

Brief Clinical Report

Laparoscopic Repair of a Penetrating Injury to the Diaphragm: A Case Report

CONSTANTINE T. FRANTZIDES, M.D., Ph.D., F.A.C.S.
and MARK A. CARLSON, M.D.

ABSTRACT

A traumatic diaphragmatic hernia that appears late may have a fatal outcome. Traditionally, the most sensitive diagnostic modality for diaphragmatic injuries has been laparotomy. This results in unnecessary laparotomies. Laparoscopy is now an alternative method for the diagnosis and treatment of numerous intraabdominal disorders. We present a case of a penetrating diaphragmatic injury that was diagnosed and repaired via the laparoscope.

INTRODUCTION

DIAPHRAGMATIC INJURY WAS FIRST DESCRIBED in the sixteenth century and was first repaired successfully in the nineteenth century.¹ Traumatic diaphragmatic hernia from blunt injury tends to be identified more often in the acute setting than does hernia from penetrating injury because the former often has visceral injury requiring laparotomy.² A latent diaphragmatic hernia that strangulates usually originates from penetrating injury.³ Penetrating injury of the diaphragm predominantly involves the left side, apparently because of the protective effect of the liver on the right and because of the right-handedness of knife-wielding assailants.⁴ The diagnosis of an occult penetrating diaphragmatic injury is difficult without operation, and hence some injuries may go undetected for years.^{5,6} Latent recognition of a traumatic diaphragmatic hernia has been associated with a 20%–36% mortality.^{6,7}

With the advent of laparoscopy in abdominal surgery, there has been renewed interest in the use of the laparoscope in screening for traumatic diaphragmatic hernia⁸ and other abdominal trauma.⁹ Laparoscopic treatment of abdominal trauma is also feasible, as we reported recently in a case of laparoscopic closure of gastric stab wounds.¹⁰ The laparoscope may represent a modality by which, for selected patients, abdominal injury may be diagnosed and treated. This is the first report of laparoscopic closure of a penetrating injury to the diaphragm.

CASE REPORT

JS, a 38-year-old man, suffered a stab wound to the left flank. His initial systolic blood pressure at the scene of the assault was 80 mm Hg. The paramedics administered 1500 mL of intravenous fluids enroute to the hospital, and the patient became and remained normotensive. He complained of shortness of breath and left flank pain. His past medical history was remarkable for seizure disorder secondary to a gunshot wound to the left temple suffered 20 years before admission. He took phenytoin (Dilantin).

On physical examination, the patient had a 2-cm wound in the left eleventh intercostal space in the midaxillary line. Breath sounds were equal bilaterally. The abdomen was flat, soft, and nontender. The hematocrit was 36. Abdominal and chest radiographs were unremarkable.

The patient was taken to the operating room for exploratory laparoscopy under general endotracheal tube anesthesia. Because diaphragmatic injury was a possibility, the patient's abdomen and thorax were prepared in anticipation of a need for chest tube placement. An infraumbilical curvilinear incision was made, and the peritoneum was entered under direct view. Two traction sutures were placed on either side of the linea alba opening, and a Hasson trocar was inserted. CO₂ pneumoperitoneum was established and maintained at 12 mm Hg. The laparoscope was inserted, and a 5-cm laceration of the left hemidiaphragm was observed with some omentum herniating into it. At this point in the operation, two additional trocars were placed (Fig. 1) to facilitate further exploration of the intraabdominal organs. Exploration of the left upper quadrant, including visualization of the colon, the anterior portion of the spleen, and the stomach, did not reveal any other intraabdominal injury. Attention was then turned to the diaphragmatic tear, and the herniating omentum was reduced back to the abdomen with an atraumatic grasping forceps. The laceration was closed in two layers with the placement of staples first to the pleura and then to the muscle and peritoneum with a hernia stapler. The patient developed a left tension pneumothorax while on the operating table, and a left tube thoracostomy was performed. The patient's postoperative course was unremarkable. He was discharged home on the third postoperative day. At 10 months follow-up, chest x-rays, CT scan, and fluoroscopy were performed and demonstrated good diaphragmatic function without evidence of diaphragmatic hernia.

