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Repair of Chronic Post-traumatic Diaphragmatic Hernia by Laparoscopic Surgery

Paisal Pongchairerks, MD, FRCST, FICS
Department of Surgery, Ramathibodi Hospital, Rama VI Road, Bangkok 10400,Thailand
E-mail: paisa12@hotmail.com

Abstract **Traumatic ruptures of the diaphragm can be diagnosed in the acute and chronic phases after penetrating or blunt injuries. All diaphragmatic hernias must be repaired once diagnosed. At present, laparoscopic or thoracoscopic repairs can be effective in patients who are not in serious hemodynamic conditions. Two patients who developed symptoms of gastrointestinal obstruction of short duration following a blunt and a penetrating trauma 15 months and 30 years previously were reported. The herniated structures were stomach and omentum in one patient and splenic flexure of colon and omentum in the other. Laparoscopic surgery was successful in reducing the herniated viscera, lysis of adhesion and repairing of the diaphragmatic defect using simple sutures with silk. Medium-term follow-up in one patient and long-term follow-up in the other revealed normal chest x-rays in both of them and were symptom free. Laparoscopic repair is an effective means of treatment for chronic diaphragmatic hernias.**

Rupture of the diaphragm can be the result of either penetrating or blunt injury of the abdomen as well as the thorax. A relatively large perforation of the diaphragm usually is associated with respiratory distress symptom and requires urgent operative correction. However, small defect of the diaphragm without significant injury to other intra-abdominal or intra-thoracic organs, can be present unnoticed for a long time until symptoms and signs of herniation of intra-abdominal viscera show up.

Most traumatic ruptures of the diaphragm involve the left hemidiaphragm with a ratio of about 9:1.[1] Conventionally, laparotomy is indicated in all patients with this diagnosis in order to manage the associated injuries and to prevent further complication caused by the diaphramatic herniation. When the diaphramatic injury is missed during the early post-trauma period without associated intra-abdominal injury, a repair through thoracotomy approach has been recommended because "it provides better exposure in reducing the herniated contents, freeing adhesions between abdominal viscera and intra-thoracic structures, and repairing the defect of the diaphragm."[1] In the present era of minimally invasive surgery, laparoscopy is a useful means for diagnosis and treatment of diaphragmatic rupture even during the acute phase if the patients are not in shock.[1-3] For chronic diaphramatic hernia, advocates have been made to employ either laparoscopy[3-5] or thoracoscopy[6] or even both.[7]

In this report, two consecutive patients with chronic traumatic diaphragmatic hernias were presented. Both of them had delayed diaphragmatic hernias that were repaired by laparoscopic method.

Case Report

Case 1

A 41-year-old man was admitted from the emergency room on December 15, 1998 because of vomiting after each meal for 4 days. During this period he could not even take liquid. The vomitus was not bilious and occurred immediately after swallowing. Plain film of the chest showed only elevated left

hemidiaphram with both lungs appeared normal. There was no evidence of hollow viscera in the chest. This patient was a victim of a severe car accident 15 months previously, which left him paraplegic due to fracture of lumbar spines. He underwent fusion and Harrington rod insertion to immobilize the spine from T7 to L1 on September 6, 1997. Despite several hospital admissions due to recurrent infection, he never complained of abdominal pain or vomiting prior to this admission.

A barium study of the esophagus and stomach showed a dilated esophagus and the stomach with deviated axis suggestive of gastric volvulus. However, from the clinical setting, a ruptured diaphragm with gastric herniation could also be a possibility. On December 25, 1998 a diagnostic laparoscopy was performed. It was found that the gastric fundus and body had herniated into the left chest through a rupture of the tendinous part of the left hemidiaphragm. The spleen remained in the abdomen. There was moderate adhesion of the greater omentum to the left lung and also the edge of the defect of the hemidiaphragm. The defect measured about 6 cm in size and situated at the central part of the left hemidiaphragm.

Case 2

A 38-year-old female was referred from a provincial hospital on January 28, 1999 because of colicky pain in her mid-abdomen associated with vomiting and obstipation for 5 days. She had a distended abdomen with hyperactive bowel sounds. Thirty years ago she received a butted wound at her left chest by a buffalo that caused air leakage from her chest for a short time then subsided spontaneously without specific treatment. She had Cesarean section 5 years previously without any complication. Plain films of the chest and abdomen at this admission showed dilated proximal large bowels up to the left upper quadrant with elevated left hemidiaphragm and a small air bubble in the left lower chest (Figure 1). Barium enema revealed complete obstruction at the splenic flexure without any filling defect (Figure 2).

