

Original article

Late complication of diaphragmatic injury: Hernia- a report of 4 cases and review of literature

S. Ozdemir,^{1,2} E. S. Oziş,¹ K. Gulpinar,^{1,2} D. Karadag,³ L. Soylu,² A. Korkmaz¹

SUMMARY

Diaphragmatic injuries mostly occur as a result of high-speed motor vehicle accidents and to less extent after penetrating or non-traumatic causes from the abdomen. Since they are frequently symptom-free it is difficult for clinicians to diagnose. As a consequence, abdominal viscera herniation towards the thoracic cavity, mainly to the left side, may lead both to respiratory insufficiency as well as to the serious late complication of strangulation of the protruded visceral organ. We presented herein four cases of diaphragmatic hernia as a late complication after traumatic diaphragmatic injury; three having a history of blunt thoracic trauma and one after a penetrating injury to the upper abdomen. Diagnostic procedures and treatment are discussed.

Key words: Diaphragmatic injury, Diaphragmatic hernia

INTRODUCTION

Diaphragmatic injury is an important entity in surgical practice that may lead to serious complication and mortality.¹ Diaphragmatic injuries are frequently missed during initial patient evaluation. Although most diaphragmatic injuries occur as a result of a high-speed motor vehicle accidents, rarely penetrating or non-traumatic reasons may cause diaphragmatic rupture. Diaphragmatic rupture is a difficult state for clinicians to diagnose as they are frequently symptom free. Misdiagnosis at the first admission often leads to late com-

plications such as strangulation of the viscus.^{2,3} We, herein, present a series of four cases of diaphragmatic hernia as a late complication of traumatic diaphragmatic injury.

CASE REPORTS

We evaluated four patients who were operated between April 2006 and September 2008. Data of the patients was collected from Ufuk University Faculty of Medicine Department of Surgery (n=2) and Ankara Guven Hospital Department of Surgery (n=2). Informed consent was sought from all patients and the hospital institutional review board granted approval. Data were collected on a prepared structured sheet and compiled in an electronic database (Microsoft Excel for Windows; Microsoft Corp, Redmond, WA, USA). Table 1 shows the characteristics of the presented cases in numeric order.

Three patients were admitted to the emergency department with abdominal pain, nausea, vomiting and constipation complaints. The fourth patient was referred to our institution from the department of pneumology with respiratory distress (Patient 2). Three patients had a history of blunt trauma to thorax and the other one (Patient 3) had a history of a stab injury to left upper quadrant of abdomen. All of them were discharged in good condition after trauma. However, patients presented to hospital with complaints within 120, 108, 48, and 8 months after trauma. Three patients who presented to the emergency department were examined by an emergency physician. Abdominal rigidity, abdominal distention and decreased pulmonary sound were the major findings on physical examination. Chest X-ray was the first imaging method in all patients. Accurate diagnosis was established with Chest X-ray in two patients. There was visceral gas in the thorax (Figure 1). In other patients, the diagnosis was made by means

¹Ufuk University Medical School, Department of Surgery, Ankara, Turkey, ²Ankara Guven Hospital, Department of Surgery, Ankara, Turkey, ³Ufuk University Medical School, Department of Radiology, Ankara, Turkey

Author for correspondence:

N. Suleyman Ozdemir, MD, 31.sokak 5/12 Bahcelievler 06490 Ankara, Turkey, Fax: +90 312 2044055, Tel.: +90 312 2044066, e-mail: drsozdemir71@yahoo.com

Abbreviated title

Late complication of diaphragmatic injury

Table 1. Characteristics of the patients

Patients	Sex	Age	Time following trauma to applied to the hospital (months)	Abnormality in laboratory investigation	Using radiologic event for accurate diagnosis	Organs in hernia sac	Complication
Case I	Female	83	120	CRP : 88,9 mg/dl and sedimentation rate of 42	Chest X-ray	Small intestine	None
Case II	Female	63	108	Leukocyte count:11500 CRP: 13.35 mg/dl	Chest X-ray	Small intestine and omentum	Pleural effusion
Case III	Male	23	48	Leukocyte count:10900	Abdominal Computed Tomography	The transverse colon and greater omentum	Pneumothorax
Case IV	Male	47	8	Leukocyte count:20700 CRP: 18 mg/dl	Abdominal Computed Tomography	Small bowel and greater omentum	None

of CT (Patients 3 and 4). Thoraco-abdominal CT showed great omentum and loops of bowel (Figure 2).

