Video-Assisted Minithoracotomy for Blunt Diaphragmatic Rupture Presenting As a Delayed Hemothorax

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Introduction

Diaphragmatic ruptures after blunt trauma are rare life-threatening conditions. Most of them occur on the left-sided hemidiaphragm with herniation or associated organ injuries after a motor vehicle accident. We present an unusual case of blunt diaphragmatic rupture resulting in a delayed hemothorax. A 62-year-old man presented with acute dyspnea that initiated while straining to pass stool. He had a bruise on the lower back region of his right thorax after a slip-and-fall accident 7 days previously. Chest computed tomographic scans revealed a right-sided hemothorax without any evidence of herniation or associated organ injuries. Emergency surgery was performed through a video-assisted minithoracotomy. During surgery, we identified a diaphragmatic laceration with a severed blood vessel originating from the right superior phrenic artery. The lesion was repaired with interrupted horizontal mattress sutures. The total amount of bleeding was approximately 2000 mL. The patient had an uneventful recovery with no further bleeding episodes.

Keywords: right-sided diaphragmatic rupture, hemothorax, delayed presentation, minithoracotomy, video-assisted thoracoscopic surgery

Case Report

A 62-year-old man presented to the emergency department at our hospital with pain in the lower back region of the right thorax after a slip-and-fall accident on a mountain path. The trauma survey revealed no abnormality, except for fractures of the right 11th and 12th ribs. The patient was treated with analgesic medications and discharged from the hospital.

Seven days later, he was readmitted with acute onset of nausea, breathlessness, and chest pain that developed while straining to pass stool. On admission, the vital signs were as follows: blood pressure, 125/63 mmHg; pulse rate, 106 beats/min; respiratory rate, 28 breaths/min; body temperature, 36.0°C; and SpO2 at room air, 95%. Physical examination revealed decreased breath sounds on the right side of the lung. Focused assessment with sonography for trauma (FAST) examination was performed during primary survey. It revealed the presence of a large pleural effusion and a collapsed lung on the

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Received: July 29, 2013; Accepted: September 4, 2013
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right side. Laboratory evaluations showed a hemoglobin level of 9.4 g/dL. Chest radiography demonstrated a massive pleural effusion in the right hemithorax (Fig. 1). The initial diagnosis was delayed hemothorax due to intercostal hemorrhage associated with fractured ribs. Subsequent insertion of an intercostal tube drained 400 mL of fresh blood. Enhanced chest computed tomographic (CT) scan confirmed a right clotted hemothorax (Fig. 2). No obvious extravasation of contrast medium into the thoracic cavity was noted. The cause of the hemothorax was not detected on ultrasonographic examination. Because a dome-shaped blood clot was found between the basal segments of the lung and the diaphragm, we suspected that the hemothorax resulted from the disruption of small blood vessels on the diaphragm. When performing CT examinations during secondary survey, the patient complained of chills and nausea with a pale and sweaty face. He presented with unstable vital signs despite initial fluid therapy: blood pressure, 90/54 mmHg; pulse rate, 124 beats/min and SpO₂ with oxygen 2L/min via nasal cannula, 92%. Because he fell into a state of preshock, we decided to perform emergency surgical hemostasis.

Emergency surgery was performed through a video-assisted minithoracotomy. One access port for a thoracoscope was placed in the eighth intercostal space at the midaxillary line. We performed a muscle-sparing minithoracotomy through an 8-cm transverse skin incision over the postaxillary line in the sixth intercostal space. After evacuation of approximately 1600 mL of a mixture of fresh and clotted blood, we identified the severed blood vessel at the base of a diaphragmatic laceration, which was located in the pleuroperitoneal aspect of the diaphragm (Fig. 3). The laceration reached the muscle layer and spread along the muscle fiber direction. The bleeding site was located in a branch of the right superior phrenic artery. The lesion was surrounded by an inflammatory granular tissue with edematous pleura. We then closed the blunt diaphragmatic rupture using 2-0 Prolene (Ethicon, Somerville, New Jersey, USA) with interrupted horizontal mattress sutures. There was no evidence of injury on the parietal pleura near the fractured ribs. The postoperative course was uneventful. The patient, who was recovering satisfactorily after surgery without further bleeding episodes, was discharged from the hospital on the fifth postoperative day.

