

Delayed presentation of diaphragmatic rupture after blast injury

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ABSTRACT

A diaphragmatic injury is usually associated with injury to thoracic or abdominal organs due to blunt or penetrating trauma, and is uncommon after blast injury. We describe a patient with respiratory distress due to herniation of the stomach into the chest through a diaphragmatic injury, sustained 1 year previously when he suffered a blast injury while on deployed military operations, but without obvious visceral injury at that time. At emergency laparotomy there was a gastric perforation which was exteriorised as a gastrostomy and the diaphragmatic rupture closed. Postoperative pneumonia and pelvic abscess were both treated successfully and he left the hospital in good condition. Delayed treatment of traumatic diaphragmatic injury leads to an increased risk for herniation and/or strangulation of abdominal organs, which can be life-threatening. Recognising the symptoms indicating diaphragmatic injury is especially important in cases in which the relationship to previous trauma is less clear.

INTRODUCTION

Diaphragmatic injury is uncommon and remains a diagnostic and therapeutic challenge. Its presentation ranges from acute haemodynamic instability to gastrointestinal problems and respiratory insufficiency years later.^{1 2}

Early recognition is of great importance because of its possible life-threatening consequences. We describe a patient with respiratory distress due to a diaphragmatic rupture in which the stomach herniated into the thoracic cavity 1 year after he suffered a blast injury from an improvised explosive device (IED) detonation, after which no injuries to the thorax or abdomen were suspected.

CASE REPORT

A previously fit and well 29-year-old male soldier complained of shortness of breath, pain in the epigastrium, nausea and vomiting in the emergency department; he had experienced these symptoms in a milder form before, but they had worn off spontaneously. No cause had been identified. While deployed 1 year previously to Afghanistan, he was exposed to an IED blast, but according to the patient suffered no obvious injuries to his thorax, abdomen or limbs: no further information about the assessment after the blast injury was available. Chest examination showed diminished percussion on the left side and absence of breath sounds and abdominal examination of the abdomen revealed normal bowel sounds and no signs of peritoneal irritation. A plain chest radiograph was thought to suggest pleural empyema (Figure 1) and it was not until a CT scan of the thorax showed an

Key messages

- ▶ Delayed presentations after diaphragmatic injury are not uncommon.
- ▶ Diaphragmatic injury following blast injury is rare.
- ▶ Diaphragmatic hernias should be repaired to prevent subsequent obstructive symptoms.

intrathoracic stomach, mediastinal shift to the right and no obvious left hemidiaphragm that diaphragmatic rupture was considered (Figure 2).

Due to his worsening respiratory insufficiency and the risk of gastric strangulation, operative repair of the diaphragm was decided and because of both the experience of the surgeon and the risk of gastric perforation an abdominal approach was chosen. This necessitated inter-hospital transfer and 3 h after presentation, immediately prior to induction of anaesthesia for surgery, he became acutely shocked with a sudden increase in abdominal pain consistent with visceral perforation.

At laparotomy, stomach content was seen leaking from the pleural cavity into the abdomen, there was a 15 cm left sided diaphragmatic rupture, mostly in the muscular part (Figure 3), the stomach and spleen were both in the left chest and there was a perforation of the greater curvature of the stomach (Figure 4). The organs were repositioned in the abdomen and the gastric perforation closed around a gastrostomy tube. The diaphragm was closed without tension using a PDS loop and some non-absorbable sutures after thorough thoracoabdominal lavage, with large bore drains above and below the diaphragm.

Despite postoperative antibiotics the patient developed a left sided pneumonia, which did resolve with further antibiotics, and a pelvic abscess, which was drained. The patient then recovered quickly and finally left the hospital in a good condition.