Three patients underwent prompt surgery. Diaphragmatic reconstruction was performed with laparotomy. Hernia was detected on the left side in patient 2,3 and 4. In patient 1, hernia was on the right side (Figure 1). In three patients, small bowel and greater omentum were the hernia content. In patient 3, the contents of the hernia were transverse colon and greater omentum. The hernia contents of four patients were reduced to the abdominal cavity after meticulous dissection of adhesion without any iatrogenic injury and the defect was repaired using interrupted 0 polypropylene sutures. A propylene patch was placed over the sutured area of the

defect for additive support. While hernia content was being reduced to the abdominal cavity, pneumothorax occurred in patient 3. A chest tube was placed in the pleural cavity. Postoperative courses were uneventful in all of the patients and they were all discharged between 5th and 7th postoperative days. No morbidity and mortality were seen during the mean 9-month follow-up postoperative period.

DISCUSSION

The diaphragm is a very compliant musculo-aponeurotic organ and its injuries may be seen in 2-6% of trauma patients.^{1,3} Diaphragmatic damage occurs mostly due to blunt trauma of the abdomen and/or chest while penetrating in-

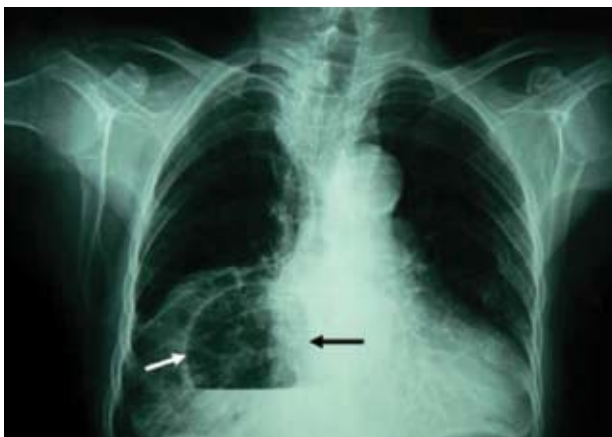


Figure 1. Preoperative Chest X-ray of patient No 1 showing herniated abdominal organs through the right side of hemidiaphragm



Figure 2. Preoperative CT of patient No 3 showing herniated transverse colon and greater omentum through the left hemidiaphragm

juries are scarcely seen. Etiology of the ruptures has been classified by Matsevych⁴ as penetrating, non-penetrating and non-traumatic ruptures. Injuries are usually seen on the left side of the diaphragm as the right side is protected by the liver.³ In this study, three patients had previous blunt trauma to thorax and one had a history of a penetrating injury to the upper abdomen. In three cases, diaphragmatic rupture was on the left side. It is a general consensus that the liver prevents the herniation of intraabdominal organs through right hemidiaphragm after abdominal trauma.⁴

Diaphragmatic injury is an important cause of mortality and morbidity. Mortality varies between 7.7% and 33.3%.³⁻⁶ It has been reported that early diagnosis of the diaphragmatic injuries decreases the rate of morbidity and mortality. It is not always possible to operate early because this diagnosis is difficult to make and the injury is frequently missed. The pressure gradient between abdomen and thorax during blunt trauma is the main cause of the diaphragm tear. Although the pressure gradient between the abdominal cavity and thorax causes herniation of the organs, this migration often delays probably due to the plugging effect of the viscera over the defect. Because of the non-specific signs or symptoms, diagnosis can be delayed in up to 14.6% of the cases.³ The diagnosis of posttraumatic diaphragmatic hernia according to the time of injury and one set of symptoms was classified by Carter et al⁷ in 1951. According to Carter, there are three types of diaphragmatic hernia. In type I hernia, all of the patients had diagnosis immediately following trauma. Type II, when the diagnosis was within the recovery period and type III in those presenting with ischemia or perforation of the herniated organs. Obstruction and strangulation are the most commonly seen complications of late presenting diaphragmatic hernia.⁴

