

# Isolated Left Sided Diaphragmatic Injury Due to Blunt Trauma



Omer Faruk Ozkan<sup>1</sup>, Faruk Ozkul<sup>1</sup>, Ali Guner<sup>1</sup>, Arif Burak Cekic<sup>2</sup>, Ayhan Çağlıcı<sup>2</sup>

## ABSTRACT

Diaphragmatic injury presents acutely and be associated with other life threatening injury of other organs. Sudden increase in abdominal pressure may cause injury in the membranous or muscular part of the diaphragm. While isolated diaphragmatic rupture after blunt trauma is rarely seen, its diagnosis can be overlooked frequently. Early diagnosis is the most important step in the treatment. Cases with delayed diagnosis can result in a diaphragmatic hernia with high mortality and morbidity rates due to complications such as strangulation and incarceration. The most critical point during the diagnosis is the suspicion for clinical diaphragm injury. X-ray graphy and computed tomography can be a guide for identifying diaphragmatic injuries. In this case report we presented an isolated left side diaphragmatic rupture after blunt abdominal trauma and treated with an urgent surgical operation.

**Key words:** Diaphragmatic injury, blunt trauma, images

## Künt Travma Nedenli İzole Sol Diyafragma Hasarı

### ÖZET

Diyafragma yaralanmaları, genellikle hayatı tehdit eden diğer organ yaralanmalarına eşlik etmektedir. Karın içi basıncın ani olarak artışına neden olan etkenler, diyaframın membranöz ve musküler bölümünde hasara neden olabilmektedir. Künt travmalar sonrası, izole diyafram yaralanmaları nadir görülmekle beraber, gözden kaçabilmektedir. Erken tanı tedavideki en önemli aşamayı oluşturmaktadır. Tanının atlanması, stragülasyon ve inkarserasyona bağlı mortalitenin yüksek olduğu diyafram hernilerine neden olabilmektedir. Tanıda en önemli aşama diyafram yaralanmasından şüphelenilmesi olup, direk grafi ve bilgisayarlı tomografi diyafram yaralanmasında tanıda yol gösterici olabilmektedir. Çalışmamızda, künt karın travması sonrası izole diyafram yaralanması saptanan ve tedavi edilen hastanın sunulması amaçlanmıştır.

**Anahtar kelimeler:** Diyafragma hasarı, künt travma, görüntüler

## INTRODUCTION

Diaphragmatic rupture was first described by Sennertus in 1541 and the surgical repair was performed by Riolfi in 1886 (1). Traumatic rupture of the diaphragm is a rare injury and occurs in 0.8% to 7% of all thoracoabdominal blunt trauma. Blunt and penetrating trauma are the most common causes of diaphragmatic injuries (1,2). Sudden increase in abdominal pressure due to blunt trauma may cause injury in the membranous or

muscular part of the diaphragm. Left sided rupture of diaphragma is three times more common than on the right side due to the relative weakness of diaphragma on the left side (2). Diagnosis of diaphragmatic injury requires suspicion. However, chest x-ray and computed tomography is still the most common screening tool for the diagnosis of this condition. Difficulties in diagnosing due to coexisting injuries and the silent nature of diaphragmatic rupture cause delayed diagnosis during the

<sup>1</sup>Canakkale 18 Mart University Medical School, Department of General Surgery, Canakkale, <sup>2</sup>Trabzon Numune Training and Research Hospital, Department of General Surgery, Trabzon, Turkey

Received: 04.01.2013, Accepted: 15.06.2013

**Correspondence:** Omer Faruk Ozkan, Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of General Surgery, Floor 2, Çanakkale, Turkey  
Phone: +90.505.218.61.09  
E-mail: ozkanfomer@gmail.com

primary resuscitation in the emergency room. Delayed diagnosis increases mortality and morbidity of diaphragmatic rupture (2,3). Successful management of diaphragmatic rupture depends on the early detection and repair of the diaphragmatic defect. Herein, we reported the diagnosis and management of a left sided diaphragmatic rupture not accompanied with intraabdominal or intrathoracic organ due to blunt trauma.

