

CASE REPORT

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Delayed asymptomatic blunt traumatic diaphragmatic hernia: an unusual case report**Cylia Revata¹ and Mulia Rahmansyah^{1,2*}****ABSTRACT****INTRODUCTION**

Traumatic diaphragmatic hernia (TDH) is uncommon, being encountered in around 0.8%-8% of patients with blunt abdominal trauma. Severe comorbidities such as fractures and thoraco-abdominal or head injuries that accompany TDH, are responsible for poor prognosis and often mask diaphragmatic injury itself. Objective of this case report was to highlight rare blunt TDH case to avoid missed diagnosis leading to complications.

CASE DESCRIPTION

Sixty seven-year old man presenting with right chest pain without difficulty of breathing after falling from stairs 1 hour before hospital admission. On clinical examination, vitals were stable, but with decreased breath sounds on right lower side of chest. Patient had history of trauma from being crushed by elevator 40 years ago without any proven diaphragmatic injury. Initial erect chest X-ray findings were inhomogeneous opacity shadow on lower right hemithorax suspected to be diaphragmatic hernia and 7th right rib fracture with pleural effusion. Thorax CT scan showed herniated right lobe of liver, gall bladder, and mesenteric fat on right hemithorax causing displacement of mediastinal structures. Patient was diagnosed with delayed TDH and hemothorax caused by newly fractured rib. Patient was referred to a better-equipped facility due to the limited surgical facilities in referring hospital.

CONCLUSION

Delayed TDHs are not common, but can lead to serious consequences. Blunt TDH occurs more often on left than on right side, in ratio of approximately 3:1. Traumatic diaphragmatic hernia is sometimes diagnosed many years after traumatic event due to latent phase of disease possibly ranging from days to years.

Keywords: Traumatic diaphragmatic hernia, CT, diagnostic radiology, delayed

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INTRODUCTION

Traumatic diaphragmatic hernia (TDH) is an uncommon disease, being found in around 0.5%-1.6% of all trauma patients and estimated to occur in 1%-7% of patients with abdominal trauma, especially blunt trauma.⁽¹⁾ This hernia affects predominantly males (male: female= 4:1) in the third decade of life and is more often caused by blunt trauma (75%-94%). The herniation is located more frequently on the left side (68%-80%).⁽²⁻⁴⁾ The mechanisms for blunt trauma to cause diaphragmatic hernias may include diaphragmatic extension, detachment from muscle attachment points, or increased abdominal pressure above the bursting pressure of the diaphragm.⁽¹⁾ Ruptures usually occur at the centrum tendineum or musculotendinous junction. The natural history of diaphragmatic damage is unknown, but some animal studies have shown that it can be cured without developing a hernia.⁽⁵⁾

In the acute phase, TDH is often accompanied by fractures, mostly pelvic and rib fractures, and by thoracoabdominal or head injuries. These more severe comorbidities are responsible for the poor prognosis rather than the diaphragmatic injury itself and often mask the diaphragmatic injury.⁽²⁾ Mortality ranges from 0~1% - 28~33%, often due to associated injuries. The incidence of severe liver injury caused by right-sided TDH and of preoperative shock, are significantly prognostic for mortality.^(1,6) On these grounds, diaphragmatic rupture must be suspected in a patient with thoracoabdominal injury. In the chronic phase, the hernia may cause gut obstruction or complications in the respiratory and circulatory systems. In some cases, the hernia does not cause complications and so stays asymptomatic.⁽⁴⁾

Traumatic diaphragmatic hernia is sometimes found many years after the traumatic event. There is even a case of a patient with colonic obstruction after a 45-year latent period. The diagnosis is easily missed or is difficult due to the silent nature of diaphragmatic lesions, especially on the right side, that makes about 66%

of diaphragmatic ruptures undetectable during trauma. Delayed presentations from days or even years after the onset of the initial trauma, are not uncommon and are often unveiled by a complication. A negative chest pressure and a rise in intraabdominal pressure will cause an enlargement of the diaphragmatic rupture and gradual movement of the abdominal contents, leading to the onset of symptoms.^(4,7) Complications, caused by movement of abdominal organs into the chest cavity, may range from herniation and obstruction of hollow organs that are complicated by strangulation and/or perforation of the herniated contents or by laceration of the liver or spleen, to lung consolidation or atelectasis.^(5,8) Therefore the diagnosis may be missed during the initial evaluation after the injury.