The patient underwent laparoscopic exploration the following day and was found to have splenic flexure and more than half of the greater omentum herniated into the left chest through a 4-cm defect situated on the anterior muscular part of the left hemidiaphragm.

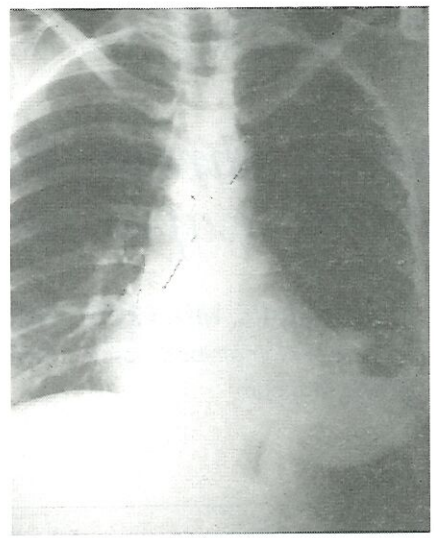

Fig. 1 Plain film of the chest of Case 2 at admission showing elevated left hemidiaphragm and a small air bubble in the left chest. Note also the dilated colon in the abdomen.

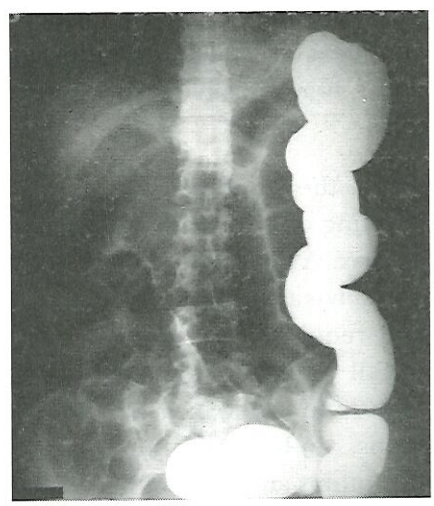

Fig. 2 Barium enema of Case 2 at admission showing complete colonic obstruction without filling defect

The spleen and stomach remained in the abdomen. There was no adhesion to the lung or intra-thoracic structure. The omentum only firmly adhered to the edge of the defect.

Operative technique

Under general anesthesia, open technique of laparoscopy was carried out via an infraumbilical incision. Pneumoperitoneum was created by insufflation of carbon dioxide to maintain a constant intra-abdominal pressure of 12 mmHg with the patient in

reverse Trendelenburg position. In each case, the evisceration of the involved viscera was seen from the abdominal side first. Using atraumatic graspers or Babcock forceps, the herniated part of the stomach (in Case 1) and omentum with the colon (in Case 2) were reduced into the abdomen without difficulty. The laparoscope was then advanced into the thoracic cavity to visualize intra-thoracic situation. Adhesion of the omentum to the lung and the edge of the defect in the diaphragm was carefully separated using Harmonic scalpels. Dissection of the diaphragm was continued until the edge of the defect was completely clear. An intercostal tube drain was inserted under laparoscopic view. The edge of the diaphragmatic defect was then closed with simple sutures of No. 0 silk placed intracorporeally. Operating times were 165 minutes in Case 1 and 130 minutes in Case 2. Intraoperative blood loss was minimal in Case 1 and there was some bleeding from the surface of the spleen in Case 2. There was no cardiopulmonary compromise caused by the pneumoperitoneum in either case.

Postoperative course

Oral fluid was allowed on the third and second postoperative days in Case 1 and Case 2, respectively. The postoperative course in each patient was uneventful and both of them left the hospital on the sixth postoperative day.

In Case 1, a chest x-rays taken at one month and 8 months later revealed normal finding (Figure 3). Subsequently, he underwent another surgical procedure in September 1999, which was 9 months after repair of the diaphragmatic hernia, for reconstruction of his spinal cord defect. This latter surgery consisted of harvesting greater omentum for the coverage of the exposed spinal cord after a microscopically nerve grafting of Sural nerve to bridge the transected spinal cord. The patient tolerated the operation well and no evidence of recurrent diaphragmatic herniation was observed at time the surgery. At a follow-up session one year after the neurosurgical procedure, the patient was well in terms of his pulmonary and gastrointestinal functions.

In Case 2, a follow-up chest x-ray 3 months after the operation (April 12,1999) showed normal finding and then the patient has not come back again. A follow-up questionnaire revealed her to be in good health.