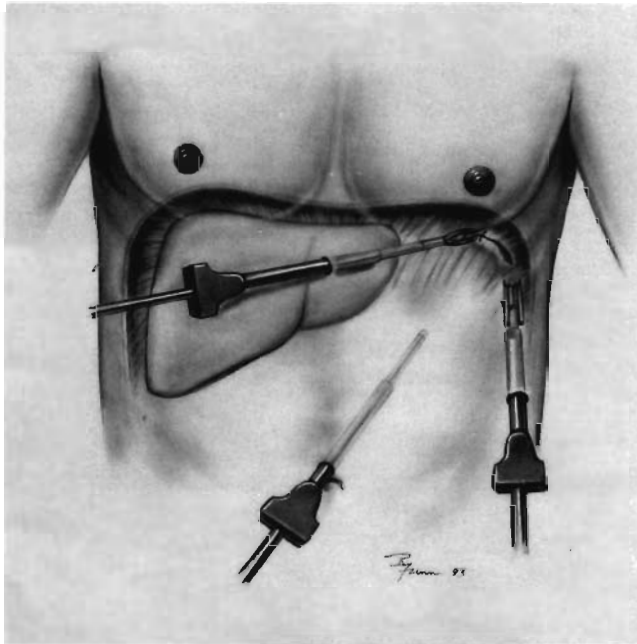


FIG. 1. Diagrammatic representation of the diaphragmatic perforation repair using the hernia stapler.

DISCUSSION

Approximately 5.8%–8% of patients undergoing laparotomy for abdominal trauma will have a diaphragmatic injury.¹¹ In the patient with nonoperatively managed penetrating abdominal trauma, occult injuries to the diaphragm are difficult to diagnose. Physical examination, chest radiographs, CT, and diagnostic peritoneal lavage have low sensitivity.⁷ Stab wounds to the upper abdomen and lower chest to the level of the fourth intercostal space may result in diaphragmatic injury.¹¹ Once a hole is made in the diaphragm, there may be as much as 100 cm of water pleuroperitoneal pressure gradient (during deep inspiration), which can force intraabdominal contents into the chest.¹² The colon, stomach, omentum, and small bowel are herniated in decreasing order of frequency.¹³ Latent herniation with obstruction is well described, and subsequent strangulation is fatal in up to 80% of patients.⁶

To eliminate the dread consequence of a latent strangulated diaphragmatic hernia, some authors have advocated routine abdominal exploration for penetrating trauma in the upper abdomen and lower chest to evaluate for diaphragmatic injury.⁷ With this protocol, all but 1 of 18 traumatic hernias were found and repaired in the acute phase. The authors conceded, however, that their protocol resulted in a 31% unnecessary laparotomy rate. They believe that this rate was acceptable, since they could prevent latent herniation.

Laparoscopy has been used in some series to evaluate both blunt and penetrating abdominal trauma.^{14–17} The authors demonstrated that in selected stable patients, unnecessary laparotomy was avoided by performing laparoscopy. Laparoscopy has been used to determine peritoneal penetration of tangential gunshot wounds.¹⁸ In another series with 39 stable blunt and penetrating trauma patients, laparoscopy was performed before planned laparotomy.⁹ Injuries to the diaphragm, colon, liver, and retroperitoneum were diagnosed via the laparoscope, but not with 100% sensitivity. Splenic and small bowel injuries seen with laparotomy were not observed with laparoscopy. The extent of hemoperitoneum was underestimated with laparoscopy. The authors concluded that laparoscopy was useful under selected conditions not involving the spleen or small bowel and without major hemorrhage.

In patients with diaphragmatic lacerations, positive intraabdominal pressure may be transmitted to the pleural cavity, resulting in a tension pneumothorax as seen in our patient. Trauma patients, therefore, undergoing laparoscopy should have their chest prepared and draped, and the necessary instruments and tubes for an emergency chest decompression should be kept close at hand.

We have shown with this and our previous case report¹⁰ that a penetrating abdominal injury may be diagnosed and repaired via the laparoscope. The occult diaphragmatic injury requires direct visualization for early diagnosis. Laparotomy and laparoscopy both can accomplish this, but laparoscopy should prove to have less morbidity than laparotomy. Laparoscopy, therefore, may become the modality of choice for ruling out occult diaphragmatic injury.

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Address reprint requests to:
Constantine T. Frantzides, M.D., Ph.D.
Associate Professor of Surgery
Medical College of Wisconsin
Froedtert Memorial Lutheran Hospital
9200 West Wisconsin Avenue
Milwaukee, WI 53226