CASE REPORT

Laparoscopically assisted repair of an acute traumatic diaphragmatic hernia

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SUMMARY

A 60-year-old man with chronic obstructive pulmonary disease and a heavy smoker and drinker presented to the emergency department with left-sided thoracoabdominal pain after falling down the stairs. Initial clinical findings were left-sided chest tenderness with no clinical evidence of subcutaneous emphysema. Twenty-four hours later the patient's respiratory distress increased—repeat chest X-ray showed a left gastrothorax indicative of a ruptured left hemi diaphragm. Diagnostic laparoscopy in the supine position via an umbilical port confirmed the presence of the stomach, spleen and splenic flexure of the colon in the left chest. Laparoscopic reduction of the stomach and colon was performed, but a small upper midline incision was required to reduce the spleen without injury. The diaphragmatic tear was repaired by direct open suture. The patient required a brief period of postoperative ventilation via a tracheostomy. The patient remained well at a 3-month follow-up visit.

CASE PRESENTATION

A 60-year-old man who was a heavy smoker and drinker presented to the emergency department (ED) with a left-sided thoracoabdominal pain after falling down the stairs while drunk. The patient was documented to have a brief seizure on arrival in the ED possibly related to alcohol withdrawal. The patient was assessed according to ATLS protocols and initial clinical findings were left-sided chest tenderness only.

There was no clinical evidence of subcutaneous emphysema, breath sounds were equal in both hemithoraces and no bowel sounds were heard in the chest. Abdominal examination was unremarkable and the Glasgow Coma Score was 15/15.

INVESTIGATIONS

Initial trauma radiographs demonstrated fractures of the left third, fourth, seventh and eighth ribs without pneumothorax. Head CT scan was normal.

TREATMENT

The patient was transferred to the high dependency unit for respiratory support and a thoracic epidural for analgesia, given his medical history of significant chronic obstructive pulmonary disease. The next day his oxygen requirements steadily increased despite effective epidural analgesia and he developed widespread left-sided surgical emphysema (figure 1). Left-sided tube thoracostomy improved his respiratory symptoms initially. Twenty-four hours later his respiratory distress increased and overall clinical condition deteriorated—repeat chest X-ray showed a left gastrothorax indicative of a ruptured left hemidiaphragm (figure 2).

BACKGROUND

Traumatic diaphragmatic injury (TDI) is uncommon,¹ life-threatening and remains a diagnostic and radiographic challenge with an overall mortality rate of up to 31% in recent series.² It may remain unrecognised after trauma, and only present years later with strangulation of an incarcerated abdominal viscus or respiratory compromise owing to reduce intrathoracic volume.³

Once diagnosed left-sided diaphragmatic hernia should be repaired to reduce the risk of subsequent complications and there are many large series of this being achieved through either the chest⁴ or the abdomen⁵—the choice being largely dependent on the skill set of the surgeon involved.⁶

Laparotomy for diaphragmatic repair often necessitates an extensive upper midline incision, which is associated with reduced respiratory effort after surgery and an increased risk of infective chest complications, especially in those with pre-existing lung disease.⁷ The advent of laparoscopy has provided a potential method of minimising these surgical incisions, but reports of laparoscopic or laparoscopic-assisted repair of diaphragmatic hernia are scarce and are generally limited to chronic post-traumatic or congenital hernias.⁸

We report a case where acute laparoscopically assisted repair of a traumatic left diaphragmatic rupture with multivisceral incarceration allowed maximisation of impaired respiratory function while achieving a good surgical outcome.

Figure 1 Chest X-ray from the first postinjury day demonstrating left side surgical emphysema.

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Figure 2 Chest X-ray from second postinjury day demonstrating a left gastrothorax.

Diagnostic laparoscopy in the supine position via an umbilical port confirmed the presence of the stomach, spleen and splenic flexure of the colon in the left chest (figure 3). Laparoscopic reduction of the stomach and colon was performed using ports in the left and right hypochondria and left iliac fossa, but a small upper midline incision was required to reduce the spleen without injury. The diaphragmatic tear was repaired by direct open suture (figure 4).

OUTCOME AND FOLLOW-UP

Owing to the patient's significant emphysema he required a brief period of postoperative ventilation via a tracheostomy and the thoracic epidural remained for 6 days; he stayed in the critical care ward for 20 days in total. He was eventually discharged without residual effects 28 days after his injury. He remained well both clinically and radiologically at a 3 month follow-up visit with no worsening of his lung function.