DISCUSSION

The first ante-mortem report of traumatic diaphragmatic injury (TDI) was described by Bowditch in 1853.³ Analysis of the data from the National Trauma Data Bank (NTBD) showed an incidence of 0.63% of TDI and in these cases a left sided injury is recorded three times more often than a right.⁴⁻⁶ A recent study showed that 3% of patients hospitalised after a blast injury had an abdominal injury (range 1.3%–33%).⁷

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Case report

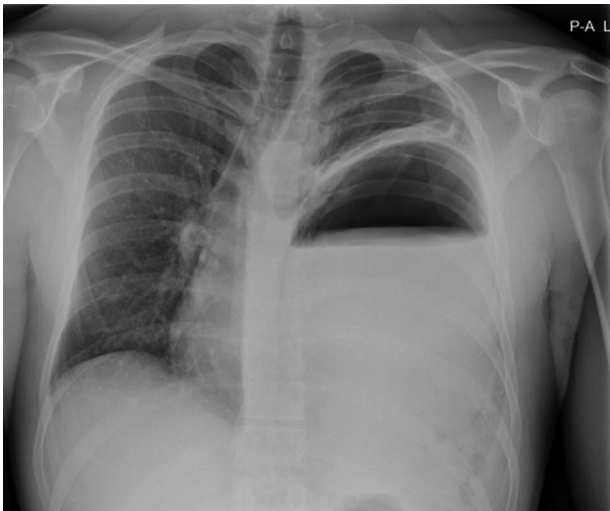


Figure 1 Erect chest x-ray showing almost complete atelectasis of the left lung with a large amount of fluid in the left hemi thorax and mediastinal shift to the right.

The presentation of diaphragmatic injury varies from mild symptoms to life-threatening situations due to bowel obstruction and ischaemia or pulmonary distress in complicated cases.²⁻⁸ Grimes described three distinct phases of presentation of TDI: the acute phase with respiratory and haemodynamic instability; a latent phase with symptoms of decreased functional capacity of the thorax due to the movement of intra-abdominal contents in the thoracic cavity; and the obstructive phase which occurs months to years after the injury when herniated viscera become obstructed or strangulated.⁹ The complaints of our patient correspond best with the obstructive phase, which was confirmed by the radiological examination and laparotomy.

Patterns of injury after blast injury are described in recent literature. One of the pitfalls in those cases is that during the initial assessment, subtle or slowly evolving clinical signs and intra-abdominal organ injuries might be overlooked; in addition,



Figure 2 CT scan of the chest after intravenous contrast. There is an extremely dilated stomach in the left hemi thorax with atelectasis of the left lung and mediastinal shift to the right.

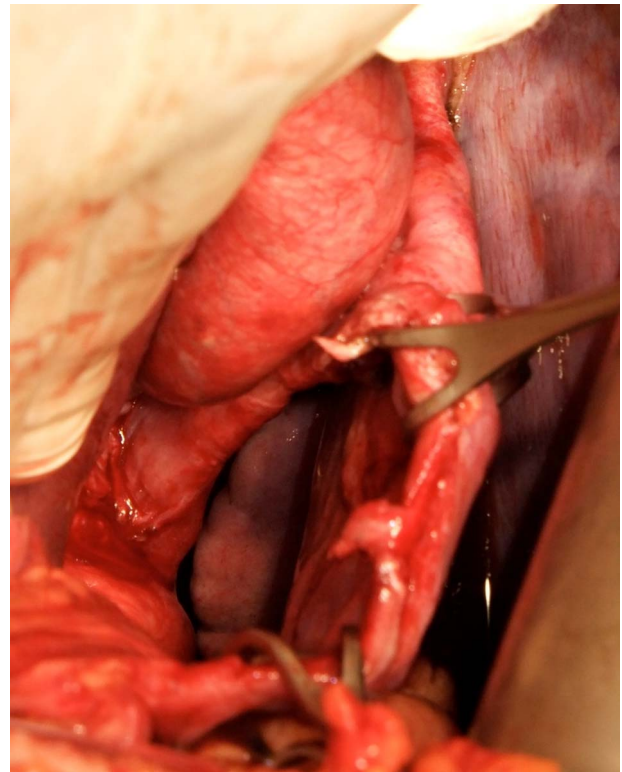


Figure 3 Operative photograph showing the ruptured diaphragm exposed between the two clamps. The lower lobe of the left lung is visible through the damaged diaphragm.

