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# IMAGING IN TRAUMATIC DIAPHRAGMATIC RUPTURE – A DIAGNOSTIC DILEMMA

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## ABSTRACT

**Case report:** We report a rare case of traumatic diaphragmatic rupture with chest radiology and Computed tomography(CT) findings in whom emergency laparotomy was performed resulting in successful repair of diaphragmatic injury.

**Discussion:** Traumatic diaphragmatic rupture occurs in patients who sustain blunt and penetrating thoracoabdominal injuries. The most common herniated viscera are the stomach and colon on the left side and the liver on the right side. Specific signs in X-ray and Compute tomography (CT) will help in early diagnosis.

**Conclusion:** Traumatic diaphragmatic rupture remains a diagnostic challenge for both radiologists and surgeons. Early diagnosis and repair of diaphragmatic tears is desirable. Clinical examination coupled with meticulous radiological examinations like X-ray and Computed tomography(CT) will help in early diagnosis.

**Key Words:** Trauma, Diaphragm, Rupture, Blunt injury

## INTRODUCTION

Blunt diaphragmatic ruptures are difficult to diagnose at initial presentation because of non-specific clinical features. However, these injuries do not resolve spontaneously; therefore, it warrants timely management. If the diagnosis is missed, patients may develop intrathoracic visceral herniation and strangulation, with a morbidity and mortality rate of up to 50%.<sup>1</sup>

Although chest radiographs are recommended for all patients after major trauma, chest radiography is insensitive in depicting diaphragmatic rupture, with sensitivity of 46% for left-sided ruptures and 17% for right-sided ruptures.<sup>2</sup> CT is the imaging modality of choice in the evaluation of severe blunt abdominal trauma. CT has a sensitivity of 61-71% and a specificity of 87-100% as an aid in the diagnosis of acute traumatic diaphragmatic rupture.<sup>3</sup>

## CASE REPORT

A 40-year-old man was brought to the emergency department after sustaining blunt thoracoabdominal trauma after a motor vehicle injury. The patient complained of acute shortness of breath.

On examination, there was mild tachypnea and tachycardia. General examination of the patient was unremarkable and respiratory examination of the patient revealed reduced air entry with decreased chest expansion in the left hemithorax and auscultation of bowel sounds in the left lower chest.

Preliminary routine investigations were normal and the patient's chest x-ray (postero-anterior view in erect position) revealed tracheal and mediastinal shift to the right and fundal gas shadow in left hemithorax. Left hemidiaphragm could not be well outlined. Definite defect of diaphragm could not be appreciated well on x-ray. The x-ray showed no evidence of rib fractures or pneumothorax.

Plain CT scan of thorax was advised to the patient which revealed focal defect of left diaphragm measuring 6.1x5.4cm (Anteroposterior x Transverse) with herniation of stomach and proximal half of body of the stomach into the left hemithorax with waist-like constriction of the herniating stomach at the site of the diaphragmatic tear (collar sign) causing mass effect in the form of tracheal and mediastinal shift to the right side associated with minimal pneumothorax. The herniated stomach was lying in a dependent position against the posterior

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ribs (Dependent viscera sign) as the patient was scanned in supine position. Patchy ground glass opacities were noted involving the apicoposterior segment of left upper lobe suggesting contusion. The patient underwent emergency laparotomy for repair of his injury. Successful repair of the diaphragmatic injury was achieved.

## DISCUSSION

Traumatic diaphragmatic rupture can be due to blunt, penetrating injuries or iatrogenic causes. It occurs in up to 6% of patients after major blunt trauma.<sup>4</sup> The most common cause is motor vehicle collisions. Most cases occur in young men after motor vehicle accidents.<sup>5</sup> The most common herniated viscera are the stomach and colon on the left side and the liver on the right side. Injuries to the left hemidiaphragm occur three times more frequently than injuries to the right side following blunt trauma, possibly due to a buffering effect of the liver on the right hemidiaphragm. Most ruptures are longer than 10 cm and occur at the posterolateral aspect of the hemidiaphragm between the lumbar and intercostal attachments, spreading radially.<sup>6</sup>

Specific diagnostic findings of diaphragmatic tears on chest radiographs include intrathoracic herniation of a hollow viscus with or without focal constriction of the viscus at the site of the tear (collar sign) and visualization of a nasogastric tube above the hemidiaphragm on the left side. Other findings include elevation of the hemidiaphragm, distortion or obliteration of the outline of the hemidiaphragm, and contralateral shift of the mediastinum.

CT findings suggestive of hemidiaphragmatic tears are direct discontinuity of the hemidiaphragm which is the most sensitive sign of rupture (sensitivity of 73% and a specificity of 90%),<sup>7</sup> intrathoracic herniation of abdominal contents (has a sensitivity of 55% and a specificity of 100%). Another frequently diagnosed sign is the collar sign, a waist like constriction of the herniating hollow viscus at the site of the diaphragmatic tear (sensitivity of 36%). The dependent viscera sign is an additional sign.<sup>8</sup> 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 and consequently, the dependent viscera sign is present if the upper one-third of the liver abuts the posterior ribs on the right side or if the stomach, spleen, or bowel abuts the posterior ribs on the left side.