Discussion

In the present report, we describe an unusual case of diaphragmatic rupture after blunt trauma resulting in a delayed life-threatening hemothorax without herniation or any thoracoabdominal organ injury. Increase in intra-abdominal pressure while the patient strained to pass stool probably exacerbated the diaphragmatic rupture, resulting in the massive hemothorax. This rare condition was successfully diagnosed and treated via a video-assisted minithoracotomy.
Diaphragmatic ruptures, also called diaphragmatic injuries or tears, occur in 0.8%–8% of patients after a blunt trauma. In previous reports, the causes of blunt trauma have been attributed to motor vehicle accidents in 80%–90% of cases and falls from a height in 10%. The most common location of a diaphragmatic rupture is the left side (56%–86%), followed by the right side (11%–39%); a small percentage of cases are bilateral (2%–6%). Most of the ruptures occur at the posterolateral aspect, which is the weakest point of the diaphragm. They are classified into two broad categories according to the time of diagnosis: acute phase and late phase. The acute phase includes cases diagnosed within the first 2 weeks after injury. Blunt diaphragmatic ruptures in the acute phase are frequently associated with life-threatening injuries to the thoracoabdominal organs. For example, liver injuries are seen in 93% of patients with right-sided rupture. In contrast, the most common complication during the late phase is herniation of intra-abdominal organs into the thoracic cavity. Because the amount of bleeding from the diaphragm itself is small, the possibility of intra-abdominal organ injuries should be considered in the case of a massive hemothorax. In addition, delayed appearance of hemothorax after blunt trauma is usually associated with rib fractures.

In this particular case, blunt diaphragmatic rupture was successfully diagnosed and treated via video-assisted minithoracotomy. CT is the gold standard diagnostic modality and allows the visualization of other associated intra-abdominal injuries, if present. However, in patients with right-sided diaphragmatic ruptures, diagnosis using CT images is often difficult because the diaphragmatic laceration may be obscured by the liver. Video-assisted thoracoscopic surgery (VATS) is a more accurate method for diagnosis in these cases. Recently, VATS has become the preferred method for treating hemodynamically stable patients who present with diaphragmatic rupture without any evidence of intra-abdominal injury. However, there is no consensus on the use of VATS for hemodynamically unstable patients. In addition, VATS has limited therapeutic use. Diaphragmatic ruptures in patients without intra-abdominal injury are traditionally repaired through an open thoracotomy. In the present case, a video-assisted minithoracotomy, also known as a hybrid VATS, was a safe and effective surgical procedure to remove the clotted hemothorax and repair the diaphragmatic laceration, even though the patient was in a preshock state with intrathoracic bleeding. The minithoracotomy with thoracoscopic technique allowed good exposure of the entire hemothorax, adequate space for all maneuvers, and easier access to the bleeding site at the periphery of the diaphragm. This minimally invasive approach could contribute to faster recovery and reduced pain for patients, resulting in shorter postoperative hospital stays. Therefore, a video-assisted minithoracotomy can be helpful in diagnosis and treatment of blunt diaphragmatic rupture in hemodynamically unstable patients without intra-abdominal injury.

Conclusion

Diaphragmatic rupture presenting as a delayed hemothorax after blunt trauma is a rare life-threatening event. Physicians should be aware of the possibility of diaphragmatic rupture in patients with pain in the lower back region of the thorax, even after minor blunt trauma. A video-assisted minithoracotomy would be a safe and effective method for diagnosis and treatment of this rare condition.

Disclosure Statement

The authors have no conflict of interest to declare.

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