CASE REPORT

Gastric perforation during chest tube placement for acute diaphragmatic rupture and review of the literature

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Accepted 8 August 2005

Introduction

Acute diaphragmatic rupture occurs in 10% to 15% of patients with penetrating trauma to lower chest. 12 In penetrating injuries, the insult is direct and visceral migration within the thorax will occur gradually due to the normal pressure difference between thorax and abdominal cavity. Diaphragmatic injuries are sometimes misdiagnosed, because the generally violent symptoms of associated injuries initially disguise the slight clinical sings of them, and not because surgeons pay less attention to this pathology. 13 Intercostal drains may have to be placed as emergency procedure in chest trauma. We report a case of an iatrogenic gastric fistula after intercostal drain (ICD) insertion in a male patient who had haemopneumothorax after penetrating trauma to left lower chest.

Case report

A 35-year-old male was admitted to the emergency department with penetrating trauma on the left posterior side of the chest. His complaints were chest pain at left side, abdominal pain at left upper quadrant and dispnea. His pulse rate was 94/min, arterial blood pressure was 135/107 mmHg, and respiratory rate was 36/min. On physical examination, there was a 2 cm wide stab wound at the sixth intercostal space, penetrating to posterior thoracic cavity and decreased respiratory sounds at left side at auscultation. A chest radiograph revealed loss of definition at left diaphragmatic border. Left hemopneumothorax was diagnosed and a chest drain was inserted by the attending physician through midaxillary line of seventh intercostal space. A reddish brown drainage of 600 cc occurred for the first 24 h. After oral food intake, he had nausea and vomiting, fever of 38.5 °C and drainage of food particles from chest tube. We consulted him at 36th hour of admittance. A new roentgenogram revealed that the fundal gas collection was located over the left
hemidiaphragmatic area and chest tube was located there too, superimposing with the gastric fundus (Fig. 1). A computed tomography (CT) with both oral and intravenous contrast was obtained, revealing that the stomach was dislocated to the left thorax and the contrast medium was disseminated to the left pleural cavity (Figs. 2 and 3). He had a white blood cell count of 15900/ml. Our initial diagnosis was posttraumatic diaphragmatic hernia and gastric penetration and fistulization due to the tube. An emergency laparotomy with upper abdominal approach revealed that corpus and fundus of the stomach were displaced to the left thoracic cavity through a 3 cm left diaphragmatic defect, leading to proximal acute intrathoracic gastric herniation and obstruction. No contamination of the abdomen with blood or gastric content was present. The chest tube penetrated both posterior and anterior walls of the fundus, causing a iatrogenic gastric fistula. Chest cavity irrigation and a new ICD tube replacement was followed by primary repair of the gastric lesions and diaphragmatic defect and placement of abdominal drain and nasogastric tube. A pneumothorax that became evident on the second postoperative day with a fever of 38.7 °C resolved with appropriate antibiotic therapy.

Nasogastric tube was removed on the second and oral intake was encouraged on the third postoperative days, respectively. Chest tube was removed on day 7 and the patient was discharged on day 8. Patient was asymptomatic at 3 months follow-up.

Discussion

Traumatic diaphragmatic rupture (TDR) can result from penetrating injuries, falls, blunt trauma and as a complication of pregnancy. Major causes are penetrating injuries such as gunshot and stab wounds. A review on this subject suggested that 75% of the injuries to the diaphragm are caused by blunt trauma and 25% by penetrating trauma. Traumatic rupture of diaphragm occurs in up to 5% of patients requiring laparotomy for blunt or penetrating trauma to the chest or abdomen. In conservatively managed patients, the rate of initially missed diaphragmatic injuries ranges from 12% to 66% and they may even be overlooked at laparotomy. The true incidence of diaphragmatic injury or rupture,

Figure 1  Posteroanterior chest roentgenogram revealing fundal gas collection at thoracic cavity and superimposing ICD tube.

Figure 2  Thoracoabdominal computed tomography revealing stomach and fundal gas at thoracic cavity. Note the contrast medium scattered to the cavity (thin arrows).

Figure 3  Pneumothorax at thoracoabdominal computed tomography (thick arrow).
however, is unknown because some diaphragmatic injuries and ruptures may remain asymptomatic in particular those of the right diaphragm and therefore are never diagnosed. In penetrating traumas, there is no predisposing area of injury and the defect of the diaphragm is usually smaller than the defects caused by blunt traumas and therefore potentially more dangerous in terms of later obstruction and strangulation, although many trauma surgeons believe that right-sided diaphragmatic injuries from a penetrating wound will rarely become symptomatic. Patients with a ruptured diaphragm can be categorised into one of three groups according to the time of diagnosis after injury: 

1. Patients in whom diagnosis is correctly established immediately, up to 14 days after injury. Our case was diagnosed at this phase.