### CASE

A 23 year old woman admitted to emergency room after an in vehicle traffic accident. Fluid replacement was started after routine examinations were done. Except mild leucocytosis (Wbc:12000/uL) other laboratory findings were normal. Physical examination of the patient revealed decreased respiratory sounds on the left side and tenderness on the left hemithorax and in the abdomen. An elevation on the left side of diaphragm, gas view regarding the stomach in thorax on the upper diaphragm margin and collapsed left lung were detected in the chest x-ray (Figure 1). Thoracoabdominal CT showed a partial lung collapse in the left hemithorax and gastric appearance with air image in the left thorax (Figure 2). The patient was taken into operation. A midline incision was made for laparotomy. Exploration revealed an 8 cm long injury with irregular edges extending to the left liver lobe in the left diaphragm. Stomach and omentum were herniated into the left hemithorax. Other organs in the abdomen were normal. Stomach and omentum were placed in the abdomen and a chest drain was placed towards apex in the left side of thorax. The defect in the diaphragm was repaired with 0 size prolene, one by one with U sutures. On the 3rd postoperative day thorax

drain was removed. The patient with normal clinical follow up, was discharged with complete recovery on the 10th postoperative day.

### DISCUSSION

Traumatic diaphragmatic injury (TDI) generally develops after blunt and penetrating traumas. Its frequency varies in various case series (1-3). In the study performed by Celik et al. (1), penetrating causes were discovered in 87% of cases, and blunt trauma related TDI in regions where agricultural and construction sectors are prominent are seen more commonly. This rational difference varies depending on the environmental factors of the localizations of the hospitals where TDI diagnosis is established (2-3).

Clinical three phase classification of diaphragmatic rupture defined by Grimes in 1974 is still valid. In this clinical staging system, first phase is described as the stage where clinical findings develop during the acute period of injury, and second phase is described as the stage where the obstruction findings develop, related to the strangulation at the third stage connected to the skip of rupture. Second phase is considered as a silent clinical period, and can take up to months and even years. For the optimum approach to TDI, diagnosis should be established during the first phase described by Grimes and application of a fast treatment protocol should be aimed. It must be known that mortality and morbidity rates related to strangulation during the later stages due to the delayed diagnosis and treatment, can increase (4). Traumatic diaphragmatic rupture is more common on the left side than the right side after both blunt and penetrating traumas. When evaluated with regard to blunt traumas, it is seen on the left side, right side



Figure 1. Preoperative chest x-ray demonstrated the left diaphragm higher localization and stomach inside the left chest cavity.

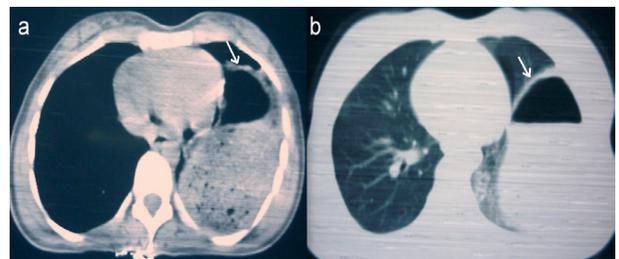


Figure 2 (a, b). CT scans show left diaphragmatic rupture with herniation of distended stomach.

and both sides in 65-85%, 15-35% and only in 1% of the patients, respectively (5,6). More frequent presence of TDI on the left side is correlated to various anatomical and clinical factors. These can be explained with; the fact that diaphragm is congenitally weaker in the left medial posterolateral tendinomuscular area, the protective effect of liver on the right side, higher mortality rates concerning major trauma related to right side injuries. While left side diaphragmatic ruptures due to trauma are seen more frequently during clinical studies, right and left side injuries are seen in equal numbers in autopsy cases. The relative rare frequency of right side injury is related to the absence of diagnosis due to mortality connected to major trauma (5-7).

