

TRAUMATIC DIAPHRAGMATIC RUPTURES

TRAVMATİK DİYAFRAGMA YARALANMALARI

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ÖZET: Erciyes Üniversitesi Tıp Fakültesi Genel Cerrahi Anabilim Dalında 85 travmatik diafragma rüptürlü hasta tedavi edilmiştir. Bu olgular travma mekanizması, yaralanma bölgesi, herniye olan organlar, yandaş yaralanmalar, tedavi şekli, morbidite ve mortaliteye göre retrospektif olarak değerlendirilmiştir. Rüptürler 61 hastada (%72) solda ve 24 hastada (%28) sağda idi. 51 hastada (%60) organ fıtıklaşması söz konusu idi. Mide %57 ile en sık fıtıklaşan organ idi. 78 hastada (%92) yandaş organ yaralanması mevcuttu. 1 hasta peroperatif dönemde kanamaya bağlı olarak ve 5 hasta ise postoperatif dönemde multipl organ yetmezliği ile kaybedildi. Genel mortalite oranı %7 idi. (6 olgu). Ameliyat sonrası komplikasyonları yara enfeksiyonu (4 hasta) ampiyem (2 hasta), atelettazi (2 hasta), pnömoni (1 hasta) ve intraabdominal apse (1 hasta) idi. Bir hasta yapışıklıklara bağlı barsak tıkanıklığı nedeniyle tekrar ameliyat edildi. Sonuç olarak, mortalite ve morbiditede en önemli etken yandaş organ yaralanması olarak belirlenmiştir.

Anahtar kelime: Diafragma rüptürü, travma

Introduction

The incidence of diaphragmatic rupture is increasing in parallel with the increases in traffic accidents^{1,2}. The diagnosis of the rupture may be difficult in the early period and some cases have been recognized months or even years later³. The treatment of diaphragmatic rupture in the early posttraumatic period is relatively straightforward; however, the delay in the diagnosis may result in complications, which increase the mortality and morbidity.

In this report, we evaluate our traumatic diaphragmatic rupture cases retrospectively and discuss the difficulties in diagnosis, complications and results.

Patients and Methods

The case records of 85 patients who were treated for traumatic diaphragmatic rupture at the Erciyes University School of Medicine, Department of General Surgery between January 1988 and February 2000 were examined

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retrospectively. The patients were evaluated with respect to type of trauma, site of trauma, herniated organs, associated injuries, morbidity and mortality.

Results

Of the 85 patients, 78 (92%) were male and 7 (8%) were female. Their ages varied between 7 and 55 (average 35). Forty-one patients (48%) had blunt trauma and 44 (52%) had penetrating trauma. Traffic accidents and gunshot wounds were the most frequent causes among blunt and penetrating trauma cases respectively (Table I). Sixty-seven patients (79%) underwent laparotomy with one or more of the following indications: hemodynamic instability, gunshot wounds and positive peritoneal lavage; in these patients the diagnosis of diaphragmatic rupture was made intraoperatively. Among the 27 patients (32%) who were hemodynamically stable the preoperative lung radiograph was diagnostic in 17 (20%). Five patients were referred from other hospital with chest tubes inserted; gastric or colonic contents drained from the tubes in four were all blunt injuries caused by traffic accidents; in one case the tube had penetrated through the diaphragm and lacerated the liver. In one case the diagnosis was made with thorax ultrasonography and in one case with contrast radiographs taken after barium administration through the nasogastric

tube (Table II). The diaphragmatic rupture was on the left in 61 patients (72%) and on the right in 24 (28%). No patient had bilateral rupture.

Table I. The causes of diaphragmatic rupture

Etiology	n	%
Blunt abdominal trauma	41	48
Traffic accident	34	40
Fall	5	6
Spor injury	1	1
Crush injury	1	1
Penetrating abdominal trauma	44	52
Gunshot wound	23	27
Stab wound	20	24
Blast injury	1	1
Total	85	100

Table II. Preoperative diagnostic method

Diagnostic method	n	%
Chest radiograph	17	(%20)
Drainage of gastric or colonic content from the chest tube	5	(%5,9)
Ultrasonography of the thorax	1	(%1,2)
Upper gastrointestinal series	1	(%1,2)
Total	24	28

The length of the diaphragmatic laceration varied between 1.5 and 15 cm (average 8 cm). Herniation of abdominal organs into the thorax was present in 51 cases (60%). The most frequently involved organ, the stomach, had herniated alone (23 patients, 45%) or along with other organs (29 patients, 57%); the colon was the second most frequently involved organ. In 9 cases (%18), more than one organ had herniated into the thorax (Table III).