2. Patients diagnosed in the period after acute injury, but before intestinal obstruction or strangulation.

3. Patients in whom correct diagnosis is established because of intestinal obstruction or strangulation.

In this type of injury, intercostal drainage of the pleural cavity is required to drain the air and/or accumulated fluid. Most common indications are haemothorax, haemopneumothorax, hydrothorax and ampyema. Clinical findings and imaging studies help the diagnosis of air and/or fluid in the pleural cavity. Intercostal drainage may be necessary as an emergency procedure. In some cases, massively herniated and distended stomach or colon may easily be mistaken as pneumothorax or hydropneumothorax. A diaphragmatic hernia should be suspected even after a trivial trauma if an erect plain radiograph of the chest shows absence of fundic bubble in its normal position. In such cases, lateral decubitus and true erect frontal chest radiographs can aid in the diagnosis. In the presented case, acute hemopneumothorax resulting from stab wound to the lower thorax obscured the existence of posttraumatic diaphragmatic hernia, and urgent placement of an ICD tube caused gastric trauma that was displaced through the hernia. Secondary gastric obstruction and fistulization further complicated the case.

Early diagnosis and repair of diaphragmatic rupture are desirable because surgical repair is easier before fibrosis develops, and because the morbidity and mortality associated with the latent and obstructive phases of diaphragmatic rupture can be avoided. The striking problem with traumatic diaphragmatic injuries or ruptures is the difficulty in making the diagnosis in conservatively treated patients with blunt or penetrating traumas of the thoracoabdominal area. There is no “gold standard” for early diagnosis of traumatic diaphragmatic rupture, and it still seems to be a diagnostic dilemma. Many investigative techniques have been described for the diagnosis of TDR, including chest X-ray, CT, magnetic resonans imaging, upper gastrointestinal contrast studies, angiography, ultrasonography, thoracoscopy, peritoneal lavage and laparoscopy. Sensitivity of the initial chest X-ray interpretation can be increased by heightened awareness of this injury. Chest X-rays on admission supported the diagnosis in 70% of cases and the authors concluded that a chest X-ray upon admission is the best diagnostic aid in the evaluation of TDR. Although, abnormal radiographs commonly reveal elevation of the hemidiaphragm, blunting of the costophrenic angle, absence of a sharp hemidiaphragm or presence of a hemopneumothorax, only 25–50% of the initial chest roentgenograms are diagnostic for diaphragmatic rupture or injury. The likelihood of a false-negative chest roentgenogram appears higher in patients with penetrating injuries, probably because larger defects in seen blunting traumas. CT scan is second choice of imaging technique, although the axial-oriented diaphragm is not always well demonstrated by conventional CT. Success rates from 0 to 100% have been reported. CT scan may readily demonstrate the herniation of the abdominal viscera in the thorax but may not be able to directly image the diaphragmatic lacerations that lie in different scan planes. As compared with the results of initial chest X-ray, CT scanning seems to offer no advantage, statistical analysis did not show a significant difference between the two diagnostic tools. In the case presented, insufficient initial evaluation with an X-ray caused the physicians to overlook the diaphragmatic hernia and existence of the gut inside thoracic cavity and this led to iatrogenic traumatization of the organ. After 36 h, a second X-ray revealed the fundal gas collection over left hemidiaphragmatic area. Trauma to the herniated stomach was diagnosed by CT with oral contrast which scattered to the thoracic cavity. The situation was verified intraoperatively.

Repair of the diaphragmatic ruptures or hernia can be done by classical open method or with minimally invasive methods. Open exploration can be done through the abdominal or the thoracic route. In contrast to acute diaphragmatic injuries or ruptures, in which a transabdominal approach is highly
recommended because of the associated injuries, many authors prefer a thoracotomy to reduce the hernia and repair the diaphragm.\textsuperscript{17,9,2,4,18,3} Laparoscopy and thoracoscopy in the acute setting are discussed controversially. They may offer a good chance for minimal access diagnosis and repair of the injured diaphragm.\textsuperscript{8} The videothoracoscopic approach can be beneficial to hemodynamically stable patients, but one has to be aware of possible complications due to insufficient diagnosis of abdominal injury. Hence, proper evaluation and indication as well as a more careful postoperative observation are essential.\textsuperscript{25}

Koehler and Smith\textsuperscript{16} used thoracoscopy to repair penetrating diaphragmatic rupture in two patients. They suggested that combined thoracoscopy and laparoscopy may offer both therapeutic as well as diagnostic benefit in selected stable patients with penetrating injuries to the upper abdomen and lower chest. We preferred abdominal approach as the case was not only a traumatic diaphragmatic hernia but was further complicated by gastric trauma, obstruction and fistulization. This approach was thought to be more suitable for hernia reduction, gastric repair and diaphragmatic hernia closure.

One of the most serious complications of diaphragmatic rupture is coexisting perforation of a hollow viscus, which contributes to the development of intra-abdominal abscesses and empyema thoracis. Vigorous irrigation of the thoracic cavity and abdomen during operation and adequate drainage are extremely important if there has been a perforation of a hollow viscus.\textsuperscript{24} In our case, a left sided pneumonia existed despite vigorous irrigation and sufficient drainage.

Conclusion

We conclude that in penetrating trauma to the upper abdomen or lower chest, an acute diaphragmatic rupture and visceral herniation should always be kept in mind and investigated before attempting a ICD tube. If an iatrogenic visceral trauma occurs, emergency surgery with an abdominal approach is a suitable way of successful management.

References