In our series, all four patients had chest X-rays and thorax CT. Accurate diagnosis with the chest X-ray was obtained in two patients at first admission, however, thorax CT was necessary to confirm the accurate diagnosis for the other two patients. Chest radiography is currently the most valuable simple test which reveals the visceral gas in the thorax. It is diagnostic or suggestive of DR in 18-46%.⁸ CT scan is the second choice among imaging techniques. Sensitivity and specificity of CT in the diagnosis of diaphragmatic ruptures is 54-73% and 86-90%, respectively.⁹

Emergency surgery is the only treatment modality of diaphragmatic hernia and laparotomy is the preferred intervention.^{4,5} In our series, three patients underwent emergency laparotomy while one patient was operated upon electively. Although some study reported that hernia sacs mostly include stomach and transverse colon, the greater omentum was found in all four hernia contents, small bowel in three and transverse colon in one of our patients.⁵

Reduction of the hernia sacs and their contents to the abdomen were accomplished in three patients without complication. In one patient, iatrogenic pneumothorax was developed. The defects were closed with interrupted non-absorbable sutures and the diaphragm was supported with propylene patch grafts. Some series recommend the use of mesh grafts if the long axis of the diaphragm defects are over 10 cm.^{5,10} Pleural effusion developed in two patients and healed spontaneously. All patients were discharged between 5th and 7th postoperative days without major sequel. Although progressive herniation resulting in respiratory embarrassment and strangulation contributes to increasing morbidity and mortality, we did not observe any complication after a mean 9 months period of follow-up.

Diagnosis of diaphragmatic hernia may be overlooked for general surgeons and emergency physicians owing to nonspecific signs and symptoms. Chest X-ray is diagnostic in some but Abdominal Computed Tomography is necessary mostly. Patients who have symptoms such as abdominal distension or dyspnea and old trauma history should awaken general surgeons against delayed posttraumatic diaphragmatic hernia. Prompt surgery is the main treatment modality in delayed type of diaphragmatic hernia.

REFERENCES

1. Kearney PA, Rouhana SW, Burney RE. Blunt rupture of the diaphragm: mechanism, diagnosis, and treatment. *Ann Emerg Med* 1989;18:1326-1330
2. Athanassiadi K, Kalavrouziotis G, Athanassiou M, et al. Blunt diaphragmatic rupture. *Eur J Cardiothorac Surg* 1999;15:469-474
3. Shah R, Sabanathan S, Mearns AJ, Choudhury AK. Traumatic rupture of diaphragm. *Ann Thorac Surg* 1995;60:1444-1449
4. Matsevych OY. Blunt diaphragmatic rupture: four year's experience. *Hernia* 2008;12:73-78
5. Nursal TZ, Ugurlu M, Kologlu M, Hamaloglu E. Traumatic diaphragmatic hernias: a report of 26 cases. *Hernia* 2001;5:25-29
6. Meyers BF, McCabe CJ. Traumatic diaphragmatic hernia. Occult marker of serious injury. *Ann Surg* 1993;218:783-790
7. Carter BN, Giuseffi J, Felson B. Traumatic diaphragmatic hernia. *Am J Roentgenol Radium Ther Nucl Med* 1951;65:56-72
8. Gelman R, Mirvis SE, Gens D. Diaphragmatic rupture due to blunt trauma: sensitivity of plain chest radiographs. *AJR Am J Roentgenol* 1991;156:51-57
9. Murray JG, Caoili E, Gruden JF, Evans SJ, Halvorsen RA, Jr., Mackersie RC. Acute rupture of the diaphragm due to blunt trauma: diagnostic sensitivity and specificity of CT. *AJR Am J Roentgenol* 1996;166:1035-1039
10. Slim K, Bousquet J, Chipponi J. Laparoscopic repair of missed blunt diaphragmatic rupture using a prosthesis. *Surg Endosc* 1998;12:1358-1360