

Traumatic Injuries of the Diaphragm: A Case Report

Pradeep Baral, MBBS, (FCPS); Anjali Basnyat, MBBS, MD; Rabindra Desai, MBBS, MD; Saugat Mainali, MBBS, (FCPS)

Department of Radiology, B & B Hospital, Gwarko, Lalitpur, Nepal

Address for Correspondence:

Pradeep Baral, MBBS (FCPS)

Department of Radiology, B & B Hospital, Gwarko, Lalitpur, Nepal

Email:pradeepbaral450@gmail.com

Received, 5 April, 2018

Accepted, 18 April, 2018

Traumatic diaphragmatic injury has been found in 3%–8% of patients undergoing surgical exploration after blunt trauma and in 10% of patients with penetrating trauma. The rate of initially missed diagnoses on computed tomography (CT) ranges from 12% to 63%. A missed diagnosis can later present as intrathoracic visceral herniation and strangulation with a mortality rate of 30%–60%. In this era of increasing non operative management for most cases of blunt abdominal trauma, it becomes essential to diagnose diaphragmatic rupture on imaging to ensure early and timely operative repair of the rupture. The reasons for missed early diagnoses include potentially distracting and more severe thoracic and abdominal visceral injuries and lack of familiarity with all the imaging appearances and signs of diaphragmatic rupture.

Keywords: abdominal injury, blunt trauma, diaphragm.

The diaphragm is an arched flat muscle that divides the thorax from the abdominal cavity. Although blunt injury of diaphragm is relatively common and is considered as a marker of severe trauma, it can clinically be occult as other violent injuries may mask and disguise its initial clinical presentation.¹ An accurate diagnosis requires a high index of suspicion

as missed diaphragmatic injury (DI) may result in herniation and strangulation of intra-abdominal viscera into the thoracic cavity. Therefore, the detection, an accurate diagnosis and prompt management of DIs, particularly in severely injured or poly-traumatized patients, becomes a real challenge for the trauma surgeon.² We report a case of blunt DI in a gentleman managed

successfully at our center.

Case report

A 40-year-old gentleman was brought to emergency one day after road traffic accident with sustained injury over his thorax. On examination he was ill looking with tender chest compression on the left side there was decreased air entry in the left chest and bowel sound could be appreciated over his left lower thorax. His GCS was 15/15. His chest X-ray showed completely collapsed left lower lung with multiple air foci within left hemithorax with non-visualised left dome of diaphragm. Multiple rib fractures was noted (**Figure 1**).



Figure 1: Plain X-ray chest with completely collapsed left lower lung with multiple air foci within left hemithorax with non-visualised left dome of diaphragm.

CECT thorax and abdomen done for further evaluation of the patient showed (**Figure 2**) His routine blood investigations were within normal limit. The patient was resuscitated and an emergency exploratory laparotomy revealed rupture of the left diaphragm and the

bare triangular ligament of the liver.

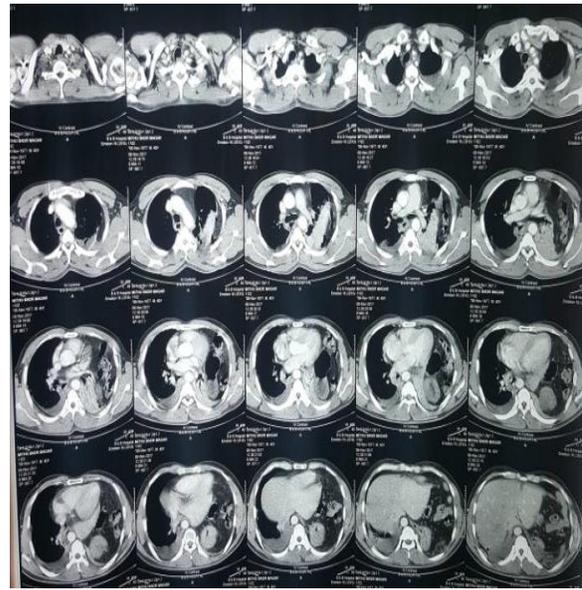


Figure 2: CECT chest showing diaphragmatic rupture with herniation of bowel into the left hemithorax.

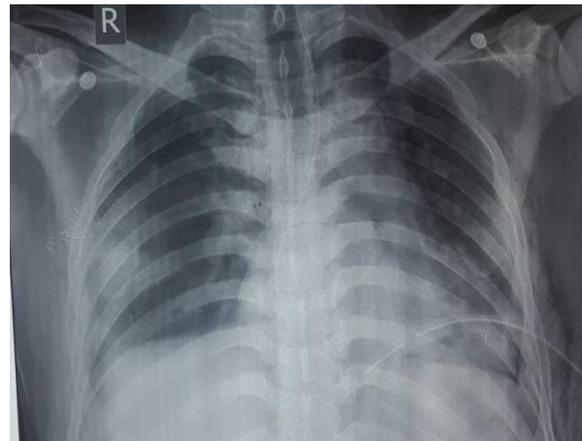


Figure 3: Post operative Chest X-ray of same patient showing normal appearance of both hemidiaphragm.

There was herniation of the stomach and omentum into the left thoracic cavity. There was minimum haemothorax and left lung was collapsed. There were no other associated intra-abdominal injuries. The stomach was healthy and replaced into the abdomen and

the diaphragmatic rent was repaired. The follow-up X-ray of the chest showed full expansion of the left lung and a normally positioned diaphragm (**Figure 3**). The patient was doing well on follow-up visit.