We report an unusual case of delayed asymptomatic blunt TDH following suspected blunt thoraco-abdominal trauma that was found accidentally in a new case of trauma. The number of such case reports in the literature is very low and is primarily related to cases of acute diaphragmatic hernia, rather than asymptomatic or delayed ones. The objective of this clinical report is to highlight this case of delayed blunt traumatic diaphragmatic hernia to avoid missed diagnosis leading to complications.

CASE REPORT

A 67-year old man coming to the emergency room after falling three steps down his stairs one hour before hospital admission, presented with right chest pain without difficulty of breathing and with right cheek laceration. The patient's past history of trauma was of being wedged in an elevator 40 years ago, resulting in blunt abdominal injury and pelvic fracture diagnosed by conventional X-ray and treated conservatively without any surgery. The patient was at that time discharged without any proven diaphragmatic rupture. On clinical examination the vitals were stable, but there were decreased breath sounds noticeable in the right lower side of the chest,



Figure 1. Initial erect chest X-ray

with no lesions being found on chest-abdomen examination.

An initial chest X-ray (Figure 1) showed fracture of the 7th right rib within a homogeneous opacity on the right hemithorax, suspected to be a right diaphragmatic hernia and pleural effusion, which was confirmed by a computed tomography (CT) scan of the thorax and abdomen without contrast administration. (Figures 2,3)

The patient was diagnosed with chronic diaphragmatic hernia and new pleural effusion caused by trauma. Chest tube insertion was performed by the surgeon before CT

examination to evacuate the pleural effusion suspected previously as being a hemothorax, producing a serous fluid mixed with blood. On the third postoperative day, the chest tube catheter was removed without any radiological evaluation. The patient was discharged 4 days later after clinical observation and conservative treatment had led to the conclusion that urgent diaphragm repair surgery was not needed, with the patient being referred to a better-equipped healthcare facility for elective hernia repair because of the limited surgical facilities in the referring hospital. Written informed consent was obtained from the patients for publication of this article and any accompanying images.

DISCUSSION

Traumatic diaphragmatic rupture (TDR) is a serious condition that requires surgical repair before it leads to undiagnosed herniation and complication caused by the herniation. It occurs more frequently on the left side because it is assumed that the liver plays a role in having a protective effect on the right side or that right-sided injury is underdiagnosed. Unfortunately, the diagnosis is often delayed because clinical and radiographic evaluations are insensitive. Initial plain radiographs have demonstrated sensitivities of 28%–65%, and CT has been shown to be 5%–84% sensitive especially because of no apparent herniation in acute

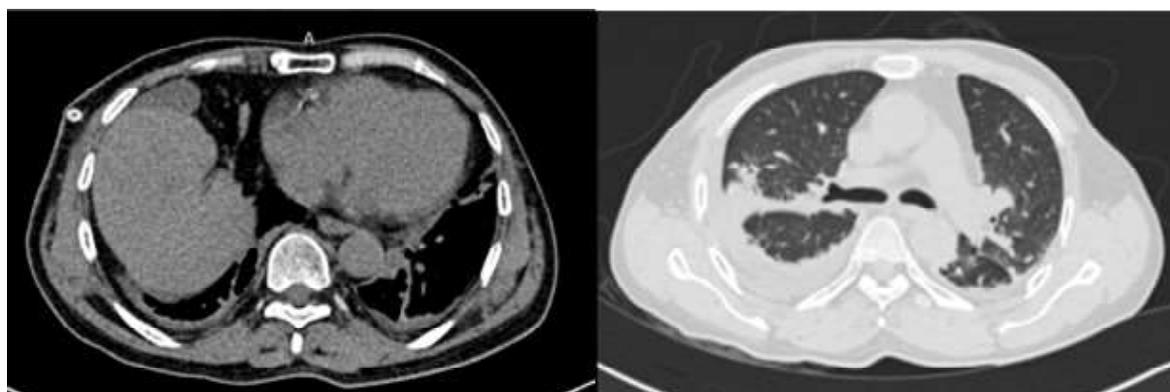


Figure 2. (a) Thorax CT scan (Axial section) showing herniated right lobe of liver, gall bladder, and mesenteric fat on right hemithorax. (b) Bilateral pleural effusion (more severe on the right side) with right lower lobe atelectasis due to compression



Figure 3. Thorax CT scan (Coronal section)

traumatic diaphragm rupture.⁽¹²⁾ In Table 1 we provide some cases that have been reported in the last 5 years in contrast to the present case.

