve damage. In our case, it could be diagnosed only intraoperatively.

Computed tomography has a sensitivity of 14%–82% and a specificity of 87%, which may be increased by helical CT. Multidetector CT allows thinner slicing and more detailed imaging in a shorter time and a greater flexibility in image reconstruction.^{8–10} Apart from the discontinuity of the diaphragm or the intrathoracic herniation of abdominal contents, a waist-like constriction of bowel (collar sign) or the upper one-third of the liver abutting the posterior right ribs (the dependent visceral sign) may be observed on the CT scan of a diaphragmatic rupture.^{11,12} Observation of these signs is believed to increase the detection of acute diaphragmatic rupture at CT scans.

Laparotomy is still the advocated approach for repairing acute diaphragmatic trauma because it offers the possibility of diagnosing and repairing frequently associated intraabdominal injuries, as was the case in our patient.¹³ However, minimally invasive modalities, such as laparoscopy, have been gaining acceptance for repairing diaphragmatic injuries.^{13,14} Video-assisted thoracoscopic surgery can be an adequate method of evaluating the diaphragm instead of a laparotomy.^{3,6} Laparoscopy

and/or thoracoscopy are considered acceptable tools for the diagnosis and repair of a missed diaphragmatic injury.¹⁴

Conclusion

Diagnosis of right DI is difficult because the diaphragmatic defect is masked by the liver. This injury seems to be self-contained and may be diagnosed with delays ranging from weeks to years.

The authors declare that they have no competing interests.

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