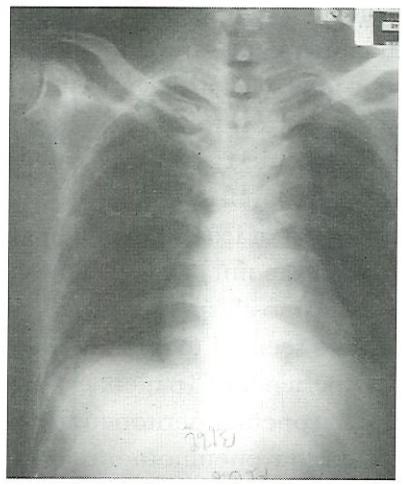

Fig. 3 Plain film of the chest in Case 1 at 8 months after surgery

Discussion

The diagnosis of a chronic diaphragmatic hernia could be difficult especially when the injury occurred long ago. In the first case, the symptom suggested gastric obstruction but the barium study incorrectly diagnosed the problem as a "gastric volvulus". This diagnosis was also entertained in a case reported by Domene in 1996.[5] In the second case the patient presented with colonic obstruction of short duration even though the trauma happened 15 years ago. The only clue in this patient was the air bubble seen in the lower left chest in her chest x-ray. Both patients never had any symptoms that suggested diaphragmatic rupture during the period of a long history. Interestingly, both had undergone major operative procedure some time in between the time of their trauma and the occurrence of symptoms without being noticed of the diaphragmatic hernias. When the defect was small, the intra-abdominal viscera could only be gradually sucked into the thoracic cavity by the negative pressure. As time went on until the time when significant amount of structures had herniated through the defect and became obstructed by the hernial ring, the patients then experienced clinical symptoms. This explained why both of them had severe symptoms only in short period of time prior to their clinical presentation.

Before the era of laparoscopic surgery, this condition was treated by laparotomy when associated intra-abdominal visceral injury was suspected; and by thoracotomy when isolated diaphramatic injury was diagnosed. There is no doubt that laparoscopy has a

beneficial role in the diagnosis and treatment of traumatic diaphragmatic hernia in proper situations in the present time. It has been well accepted that laparoscopy, in contrast to thoracoscopy, should be preferred in the acute cases, especially when there were associated abdominal signs. The choice between laparoscopy versus thoracoscopy in other situation has been a controversial point in the literature. So far the literature revealed mostly sporadic single case reports. The largest series seemed to be that of Meyer which reported the experience of 3 patients.[4] Some surgeons were cautious that pneumoperitoneum in laparoscopy would cause tension pneumothorax during surgery should there be existing communication of the abdomen and the thoracic cavity, and thus preferred thoracoscopic approach in this situation.[8-10] Others had proved the safety of creating pneumoperitoneum in cases of diaphragmatic hernias when the patients were stable hemodynamically.[3-5] In this series, it was confirmed that pneumoperitoneum of 12 mmHg was not harmful to the patients. The viscera (stomach, omentum and colon) could readily be reduced into the abdomen. Although in this report the spleen did not herniated into the chest; but in the patients reported by others[4,5,11] the spleen, liver, small intestine and gallbladder had been found to herniate through the defects and were all successfully reduced and repaired. The laparoscope could be advanced into the thoracic cavity to visualize intra-thoracic structures to make certainty and the surgeon could correct any associated pathology seen, notably adhesions as were mentioned in all reports including the present series. However, I agree that for a right-sided diaphragmatic hernia, thoracoscopic approach would probably be preferable since the right hepatic lobe would have obscured the view and hindered the manipulation of the laparoscopic instruments.

There has been another controversy in this condition, and that is whether a hernia stapler should be used to close the diaphragmatic defect so that the operating time can be markedly reduced.[3,9] However, I agree with Meyer, who presented 3 cases,[4] that simple suturing with non-absorbable materials should be used in the same manner as conventional operation. Although the operating time was a bit prolonged, with more experience it would certainly become shorter, and in fact, the operating time had not been too excessive in all reports.

Though controversies still exist, it is believed that further experience will give the answer to these issues. Any prospective randomized study might seem to be difficult to achieve since the patients' presentation might vary from case to case in trauma; but a pool of experience gained by reports in the literature eventually would provide useful information to the answer for appropriate management of the condition. The two cases example in this series at least can point to the conclusion that laparoscopic approach is safe, feasible and effective in the treatment of chronic post-traumatic diaphragmatic hernias.

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