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Delayed Traumatic Diaphragmatic Hernia With Bacterial Pleuritis

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Thoraco-abdominal blunt trauma may cause traumatic diaphragmatic hernia. Here, we report a case of delayed traumatic diaphragmatic rupture with herniation of multiple viscera along with bacterial pleuritis without perforation or necrosis. A 72-year-old man presented with severe left-sided chest pain and dyspnea following a fall in the bathroom on the previous day; he had hit the left side and back of the chest against a faucet. Computed tomography (CT) revealed pneumoderma, mediastinal emphysema, pneumothorax, and fractures of the 8th–11th left ribs. We diagnosed traumatic pneumothorax, which was treated by a thoracostomy tube inserted into the pleural space. Approximately 6 months later, he presented again with fever (39.2°C), dyspnea, and coughing. The white blood cell count and C-reactive protein were elevated at 20.3 $\times$ 10^3/μL and 28.7 mg/dL, respectively. A CT scan revealed left-sided pleural effusion and diaphragmatic hernia. Thoracocentesis was performed for the pleural effusion, and bacterial cultivation tests revealed *Bacteroides fragilis*; therefore, antibiotics were administered for 3 weeks. Subsequently, diaphragmatic hernia repair was performed. Laparotomy via a left subcostal incision revealed a defect measuring 60 $\times$ 60 mm; this was repaired with uninterrupted absorbable sutures without using a hernia mesh to avoid infection. The postoperative course was uneventful, and no recurrence was noted at the 1-year follow-up. We repaired delayed traumatic diaphragmatic rupture with herniation of multiple viscera by simple suturing without using a hernia mesh following the treatment of associated bacterial pleuritis.

Key words: Traumatic diaphragmatic hernia – Bacterial pleuritis – Multiple viscera

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Thoraco-abdominal blunt trauma causes traumatic diaphragmatic hernia in approximately 0.8%–5.8% of patients experiencing such blunt trauma.[1–4] The first successful repair of traumatic diaphragmatic hernia was detailed by Riolfi, who repaired a traumatic diaphragmatic hernia in a patient with omental prolapse in 1886.[5] Subsequently, many reports have described this condition, with the stomach being the most frequently herniating organ, followed by the spleen, small bowel, and so forth.[6–13] However, few studies have reported multiple viscera herniating into the chest simultaneously. Further, no reports have described the occurrence of bacterial pleuritis in combination with diaphragmatic hernia without perforation or necrosis. Here, we report a case of delayed traumatic diaphragmatic rupture with herniation of the spleen, tail of pancreas, small bowel, transverse colon, and omentum associated with bacterial pleuritis.

Case Presentation

In November 2013, a 72-year-old man presented to our hospital with severe left-sided chest pain and dyspnea. He had suffered a fall in the bathroom the previous day and hit the left side and back of the chest against a faucet. He had a history of hypertension and pulmonary aspergillosis. A computed tomography (CT) scan revealed pneumoderma, mediastinal emphysema, pneumothorax, and fractures of the 8th–11th left ribs (Fig. 1a). We diagnosed traumatic pneumothorax, and air drainage was performed via a thoracostomy tube inserted into the pleural space. Subsequently, the air leakage ceased and the thoracostomy tube was removed, and the patient was discharged. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from the patient.

Approximately 6 months after discharge, he presented again with fever, dyspnea, and coughing. On physical examination, the patient's height was 162.5 cm and weight was 48 kg, with a body temperature of 39.2°C, a pulse rate of 153 beats/min, a blood pressure of 98/64 mmHg, and an oxygenation saturation of 95% on room air. His white blood cell count and C-reactive protein levels were elevated at $20.3 \times 10^3/\mu L$ and 28.7 mg/dL, respectively. A chest CT scan revealed left pleural effusion and diaphragmatic hernia (Fig. 1b). However, no strangulated ileus, perforation of the gastrointestinal tract, or ischemia of any organs—any of which would necessitate emergency surgery—were noted. Therefore, we first performed thoracocentesis via a thoracostomy tube and drained the pleural effusion; samples were sent for bacterial culture. Subsequently, *Bacteroides fragilis* was detected, and antibiotic therapy was administered for approximately 3 weeks for bacterial pleuritis. After ensuring complete pleural drainage, a CT scan revealed a left-sided diaphragmatic hernial protrusion of the spleen, tail of pancreas, small bowel, transverse colon, and omentum (Fig. 1c). We therefore made a definitive diagnosis of delayed traumatic diaphragmatic rupture caused by the rib fractures; this was confirmed by examination of the first CT scan (Fig. 1a). Repair of the diaphragmatic hernia was planned after completion of the antibiotic treatment for bacterial pleuritis.