Traumatic diaphragmatic injury is accompanied at 60-100% of the cases with visceral organ injuries. Although liver and spleen injuries coexists with TDI depending on the localization rupture develops, major vascular injuries and small intestine perforation can also be seen (2, 8). In the literature search performed in Pubmed there are limited number of studies on isolated diaphragmatic rupture related to blunt abdominal and the cases are generally on the right side. This case is presented because isolated left side diaphragmatic rupture not accompanied with intraabdominal or intrathoracic organ injuries has been determined. Clinical suspicion and careful assessment of the patient are the most important steps in the diagnosis of traumatic diaphragmatic rupture. Diagnosis can be more difficult due to the smaller size of the defect after penetrating injuries, the bigger size of the defect (5-10 cm) and easier herniation of intraabdominal organs after blunt trauma makes the clinical and radiological diagnosis easier (9). Direct radiography is the first examination to be done and elevation in diaphragm, gas shadow related to abdominal organs in thorax and hemopneumothorax can be seen. CT is generally a better imaging method than the others and its sensitivity can increase more than 80% with the reconstructions in coronary and sagittal plans and it can be a guide for additional injuries within thorax and abdomen (4,10).

Following the anatomical localization of herniated organs with emergency surgery of patients with a diagnosis of diaphragmatic perforation, the repair of defect is essential. Although generally repair is performed primarily by laparotomy with sutures that are nonabsorbable in many centers due to accompanying organ injuries, nowadays thoracoscopic and laparoscopic treatment are

also used (6). In cases where primary repair can not be performed because of fragmental and tissue loss, repair with mesh is another option for treatment. In conclusion, thoracoabdominal region is frequently affected in blunt traumas. It should be kept in mind that an isolated diaphragmatic injury can develop in patients who admit to emergency room due to blunt trauma. The delayed diagnosis of TDI during acute period can cause severe pathologies such as intestinal strangulation.

#### Competing interests

The authors declare that they have no competing interests.

#### REFERENCES

1. Celik A, Altinli E, Köksal N, et al. Diagnostic process and management of diaphragmatic injuries: approach in patients with blunt and penetrating trauma. *National Trauma Emerg Surg J (Turkish)* 2010;16(4):339-43
2. Boulanger BR, Milzman DP, Rosati C, Rodriguez A. A comparison of right and left blunt traumatic diaphragmatic rupture. *J Trauma* 1993;35(2):255-60.
3. Hsee L, Wigg L, Civil I. Diagnosis of blunt traumatic ruptured diaphragm: is it still a difficult problem?. *ANZ J Surg* 2010;80(3):166-8.
4. Guner A, Ozkan OF, Bekar Y, Kece C, Kaya U, Reis E. Management of delayed presentation of a right-side traumatic diaphragmatic rupture. *World J Surg* 2012;36(2):260-5.
5. Wilson RF, Bender JS. Diaphragmatic injuries. In: Wilson RW, Walt AJ (eds). *Management of Trauma*. Philadelphia: Williams & Wilkins, 1996:432-48.
6. Wadhwa A, Surendra J, Sharma A, et al. Laparoscopic Repair of Diaphragmatic Hernias: Experience of Six Cases. *Asian journal of surgery* 2005;28(2):145-50
7. Lomoschitz FM, Eisenhuber E, Linnau KF, Peloschek P, Schoder M, Bankier AA. Imaging of chest trauma: radiological patterns of injury and diagnostic algorithms. *Eur J Radiol* 2003;48:61-70.
8. Williams M, Carlin AM, Tyburski JG, et al. Predictors of mortality in patients with traumatic diaphragmatic rupture and associated thoracic and/ or abdominal injuries. *Am Surg* 2004;70: 157-62.
9. Shanmuganathan K, Killeen K, Mirvis SE, et al. Imaging of diaphragmatic injuries. *J Thorac Imaging*. 2000; 15: 104.
10. 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(5):1035-9.