CASE REPORT

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Traumatic diaphragm rupture treated with left anterolateral thoracotomy approach: a case report

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ABSTRACT

Background: Traumatic diaphragmatic rupture (TDR) is a life-threatening condition due to the herniation of abdominal organs into pleural cavities. Rupture can occur in patients with major blunt or penetration trauma of the lower chest. Blunt TDR is usually caused by momentary high energy damage and is associated with severe trauma. This study aims to evaluate our hospital's experience with managing patients with blunt TDR, including its incidence, modes of diagnosis, operative treatments, postoperative outcomes, and factors predictive of patient outcomes.

Case Report: A 44 years old man was referred to our hospital complaining of dyspnea. Eleven hours before his admission, he was riding his motorcycle, fell to the road, and hit the tree on his left chest. After the accident, he feels dyspnea, chest pain, and abdominal pain. The patient was brought to the nearest hospital and underwent a chest x-ray and left chest tube insertion, with initial production was blood 1700 ml. On examination, there was an increased respiratory rate, a visible bruise of the posteroinferior left chest near the left flank and a pre-installed chest tube thoracostomy on the left chest. Chest x-ray showed an intrathoracic herniation of abdominal viscera, the "collar sign" appeared, and the abdomen x-ray showed the left upper quadrant abdominal organ displaced into the left thorax cavity. Thus suspected, the underlying condition of TDR in this patient. We decided to perform left anterolateral thoracotomy and continued with laparotomy and splenectomy.

Conclusion: TDR is a rare case. The trauma may include shearing a stretched diaphragm, avulsion from a muscular insertion point, or increased abdominal pressure exceeding the bursting pressure of the diaphragm. Intra-abdominal organ injuries are more common than intrathoracic injuries. Initial operative approaches were laparotomy and thoracotomy.

Keywords: Traumatic diaphragmatic rupture, Thoracotomy, Splenectomy.
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BACKGROUND

Traumatic diaphragmatic rupture (TDR) is a life-threatening condition. It is due to the increased likelihood of herniation of the abdominal organs into the pleural cavity. Studies have shown that approximately 1-7% of patients with blunt trauma have such herniation, including 10-15% of patients with trauma that results in penetration of the lower chest.[1] Traumatic rupture of the diaphragm is often the result of a severe accident. Blunt trauma or penetrating trauma are said to cause TDR. TDR due to blunt trauma is most often caused by traffic accidents or falls from a high enough height, which often can also cause lacerations on the posterolateral part of the trunk, the weakest part.[2,3] Penetrating trauma to the diaphragm can be caused by stab wounds at specific sites involving the diaphragm.[3]

The mechanism of diaphragmatic rupture due to blunt and penetrating trauma is quite different. The diaphragmatic rupture caused by blunt trauma (blunt TDR, BTDR) has a trauma mechanism in which blunt trauma will cause shearing of the stretched diaphragm. In addition, an increase in excessive abdominal pressure is also one of the causes that lead to BTDR. Generally, blunt trauma that can result in BTDR is often severe and can be life-threatening.[1,4,5] Meanwhile, penetrating trauma to the diaphragm can be caused by a stab wound or gunshot wound that can tear the diaphragm and cause trauma. Diagnosis of trauma to the diaphragm is very difficult. It is partly due to the absence of specific clinical findings to indicate TDR presence. This causes, in assessing the trauma of the diaphragm, the clinician must be sensitive and have a high level of suspicion to be able to assist in diagnosing TDR cases. Until now, many studies have examined penetrating and blunt trauma to the diaphragm, but studies that only specifically assess BTDR or case reports related to BTDR are still limited. This study aims to evaluate our hospital's experience with managing patients with blunt TDR, including its incidence, modes of diagnosis, operative treatments, postoperative outcomes, and factors predictive of patient outcomes.