Isolated diaphragmatic injury was present in 7 patients (%8); 78 (92%) had associated organ injuries. The liver was the most frequently injured organ (29 cases, 28.1%) (Table IV).

Various complications, mainly pulmonary complications (empyema, atelectasis, pneumonia, ARDS) and wound infections occurred in 11 cases (13%) (Table V). The complication rate was 11.7% in cases with associated organ injuries whereas only one pulmonary complication occurred in cases with isolated diaphragmatic injury.

The overall mortality was 7% (6 cases). The mortality in cases with associated organ injury was 7.7% (6 cases); there

Table III. Herniated organs

Herniated organ	n	%
Stomach	23	45
Colon	7	13,7
Omentum	5	9,8
Jejunum	4	7,8
Stomach-colon-spleen	3	5,8
Stomach-spleen	3	5,8
Colon-small intestine	2	3,9
Spleen	2	3,9
Liver	1	1,9
Colon-spleen	1	1,9
Total	51	100

Table IV. Associated organ injury

Injured organ	n	%
Liver	29	28,1
Spleen	21	20,3
Stomach	20	19,4
Mesentery	9	8,7
Colon	8	7,7
Small intestine	8	7,7
Kidney	5	4,8
Pancreas	2	1,9
Urinary bladder	1	0,9
Total	103	100

Table V. Complications

Complication	Isolated DR* (n=7)	DR+Associated OI* (n=78)	Total
Pulmonary complications	1	4	5
Wound infection	0	4	4
Ileus due to adhesions	0	1	1
Intraabdominal abscess	0	1	1
Total	1	10	11

*DR= Diaphragmatic rupture, *OI= Organ injury

was no mortality in the isolated diaphragmatic injury group. One patient with severe cranial trauma, multiple fractures and exsanguating hemorrhage from hepatic and splenic injuries died due to hemorrhagic shock. Five patients died between 4th and 21st postoperative days due to multiple organ failure. Two of these patients had severe cranial trauma and one had thoracic trauma.

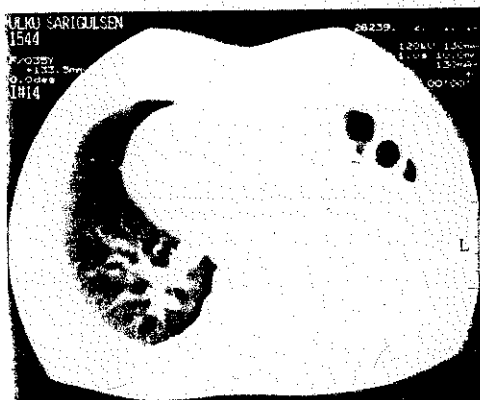
Discussion

Diaphragmatic rupture is diagnosed in approximately 2% of the trauma patients in an emergency unit. The diagnosis is difficult particularly in isolated injuries and often the rupture is recognized during operation^{4,5}. In our series, the diagnosis was made preoperatively in 27 cases (32%). In 17 patients (20%) the chest radiograph was diagnostic. Blurring of the diaphragmatic contours, intestinal loops, gastric fundus or the nasogastric tube in the thoracic cavity and mediastinal shift are observed in the radiographs (Figure 1). In patients with thoracoabdominal trauma, if the diaphragmatic contours can not be clearly identified, rupture should be suspected. The diagnostic accuracy of the chest radiograph in diaphragmatic rupture is 25-30%⁶. The value of 20% in this series is lower. The reason for this discrepancy is unclear. Because no specific modality is available, the diagnosis is difficult.

Figure 1: The elevation of the left diaphragma and blurring was shown on the chest radiography.



Figure 2: Demonstration of intestinal segments in the thoracic cavity by computerized tomography is diagnostic for diaphragmatic rupture.



Isolated injuries are even more difficult to recognize. Clinical findings may appear months or even years later in cases followed conservatively⁶. These "late" cases may present with compression of the lung or intestinal obstruction. Herniation may be misdiagnosed as hemo-pneumothorax and if a chest tube is inserted serious complications such as gastric and colonic injuries may ensue. The diagnosis of right-sided injuries is more difficult. The lung or liver scintigraphy or thoracoscopy may be necessary; the diagnostic value of the chest radiograph is limited^{1,3}. The advent of videothoracoscopy restrict the indications for thoracotomy in blunt chest trauma⁷. Especially in penetrating wounds a small injury to the diaphragma is not detectable on physical examination and may not be visualized on an early chest radiograph. Because the consequences of missing such an injury may be severe, thoracoscopy may be used to rule out the diaphragmatic injuries and the accuracy of the video-assisted technique is excellent⁸.