The patient underwent laparotomy via a left subcostal incision. Exploration revealed herniation of the spleen, tail of pancreas, small bowel, transverse colon, and omentum into the left thorax from the diaphragmatic defect (Fig. 2a), which measured approximately 60 × 60 mm (Fig. 2b). These viscera were returned to the abdominal cavity with additional incisions made on the right and left areas of the left diaphragm because the exposed viscera were large in volume. We then carefully broke up the adhesions between the spleen and the inferior lobe of the left lung. After confirming air leakage from the inferior portion of the left lung, we sutured this damaged area. Then, the diaphragmatic defect was repaired with uninterrupted absorbable sutures without using a hernia mesh to avoid infection (Fig. 2c). The patient's postoperative course was uneventful, and he has remained recurrence free at the 1-year follow-up.

Discussion

Traumatic diaphragmatic hernia is a rare condition caused by blunt thoraco-abdominal trauma. The incidence of diaphragmatic rupture varies from 0.8% to 5.8% following blunt trauma.[1–4] The first case of traumatic diaphragmatic hernia was described by Sennertus in 1541,[14] and the first successful repair was detailed by Riolfi in 1886.[5] A large number of reports describing this condition and its treatment have been published since then. The proposed mechanism for such hernia is an increase in the intraabdominal or intrathoracic pressure at the time of impact, which results in

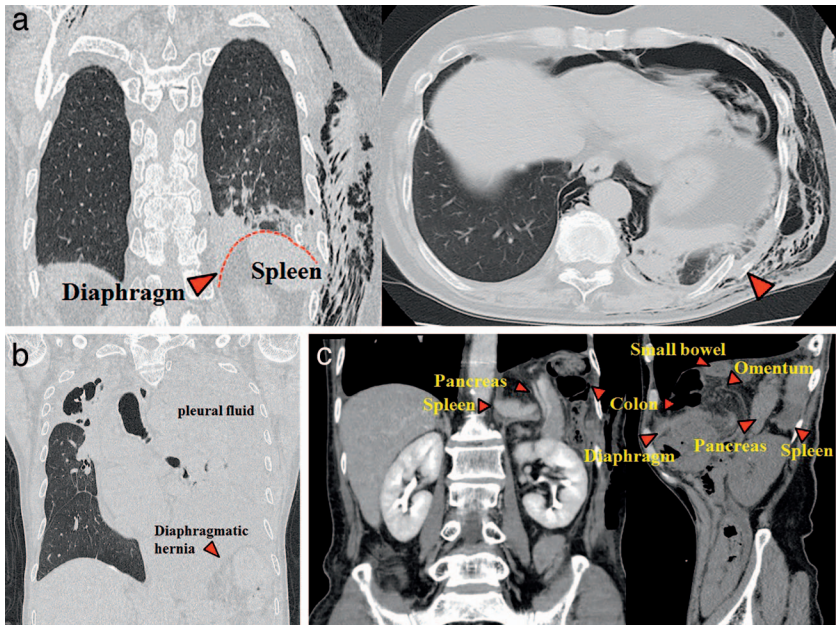

Fig. 1 Chest CT scan. (a) Coronal CT scan showing pneumoderma, mediastinal emphysema, pneumothorax, and deviation of the fractured ribs to the intrathoracic space. The cause of the hernia in our case was weakening of the diaphragm due to the rib fractures. (b) A coronal chest CT scan after 6 months. The coronal CT scan revealed left-sided pleural effusion and diaphragmatic hernia. (c) CT scan showing diaphragmatic hernia with multiple viscera. A coronal CT scan revealed left-sided diaphragmatic hernia with protrusion of the spleen, tail of pancreas, small bowel, transverse colon, and omentum.

shearing forces on to the stretched diaphragm and avulsion from its points of attachment.[8–12]

Traumatic diaphragmatic hernias occur following injury to the musculotendinous membrane and are believed to predominantly occur on the left side because of the anatomically protective location of the liver on the right side.[10] In our case, the cause of the hernia was the weakening of the diaphragm due to rib fractures. In previous reports, the stomach was the most frequently herniating organ, followed by the spleen, small bowel, and so forth.[6–13] Moreover, a maximum of 1–2 visceral organs were reported in such diaphragmatic hernias; however, in our patient, we noted the unusual herniation of multiple viscera into the left thoracic space. Therefore, we made further incisions in the diaphragm to return the viscera safely into the abdominal cavity without bleeding, especially from the spleen.