There are three stages of TDH: acute, latent, and obstructive. Abdominal-chest discomfort and cardio-respiratory dysfunctions are common clinical manifestations during the acute period. The latent phase, which can range from days to years, is a gradually developing hernia phase. During this phase, the patient will experience no symptoms or some chronic non-specific thoraco-abdominal clinical symptoms, such as pain in the upper quadrant or in the chest; dyspnea/orthopnea; decreased breathing sounds. Clinical signs of visceral obstruction or ischemia belong to the obstructive phase, whereas the previously stated symptoms may progress.⁽¹³⁾

With a left-to-right ratio of around 3:1, blunt TDH is more common on the left side than on the right.^(8,13) Multiple factors are thought to contribute to the higher frequency of left-sided TDH: the liver's protective effect on the right side, a congenital embryologic weakness in the posterolateral aspect of the left hemidiaphragm, and the right hemidiaphragm's greater inherent resistance compared to the left. The prevalence of left-sided TDH may also be owing to right-sided TDH being underdiagnosed. Rather than

being late-presenting, most chronic TDR, particularly on the right side, are initially misdiagnosed.⁽¹¹⁾ Several characteristics of the diaphragm may cause misunderstanding during the imaging work-up of trauma patients. When the diaphragm comes into contact with soft-tissue organs, pulmonary lesions, or fluid, it can be difficult to see. Right side diaphragmatic hernia is frequently buffered by the liver, causing silent or undiscovered diaphragmatic injury, especially when the right hemidiaphragm directly meets the liver. Furthermore, the normal diaphragm might appear uneven or nodular, leading to diagnostic ambiguity.^(14,15)

Delayed traumatic diaphragmatic hernias (dTDHs) are not common, but can lead to serious consequences. Early detection of diaphragmatic injuries is crucial to prevent the occurrence of dTDHs. Surgeons should maintain a high suspicion for injuries of the diaphragm in patients who have suffered abdominal or lower chest traumas, especially during the initial surgical explorations. The need for radiographical follow-ups is emphasized to detect diaphragmatic injuries at an earlier stage. Both radiologists and surgeons face a diagnostic hurdle when it comes to diaphragmatic injuries. Initial imaging is usually by chest radiography, and herniation can be seen even on chest radiography. When there are minor anomalies on a chest radiograph or when the diaphragm and herniating organs come into contact with intrathoracic fluid or soft tissue, a CT scan can be helpful. Because blunt abdominal injuries is normally treated conservatively and exploratory laparotomies are rarely performed, a noninvasive and accurate diagnostic approach is required. As a result, CT has become an important diagnostic tool for patients who have suffered blunt trauma, particularly thoraco-abdominal CT for suspected traumatic diaphragmatic rupture.^(14,15) The presence of two or more CT symptoms is linked to an increased likelihood of TDH. The ability to recognize the numerous CT signals that indicate TDH is critical for increasing the detection of underdiagnosed traumatic thoraco-abdominal injury patterns.

Table 1. Comparison of similar cases reported in the last 5 years

	Pakula A, et al. (10)	Sala C, et al. (7)	Chlapoutakis S, et al. (8)	Taha A, et al. (9)*	Domrachev S, et al. (9)	This study
Patient	37 yr man	41yr man	27 yr man.	Patient one: 30 yr man	Patient four: 26 yr man	67 yr man
Medical history	Motor vehicle accident on 12 yr	Motorcycle accident with bladder rupture	Victim to a violent torture in a prison, treated as left massive hemothorax	Road traffic accident	Road traffic accident	Car accident on 5th yr
Interval between the trauma and diagnosis	25 years	20 years	14 years	3 years	20 years	48 years
Acute symptoms	Lower left sided abdominal pain		Light dyspnea and swallowing difficulties	Shortness of breath	Shortness of breath	Right chest pain
Chronic symptoms		Wheezing and cough since 1 month			Recurrent upper quadrant abdominal pain	5 years of shortness of breath during exercise and lying down intensified after ingestion of food and fluid
						Wedge in the elevator caused blunt abdominal injury and pelvic fracture