Demonstration of intestinal segments in the thoracic cavity by ultrasonography is diagnostic. The diagnosis was made preoperatively in one patient with this method in this series. However, computerized tomography (CT) has been promoted as a more effective method^{2,3,4,6,9} (Figure 2). Helical CT is being evaluated and the preliminary results are encouraging^{10,11}. The use of laparoscopy in this setting is recent. It has been used in the diagnosis and sometimes treatment of left-sided injuries but the results are preliminary^{12,13,14}. Despite these diverse diagnostic modalities, the diagnosis is made during laparotomy in the majority of the cases.

Blunt diaphragmatic injuries occur mostly on the left side and the posterolateral region^{6,9,15}. The reason for this distribution is that this region is weak from an embryologic point and the liver cushions the diaphragm on the right side^{15,16}. The major cause of blunt injury is traffic accidents¹⁷⁻¹⁹, as in the case in this series (Table I). The trauma increases the intraabdominal pressure that causes rupture of the posterolateral region which is the weakest area. In this series, 61 cases (72%) had left-sided rupture. Broken ribs may also injure the diaphragm. Depending on the location and interval from the traumatic event abdominal organs herniate towards the thorax under the effect of the pressure difference between the abdomen and thorax during inspiration^{16,20}.

Gunshot wounds are one the most common causes of penetrating trauma. In this series, 27% of the cases with penetrating diaphragmatic injury had gunshot wounds (Table I). Most penetrating diaphragmatic injuries are associated with intraabdominal organ injuries and the diagnosis is made during operation for acute abdomen⁶. Except one case, all patients with penetrating injury underwent emergency laparotomy for acute abdomen and the diaphragmatic injury was diagnosed during the operation. The incidence of associated organ injury is penetrating diaphragmatic ruptures is 80-90%³. The

frequency was 92% in this series. The liver is the most frequently involved organ (29 cases, 28%) (Table IV). The length of the initial laceration is usually less than 2 cm and if these are not repaired in the early period, the wound enlarges due to the pressure difference between the thoracic and abdominal cavities and herniation occurs⁶.

Bilateral injury is very rare and often fatal⁴. The reported incidence is increasing and the reported figures vary between 0.8 and 5%². There was no case with bilateral injury in our series.

Primary repair with nonabsorbable (silk) sutures is the most common method². In this series, the injuries were repaired with No 0 silk. The operation may be performed through the abdominal, thoracic or thoraco-abdominal routes. The abdominal route is usually preferred because associated organ injury is present in 80-90% of the cases and an abdominal incision is required to repair the lacerated organ^{2,4,19}. In this series, all operations were performed through the abdominal route. If intrathoracic organ injury, esophageal and tracheal injury and the necessity for cardiac resuscitation are present, thoracotomy is more appropriate^{3,4,21,22}. Because the liver may complicate the repair of a right-sided injury, the thoracic route has been recommended³. In cases diagnosed late and in patients with large defects, synthetic or autogenous tissue grafts may be used^{3,4,15}. Primary repair was possible in all cases in our series.

Most of the complications after diaphragmatic repair are pulmonary. The most common complications in this series were pulmonary complications such as empyema, atelectasis and pneumonia (Table V). In left sided injuries, perforation of the herniated organs, strangulation, necrosis and bacterial contents are the major reasons for pulmonary complications. Also, traumatic lung injuries and the presence of hemopneumothorax contribute to pulmonary complications. Respiratory distress due to diaphragmatic paralysis is a common complication. Dehiscence of the suture line may cause late pulmonary complications.

The mortality in diaphragmatic rupture varies between 2% and 50% depending on associated organ injuries and the severity of the trauma^{6,23,24}. Diaphragmatic rupture should be considered in intra and extra abdominal organ injuries and delay in diagnosis due to the lack of a specific diagnostic method should be avoided. The mortality in this series is 7% (6 cases). All of these patients had severe cranial trauma and associated organ injury.

There was no mortality among the 7 cases with isolated diaphragmatic rupture; six of the 78 remaining cases died (7.7%). The morbidity and mortality is higher in patients associated organ injuries in comparison with isolated diaphragmatic rupture cases, but the difference is not statistically significant (Fisher's exact Khi square test, $p > 0.05$).

In conclusion, despite the developments in diagnostic methods the diagnosis of diaphragmatic rupture is still made during laparotomy in the majority of the cases. Since

hollow organs may herniate into the thorax, chest tubes should be inserted with extreme care, otherwise fatal complications may occur. It should be considered that associated organ injury is the most important determinant of morbidity and mortality and the delay in diagnosis contributes to the final outcome. A high index of suspicion makes early diagnosis more likely as initial physical and radiological signs may be lacking.

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