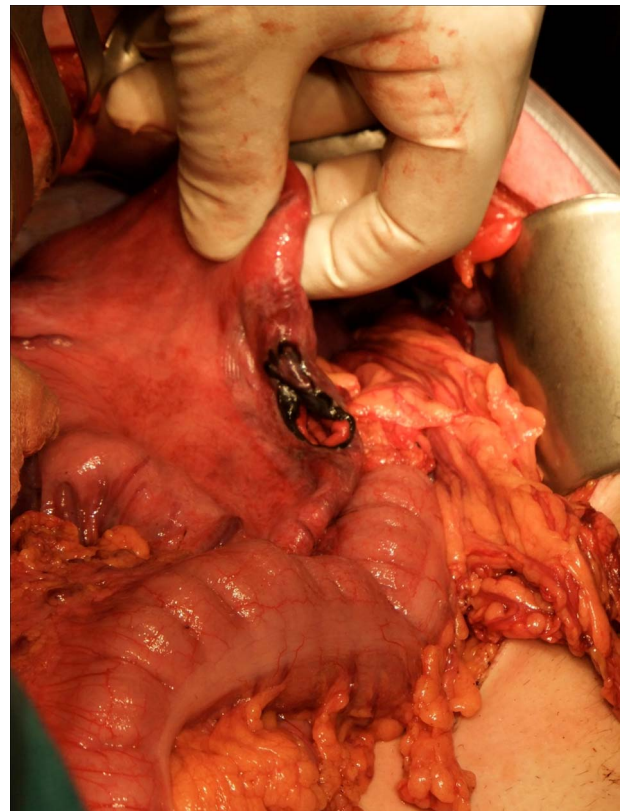


Figure 4 Operative photograph showing the perforation of the greater curvature of the stomach.

the damage from blast or indirect ballistic injury can have a delayed presentation.^{7–10} The specific delayed presentation of diaphragmatic rupture complicated with herniation of the stomach over 1 year after blast injury has not been described in the literature before.

Diagnosing injury to the diaphragm is challenging due to the wide variety of symptoms and the difficulties of recognising injury on radiological examination.¹¹ With a sensitivity of approximately 80% the CT scan is the most accurate diagnostic instrument to diagnose TDI.¹² Patients who are suspected to have TDI but have inconclusive image studies should undergo a diagnostic laparoscopy or thoracoscopy.^{13–15}

TDI has an overall morbidity of 30%–68%, with herniation and strangulation of abdominal viscera and pulmonary problems being the most common complications.^{16–17} Patients with diaphragmatic injury after a blunt trauma have a higher risk of complications (60%) compared with patients with TDI after penetrating trauma (40%).¹⁸

The surgical repair of the diaphragm can be done by either an abdominal or thoracic approach and there is no evidence as to which is the best approach for haemodynamically stable patients. It has been suggested that acute right sided injuries and chronic hernias should be approached through the right chest and left sided injuries should be approached through the abdomen.¹⁹ The choice of approach is also heavily dependent on the experience and speciality of the operating surgeon.²⁰

The injured diaphragm can be closed directly, with absorbable or non-absorbable sutures, or in larger defects with use of a mesh graft²¹ and the treatment of the traumatic diaphragmatic hernia does not differ from the treatment of congenital or other diaphragmatic hernias.

The overall mortality rate, based on data of the NTBD, is approximately 25%.⁴ The mortality rate for delayed presentation of TDI of patients with incarceration of herniated gastrointestinal viscera is 20%, going up to 40%–57% when strangulation occurs.²²

CONCLUSIONS

We describe a patient with TDI complicated with herniation and strangulation of the stomach presenting over 1 year after a blast accident after which the initial assessment immediately after the blast accident showed no signs of diaphragmatic injury. The absence of visible injuries after blast injury combined with a delayed presentation of diaphragmatic rupture with gastrointestinal herniation has seldom been reported.

Delayed diagnosis and treatment of TDI is associated with an increased risk for herniation and strangulation of abdominal organs, which can be life-threatening. Recognition of symptoms

indicating diaphragmatic injury is especially important when the relationship to a trauma is less clear.

Contributors All authors contributed to: conception and design, or analysis and interpretation of data and figures; drafting the article or revising it critically for important intellectual content; and final approval of the version to be published.

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