Discussion

Traumatic rupture of the diaphragm may occur due to blunt, penetrating or iatrogenic injuries and only 3-5% of patients require laparotomy.³ The majority of these injuries occur in men and involve the left hemidiaphragm. Approximately 75% of the diaphragmatic injuries are caused by blunt trauma and 25% by penetrating trauma (ratio ranges from 3:1 to 1:8). This is clearly a reflection of the geographic and socioeconomic region served by each hospital.² Bilateral DI is uncommon (<2%) (Asensio et al., 2004). Blunt trauma occurs mostly due either to road traffic accident or falls from a height. This pattern is more common in rural areas. A direct anterior blow to the abdomen leads to a sudden transmission of force through the abdominal viscera that acts as a hydrodynamic fluid wave leading to significantly increase intra-abdominal pressure and disruption. In our case also the mode of injury was the blunt thoracoabdominal trauma due to road traffic accident (RTA) leading to a direct anterior blow to his thorax and abdomen. DI may be associated with herniation of the stomach, small bowel, colon, spleen, liver or omentum. The incidence of right-sided DI is low due to the cushioning effect of the liver. It is

associated with significant vascular tears in the inferior vena cava or hepatic vein with higher pre-hospital mortality. Gunshot and stab wounds are the major causes of penetrating injuries of the diaphragm. They are potentially more dangerous because they create smaller defects with high probabilities of later obstruction and strangulation.

Sometimes during thoracotomy or laparotomy, iatrogenic injuries of the diaphragm may occur, but they are usually insidious and difficult to identify. The missed injuries of the diaphragm may occur either due to delayed rupture or delayed detection. In delayed rupture, the diaphragmatic muscle is devitalized at the time of the initial injury and starts acting as a barrier against herniation. Delayed detection becomes evident only when the intrathoracic pressure becomes negative and herniation occurs some time later. Therefore, during exploratory laparotomy, a meticulous inspection and palpation of the entire diaphragm becomes mandatory in every case of trauma.⁴ The diaphragm is rarely injured alone. A triad of severe blunt thoracoabdominal trauma consists of pelvic fractures, blunt diaphragmatic rupture and blunt thoracic aortic rupture. According to the literature, a 90% incidence of blunt thoracic injuries such as haemopneumothoraces and multiple rib fractures, 40% incidence of associated pelvic fractures, a 25% incidence of both hepatic and splenic injuries and a 5% incidence of associated blunt rupture of the thoracic aorta are

associated with DI.² The present case showed multiple rib fractures in association with diaphragmatic rupture and herniated healthy stomach. Other study described a 42% incidence of associated closed head injuries and a 75% incidence of long-bone fractures.

Radiographic features

Specific diagnostic findings of diaphragmatic rupture on chest radiographs may not be seen in up to 50% of cases.¹ However, the following signs are helpful in making the diagnosis:

- Inability to trace the normal hemidiaphragm contour
- Intrathoracic herniation of a hollow viscus (stomach, colon, small bowel) with or without focal constriction of the viscus at the site of the tear (collar sign)
- If large, the positive mass effect may cause a contralateral mediastinal shift
- Visualisation of a nasogastric tube above the hemidiaphragm on the left side
- Left hemidiaphragm much higher than the right CT
- Direct discontinuity of the hemidiaphragm may be seen with or without intrathoracic herniation of abdominal contents. The stomach and colon are the most common viscera to herniate on the left side and the liver is the most common viscus to herniate on the right side.

Other signs of diaphragmatic rupture includes:

- The collar sign (or hourglass sign):³ a waist-like constriction of the herniating

hollow viscus from the abdominal into the chest at the site of the diaphragmatic tear, which is classical of diaphragmatic rupture

- The dependent viscera sign: when a patient with a ruptured diaphragm lies supine at CT examination, the herniated viscera (bowel or solid organs) are no longer supported posteriorly by the injured diaphragm and fall to a dependent position against the posterior ribs
- Segmental non-recognition of the diaphragm
- Focal diaphragmatic thickening
- Thoracic fluid abutting the abdominal viscera

Conclusion

DI is a common lesion in young adult males on the left side caused by traffic accident. A high index of suspicion combined with repeated and selective radiologic evaluation is necessary for early diagnosis. Associated lesions are present in most cases and represent the main prognostic factor affecting morbidity and mortality. It is considered a relative surgical emergency. Thoracotomy and primary repair is adequate surgical treatment.

Conflicts of interest

There are no conflicts of interest

References

1. Panda A, Kumar A, Gamanagatti S, Patil

- A, Kumar S, Gupta A. Traumatic diaphragmatic injury: a review of CT signs and the difference between blunt and penetrating injury. *Diagnostic and interventional radiology*. 2014;20:121.
2. Dwivedi S, Banode P, Gharde P, Bhatt M, Johrapurkar SR. Treating traumatic injuries of the diaphragm. *Journal of Emergencies, Trauma and Shock*. 2010;3:173.
 3. Petrone P, Leppaniemi A, Inaba K, Soreid e K, Asensio JA. Diaphragmatic injuries: challenges in the diagnosis and management. *Trauma*. 2007;9:227–36.
 4. Meyers BF, McCabe CJ. Traumatic diaphragmatic hernia. Occult marker of serious injury. *Annals of surgery*. 1993;218:783.