CASE REPORT

A 44 years old man was referred to our hospital complaining of dyspnea. Eleven hours before his admission, he was riding his motorcycle, fell to the road, and hit the tree on his left chest. After the accident, he

feels dyspnea, chest pain, and abdominal pain. He has no complaint of syncope, seizure, vomiting, or bleeding from the ear, nose or mouth. The patient was brought to the nearest hospital for a chest X-ray and underwent left chest tube insertion, with the initial production was blood 1700 ml. Furthermore, the patient was referred for further management. Water Sealed Drainage (WSD) production during reference was 800 ml. On examination, there was an increased respiratory rate, a visible bruise of the posteroinferior left chest near the left flank, a pre-installed chest tube thoracostomy on the left chest, and the blood drained from the left pleural cavity (Figure 1), decreased breathing sound on the left chest. Chest x-ray showed an intrathoracic herniation of abdominal viscera, the "collar sign" appeared, and the abdomen x-ray showed the same vision that the left upper quadrant abdominal organ displaced into the left thorax cavity (Figure 2). Focused Assessment Sonography for Trauma (FAST) shows no significant result in the fluid collection splenorenal space (Figure 3). We decided to perform a left anterolateral thoracotomy. Intraoperative findings revealed a displaced spleen in the left pleural cavity with an active bleeding with a sign of spleen rupture (AAST grade V). The spleen cannot be pushed back onto the intrabdominal, so we made a 1 cm wider incision on the diaphragm defect to make the spleen easily pushed back into the intraabdominal and continued with laparotomy and splenectomy by digestive surgery division. There was no bleeding source from the intrathoracic organ (Figure 4).

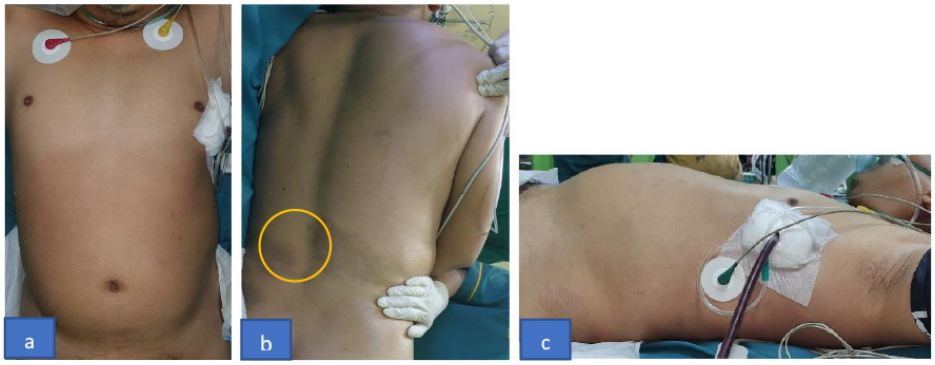

Figure 1. (a) Anterior physical examination of the trunk. (b) Bruise of the posteroinferior left chest near left flank and (c) pre-installed chest tube thoracostomy on the left chest shows blood drained from the left pleural cavity.