Surgical repair of delayed diaphragmatic hernia may be performed through an open laparotomy, thoracotomy, or thoraco-abdominal approach through laparoscopy or thoracoscopy.[10] A thoracic approach is recommended due to concerns over viscera–pleural adhesions and the risk of intrathoracic visceral perforation.[15] We elected to use an abdominal approach because we believed that there was no evidence of visceral adhesions and no evidence of a risk of perforation. However, in fact, the patient had strong adhesions between the spleen and inferior lobe of the left lung. These strong adhesions were possibly caused by the preoperative bacterial pleuritis. Therefore, in similar cases with preoperatively diagnosed bacterial pleuritis, the possibility of strong adhesions between abdominal viscera and the inferior lobe of the lung should be considered, with due consideration to the choice of approach. Laparotomy with reduction and repair of the defect is the standard treatment for traumatic diaphragmatic hernia. The treatment of diaphragmatic hernia is generally via simple sutures or repair using a hernia mesh. Simple sutures are sufficient for smaller defects, whereas larger defects need a hernia mesh.[12] The repair of the hernial defect can be made with nonabsorbable or absorbable suturing materials; however, the use of nonabsorbable sutures is widely recommended.[12] Thus far, no reports have described therapy for bacterial pleuritis occurring in combination with diaphragmatic hernia. In our case, bacterial pleuritis occurred along with traumatic diaphragmatic hernia; therefore, the defect was repaired with uninterrupted absorbable sutures without using a hernia mesh to avoid the risk of infection.

When traumatic diaphragmatic hernia occurs in combination with bacterial pleuritis, treatment for bacterial pleuritis should be administered first, if there is no ischemia or necrosis in the exposed herniated viscera. Because antibiotic therapy is required for a minimum of 2 weeks to ensure bacterial clearance, the patient should be carefully monitored for signs of ischemic organ damage based on clinical symptoms and CT findings until the operation. It is preferable to repair the diaphragmatic hernia after achieving bacterial clearance and

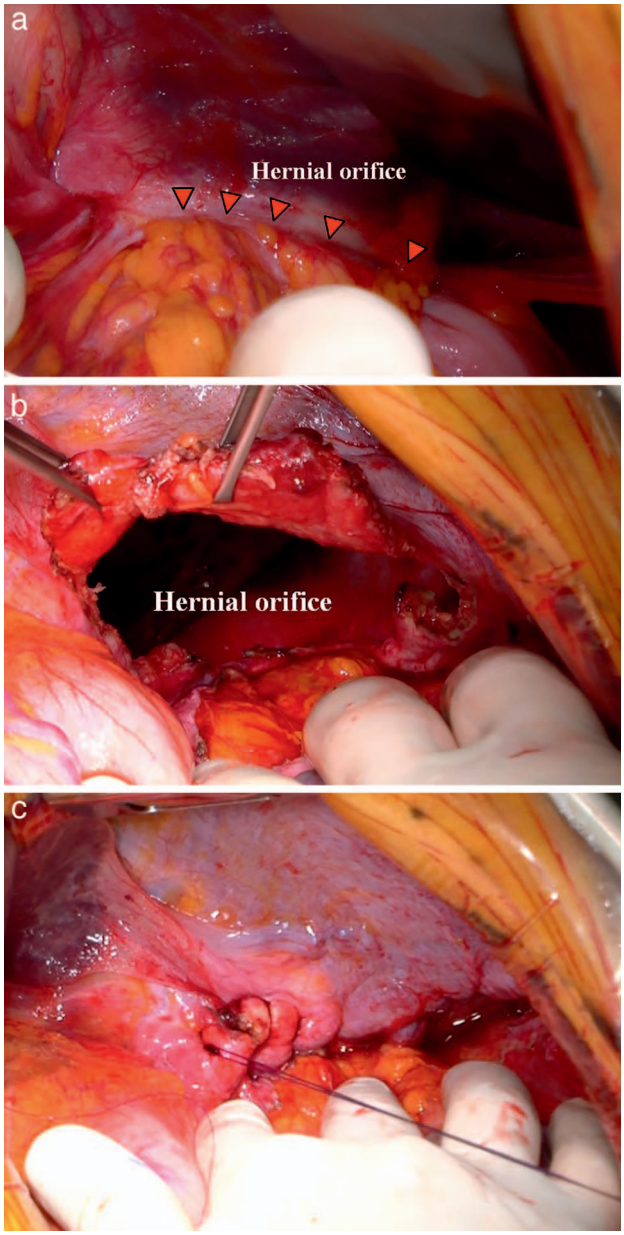

Fig. 2 Hernial orifice. (a) The spleen, tail of pancreas, small bowel, transverse colon, and omentum were seen entering the left thorax through the diaphragmatic defect. (b) The defect measured approximately 60 × 60 mm. (c) The defect was repaired with uninterrupted absorbable sutures without using a hernia mesh.

after the inflammation subsides. However, in such cases, it may be more difficult to repair the hernia because of the adhesions between the abdominal viscera and the inferior lobe of the lung. Using simple sutures without a hernia mesh can avoid the high risk of postoperative infections in these patients.

Conclusion

We successfully repaired delayed traumatic diaphragmatic rupture with herniation of multiple viscera by using simple sutures without a hernia mesh after completing antibiotic treatment for associated bacterial pleuritis.

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