DISCUSSION

Diaphragmatic rupture occurs in approximately 2.1% of blunt and 3.4% of penetrating throacoabdominal trauma.¹ In areas where interpersonal violence is uncommon such as the UK, 80–90% of cases are owing to motor vehicle collisions and three quarters are left-sided.⁹ During initial assessment for trauma most casualties will have a chest radiograph taken and the presence of bowel loops within the chest is a hard sign of diaphragmatic injury² although the diagnostic accuracy of a plain chest radiograph is four times higher for left-sided injury

Figure 3 Laparoscopic view of the spleen (yellow arrow) wedged into the diaphragmatic defect (white arrows).

Figure 4 Laparoscopic view of the diaphragmatic defect (circled).

compared to injury on the right.¹⁰ Between 20–50% of patients who are later found to have a traumatic diaphragmatic injury have their initial trauma chest radiographs described as normal.⁹ Diagnostic yield is increased by serial radiographs as a diaphragmatic defect itself will not show up on a plain chest X-ray and it is often only when the intrathoracic and abdominal pressures equalise that abdominal viscera herniate through the defect.¹¹ CT scanning has traditionally been regarded as insensitive for the diagnosis of diaphragmatic injury owing to movement artefact, but the advent of faster multislice CT scanners can image the diaphragm in a single breath hold and this has been credited with increasing the sensitivity of TDI by CT scanning¹² and numerous CT signs have been described.² The key to the diagnosis of TDI remains a high index of suspicion.¹³

Diaphragmatic repair is by direct suture with or without mesh reinforcement¹; large defects can be bridged by synthetic mesh¹⁴ and recurrence after repair is uncommon.⁸ Laparoscopic stapling of the peritoneum is as effective as laparoscopic suturing or open repair in terms of healing and tensile strength in an animal model of TDI.¹⁵ The primary endpoint reported in most series is mortality, which is generally related more to the burden of associated injury than to the cardiorespiratory compromise of the diaphragmatic injury itself.⁵

A review of 11 recent case series (1999–2010)² included 733 cases of TDI and reported an average mortality of 14.5% (range 0–31%). Of the 535 cases that were operated on, 396 were repaired via laparotomy, 96 by thoracotomy and only 38 required both cavities to be accessed. Five cases were repaired laparoscopically. The approach to surgery is dictated by the speciality of the treating consultant and the expectation of where the significant injuries are located.⁶ One study reporting 86 patients who underwent surgical repair primarily used an abdominal approach and only one of 65 patients also required thoracotomy to complete the repair compared with 7 of 15 patients who had thoracotomy first and then required laparotomy.¹⁶

The first report of laparoscopy in TDI was from Adamthwaite in 1984 who laparoscoped 10 patients with presumed TDI, two laparoscopies were negative saving them from laparotomy—the remaining eight underwent diaphragmatic repair at laparotomy,¹⁷ while the first therapeutic laparoscopy in TDI was reported in 1994.¹⁸ Experience with laparoscopic repair of TDI has focussed principally on repair of either congenital hernias or chronic post-traumatic hernia⁸ and there are less than 50 reported cases of laparoscopic repair of an acute TDI during the initial hospital admission. The two largest series are Zantut *et al*'s¹⁹ report of 16 cases, some of which will predate Frantzides report,¹⁸ although details of individual cases are not reported and the series of Matthews *et al*¹⁴ which described

17 hernia repairs, eight of which were acute and six completed laparoscopically. The commonest herniated viscera are the stomach, colon and spleen. In most reported cases these have been easily reducible, although one report describes having to extend the diaphragmatic defect to allow reduction,²⁰ while another performed splenectomy of an irreducible herniated spleen in a chronic post-traumatic hernia.²¹

Learning points

- ▶ Traumatic diaphragm injury (TDI) is uncommon and carries a significant mortality, usually from associated injuries.
- ▶ There is a high incidence of missed TDI which give rise to significant delayed morbidity and mortality.
- ▶ Repair of TDI traditionally involves either a high-midline abdominal or thoracic incision which reduce respiratory effort owing to pain and leads to infective complications.
- ▶ Reports of laparoscopic repair of TDI are uncommon.
- ▶ We recommend laparoscopic assessment of an acute diaphragmatic rupture and laparoscopic repair if possible.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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