Table 1. Comparison of similar cases reported in the last 5 years

Left/ right sided hernia	Left	Right	Left	Left	Left	Left	Left	Left	Right
Conventional chest x-ray	Loops of the colon and small intestine in the left pleural cavity, displacement of the mediastinum and deviation of the trachea to the right	Right basal consolidation with in-homogenous opacity at the medium and lower chest	Stomach and the large bowel in the left hemithorax	Elevation of the left diaphragm and intrathoracic stomach	Left sided intrathoracic stomach	Intrathoracic bowel loops	Loops of the colon and small intestine in the left pleural cavity, displacement of the trachea, flattening and deformation of the left diaphragm		In-homogenous opacity shadow on right hemithorax
Computed Tomography	Left sided hernia with stomach, pancreas, omentum, colon, and small bowel within the left hemithorax	Massive right diaphragmatic hernia with dislocation of the liver, transverse and ascending colon and part of small bowel	Spleen, small and large bowel and omentum inside the left hemithorax . Large spleen hematoma.			Intrathoracic bowel loops	Stomach, left lobe of the liver, loops of the small and large intestine, spleen, and tail of the pancreas in the left pleural cavity		Herniated right lobe of liver, gall bladder, and mesenteric fat on right hemithorax. Bilateral pleural effusion.
Procedure	Exploratory laparotomy	Right anterolateral thoracotomy	Left posterolateral thoracotomy	Left thoracotomy	Left lateral thoracotomy	Left thoracoabdominal approach	First surgery through thoracoscopic access ; second surgery through laparotomy		

*Only 3 cases were suitable with the context of blunt trauma

Traumatic diaphragmatic injuries are difficult to diagnose in emergency settings unless it is already accompanied by herniation of intra-abdominal contents. We noted that conventional plain X-ray, CT scan, or ultrasonography did not prove useful in determining acute diaphragmatic injury, although these methods are of benefit in detecting the diaphragmatic hernia when there is established herniation. However, data from studies by Magu et al.⁽¹⁵⁾ and Lu J et al.⁽¹⁶⁾ showed that helical CT and multislice CT, such as 64-slice multidetector row spiral computed tomography (64-MDCT), may allow better demonstration of most subtle signs of diaphragmatic injury with high sensitivity, specificity, and accuracy because of a dramatic reduction in motion, beam-hardening artifacts, and significant improvement in spatial resolution.

In most cases, the diagnosis may be obvious on chest radiography and computed tomography (CT) as in this presenting case. However, there are other radiological modalities that can be used in the diagnosis of delayed TDR, such as magnetic resonance imaging (MRI) and ultrasonography (USG). Magnetic resonance imaging may be used in a more stable patient as the examination may take a longer time than CT. Magnetic resonance imaging additionally provides excellent soft tissue resolution and demonstrates the diaphragm as a thin sheet of muscle separating the thoracic and abdominal cavities. All the CT signs of diaphragmatic injury apply to MR also.⁽¹³⁾ USG can be advantageous in an emergency setting, such as delayed herniation with acute or obstructive signs because of USG's good accessibility, but with the drawback of being operator-dependent. Some of the USG findings in diaphragmatic hernia cases with bowel herniation are absent lung sliding, detection of peristaltic movements, and small bowel mucosal folds. Right-sided diaphragmatic rupture should be considered when the physician is presented with a "liver sliding" sign (hepatic parenchymal movement is seen against the parietal pleural surface where lung parenchyma is normally seen). USG is also a good modality to assess

diaphragm function, and has replaced fluoroscopy in many institutions because of portability, lack of ionizing radiation, visualization of structures above and below the diaphragm, and ability to quantify diaphragmatic motion.^(12,15)

CONCLUSION

Delayed TDH is not common, but the consequences can be serious. TDH is sometimes diagnosed many years after the traumatic event due to the latent phase of the disease possibly ranging from days to years. Low sensitivity of initial imaging, especially in right-sided hernia and unseen herniation in acute traumatic diaphragm rupture, results in more misdiagnosed cases. In thoracoabdominal blunt trauma, utilization of radiological modalities, especially helical or multislice CT, is required to diagnose diaphragmatic rupture and identify its complications.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ETHICAL APPROVAL

The procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

INFORMED CONSENT

Informed consent was obtained from the patient included in the study.

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AUTHOR CONTRIBUTIONS

CR contributed to writing the original draft and data curation; MR contributed to revising and editing the manuscript. Both authors have read and approved the final draft. 

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