Indirect signs are hemothorax and hemoperitoneum. Complications include gastrointestinal strangulation and gastric volvulus.

## DIFFERENTIAL DIAGNOSIS

- Congenital hernias (Bochdalek and Morgagni),
- Diaphragmatic eventration
- Motion artifacts due to respiratory movement decrease the quality of multiplanar reformation images and can mimic a diaphragmatic rupture, especially on the right side with pseudoherniation of the liver

## CONCLUSION

Diaphragmatic injuries are rarely encountered in clinical practice and can be fatal if early diagnosis and treatment is delayed. Imaging studies are pivotal in making an accurate and timely diagnosis. A comprehensive knowledge of imaging features coupled with keen observation is required for rapid diagnosis and management.

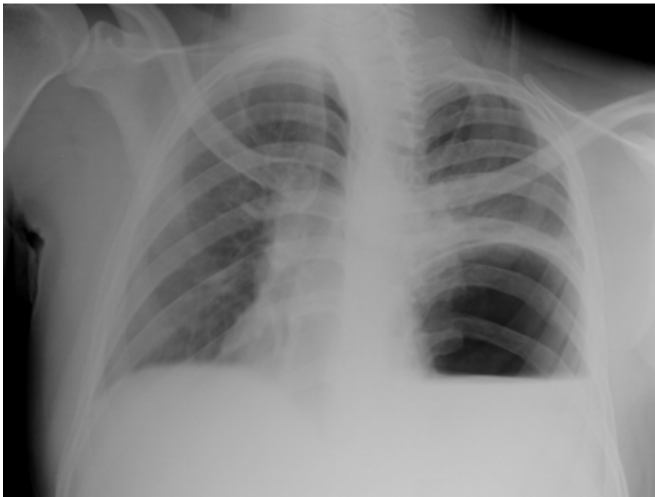
## ACKNOWLEDGEMENTS

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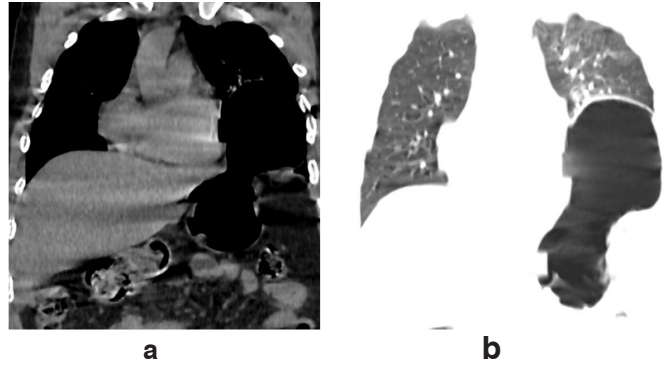
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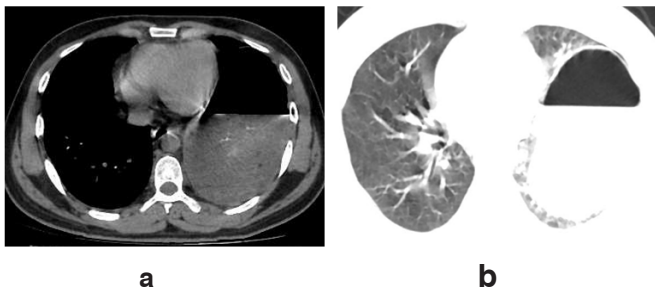
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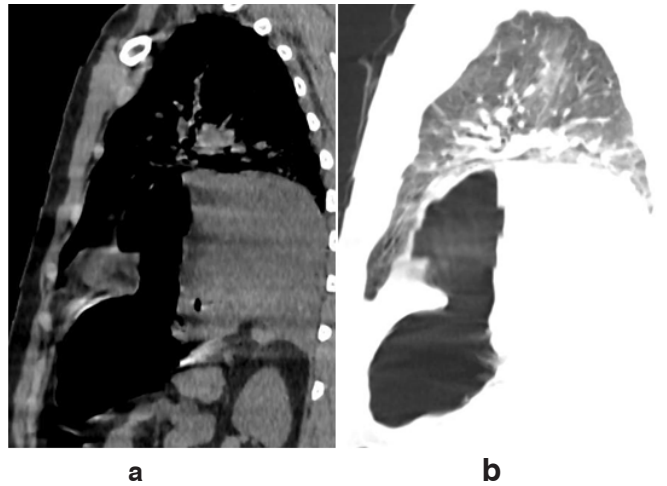
**Figure 1:** Chest X-ray PA view showing fundal gas shadow in left hemithorax with shift of mediastinal structures to right



**Figure 3a & 3b:** CT coronal sections mediastinal and lung window showing herniating stomach in to left hemithorax through a defect in left hemidiaphragm which is causing waist like constriction of the stomach at the site of defect.



**Figure 2a & 2b:** CT axial sections mediastinal and lung window showing fundus of stomach with food contents in left hemithorax lying in a dependent position against posterior ribs (dependent viscera sign).



**Figure 4a & 4b:** CT sagittal sections mediastinal and lung window showing herniating stomach in to left hemithorax through a defect in left hemidiaphragm.