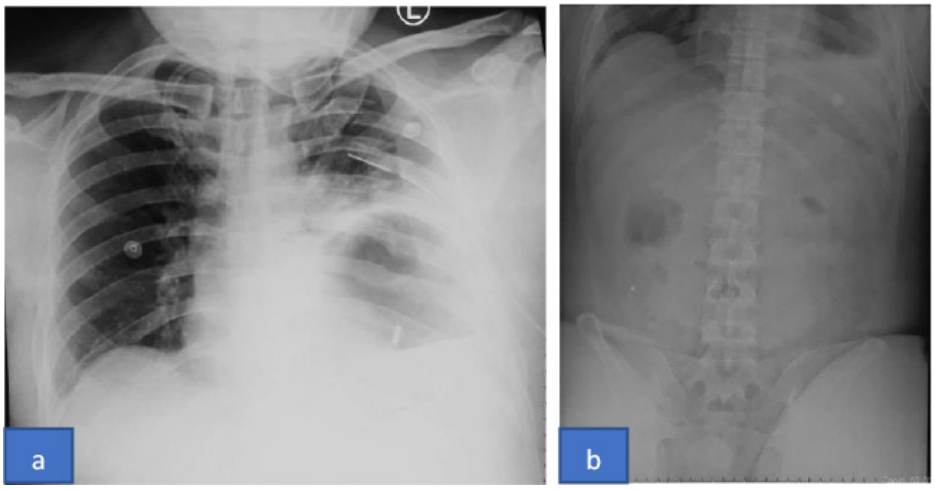

Figure 2. (a) Chest x-ray shows an intrathoracic herniation of abdominal viscera, the "collar sign" appears and (b) abdomen x-ray shows the same vision that the left upper quadrant abdominal organ displaced into the left thorax cavity.

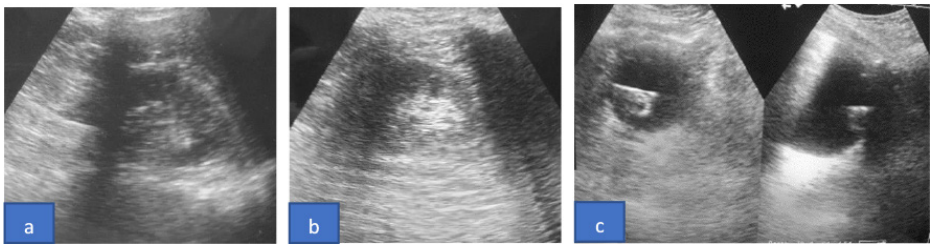

Figure 3. FAST examination shows no significant result about the fluid collection splenorenal space.

DISCUSSION

It has been stated that TDR can be caused by blunt or penetrating trauma to the thoracoabdominal region.[1] Often, in cases of diaphragmatic rupture, the patient previously had a history of blunt trauma to the abdominal or thoracoabdominal region, especially to the left posterolateral. It is due to the fact that this part has a structure derived from the pleuroperitoneal membrane, which is structurally classified as the weakest anatomical part.[1] In the case we present, the patient has a history of riding a motorcycle, falling onto the road, and hitting a tree on his left chest. On physical examination, there were signs of blunt trauma, such as an increased respiratory rate and a bruise on the left posteroinferior chest near the left flank. The findings in this area are in accordance with the theory that diaphragmatic trauma often results from trauma to the left posterolateral region. Complications that can arise from the presence of diaphragmatic trauma can be in the form of respiratory problems that can be seen from the increased respiratory rate. It can also occur in the incarceration of the spleen or the left large intestine.[4]

Performing radiological investigations in the form of plain chest radiographs is a conventional modality that serves as an initial assessment of abdominal trauma. Sometimes, a computed tomography (CT) scan is also used to confirm the chest radiograph findings. The right diaphragm is naturally stronger than the left and is partially protected by the liver, which can

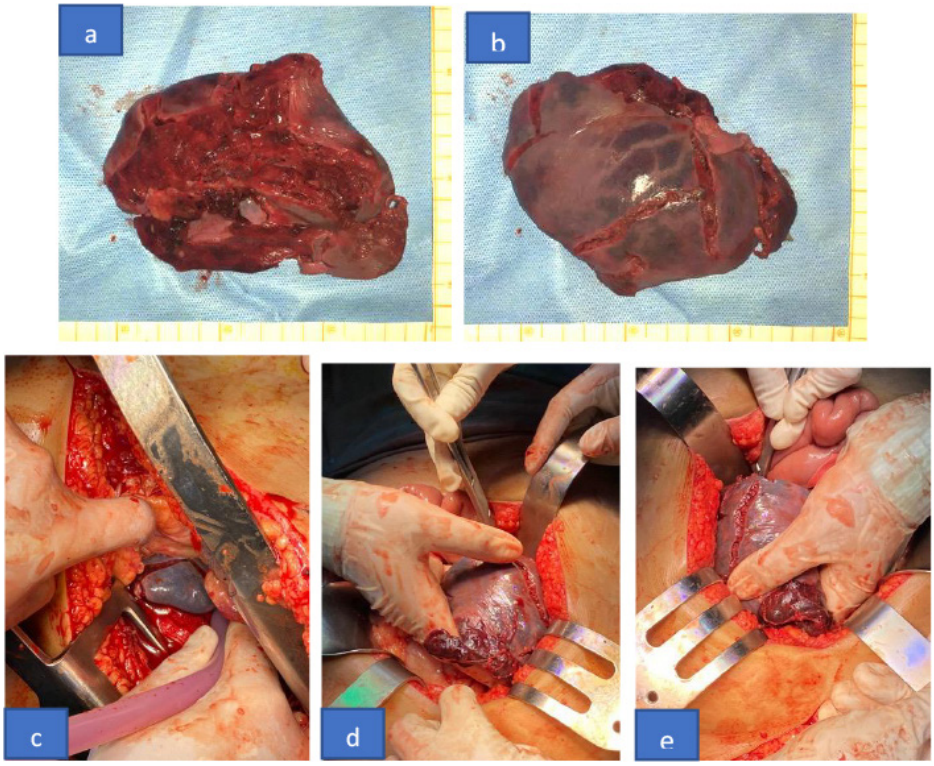

Figure 4. Intraoperative findings were found a displaced spleen in the left pleural cavity with active bleeding with a sign of (a,b) spleen rupture. We decided to make a 1 cm wider incision on the diaphragm defect to make the spleen easily pushed back into the intraabdominal and continued with laparotomy and splenectomy.

distribute pressure over a wider area. In our case, we have examined in the form of a plain chest X-ray, and the results of the examination obtained were herniation of organs in the abdominal cavity into the intrathoracic cavity. We also performed a plain abdominal x-ray to see the condition of the organs in the abdominal cavity, and we found a collar sign that raised the suspicion of a diaphragmatic rupture. The rate of left-sided TDR after blunt trauma has been reported to range from 68% to 87%.[1]

Diaphragmatic rupture is a life-threatening condition that needs prompt diagnosis and repair. CT scanning is the gold standard technique to evaluate the diaphragm.[5] Direct visualization of the injury shows the free edge of the compromised diaphragm limiting the defect. Intrathoracic visceral herniation has high specificity but varies in sensitivity. If abdominal structures herniate through the diaphragm, the free edge will limit the herniated organ, resulting in a sign known as the "collar sign". The dependent visceral and collar signs are reported to be 100% specific for diaphragmatic trauma.[4] This is a difference from our approach. We did not perform a CT scan of the abdomen because, in our opinion, plain chest and abdominal radiographs plus FAST were sufficient to raise the suspicion of BTDR.

Historically, the treatment of diaphragmatic rupture from a blunt mechanism includes an abdominal approach via a laparotomy, which allows the surgeon to also treat the commonly associated intra-abdominal injuries simultaneously with the diaphragm.[6] In a retrospective study analyzing 15 consecutive diaphragmatic rupture cases, Porojan et al. stated that a laparotomy is an approach with a primary repair success rate of 100% and a mortality rate after laparotomy only reaching 20%. The deaths are also said to be related to the patient's trauma which was too severe.[7]

CONCLUSION

We report a rare case of a ruptured diaphragm caused by a trauma mechanism that ruptured the spleen and displaced into the left pleural cavity. The trauma may include shearing a stretched diaphragm, avulsion from a muscular insertion point, or increased abdominal pressure exceeding the bursting pressure of the diaphragm. Intra-abdominal organ injuries are more common than intrathoracic injuries. Initial operative approaches were thoracotomy and laparotomy. This condition was successfully treated with a left anterolateral thoracotomy and continued with laparotomy splenectomy after repositioning the spleen.

PATIENT'S INFORMED CONSENT

The patient has given informed consent regarding the publication of this case.

AUTHOR CONTRIBUTION

All of the authors contribute equally to this study.

FUNDING

None.

CONFLICT OF INTEREST

All of the authors declare there is no conflict of interest regarding this study publication.

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