

From Scan to Scalpel: CT Detection and Surgical Confirmation of Diaphragmatic Rupture – Case Series

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Received: 01-07-2026 / Revised: 15-08-2026 / Accepted: 21-09-2026

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Conflict of interest: Nil

Abstract

Background: Traumatic diaphragmatic rupture (TDR) is an uncommon but serious condition often missed in the acute setting due to non-specific clinical and radiological findings.

Aim: To highlight the diagnostic accuracy of multidetector CT (MDCT) in identifying diaphragmatic injuries across varied trauma scenarios and its correlation with surgical confirmation.

Methods: We present a series of four patients who presented to the L.T.M.M.C & L.T.M.G.H. Sion, Mumbai in department of Radio-diagnosis with suspected thoracoabdominal trauma. The mechanisms of injury included: three cases of road traffic accidents, one case of penetrating stab injury, and one case of fall from height. All patients underwent contrast-enhanced multidetector computed tomography (MDCT) on a 160-slice CT scanner (Cannon aquilion prime SP) as part of the trauma protocol. The scans revealed classical signs of diaphragmatic discontinuity, herniation of abdominal contents into the thoracic cavity, and associated thoracoabdominal injuries. Each diagnosis was later confirmed intraoperatively during emergency surgical exploration. Imaging findings were retrospectively reviewed and correlated with operative reports.

Conclusion: MDCT is a highly sensitive tool in the early detection of diaphragmatic rupture. Prompt identification can guide timely surgical intervention, reducing morbidity and preventing complications such as visceral herniation and strangulation.

Keywords: Traumatic Diaphragmatic Rupture; CT scan; Multidetector CT; Blunt Trauma; Penetrating Trauma; Surgical Correlation.

DOI: 10.25258/ijcpr.18.10.86

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Introduction

Traumatic diaphragmatic injuries (TDI), although uncommon, carry high morbidity and are often missed during initial evaluation. Recent meta-analyses estimate the incidence of TDI in blunt trauma to be between 0.8%–5% and in penetrating trauma up to 15% [1,2]. Left-sided ruptures are more common due to the protective effect of the liver on the right side [3].

Multidetector computed tomography (MDCT) with multiplanar reformations has become the imaging modality of choice for detecting diaphragmatic injuries. It demonstrates a pooled sensitivity of approximately 80% and specificity up to 98% for blunt trauma cases [1,4].

Compared to conventional chest radiography—which may miss up to 50% of injuries—CT significantly improves early detection [5]. For penetrating injuries, particularly stab wounds involving the thoracoabdominal junction, CT still demonstrates high specificity (~92%), although sensitivity may be lower (~74%) [6]. Classic CT signs such as diaphragmatic discontinuity, the collar sign, and dependent viscera sign are useful indicators [7,8].

We present a case series of four surgically confirmed cases of TDI, resulting from road traffic accidents, a fall from height, and a stab wound,

highlighting the diagnostic utility of MDCT and its critical role in guiding timely surgical intervention.

Case Presentation

Case Report- 1: A 15-year-old man arrived at our hospital emergency department with an alleged history of assault with sharp object over left lower chest and upper abdomen. On arrival, the patient's vitals were unremarkable. General resuscitation measures were taken. X-RAY suggestive of large fundic bubble in left hemithorax with NJ tube coiling within the fundus [Figure 1A]. Once the patient was stabilized, was shifted for CT Abdomen and pelvis study.

CT-abdomen showed a defect in the left hemidiaphragm, for a length of 4.0 cm, with herniation of the entire stomach with NG tube tip

with gastric body being folded on itself with the fundus and gastric body forming an inverted U configuration suggestive of mesenteroaxial volvulus [Figure 1B, 1C] and AAST grade III splenic injury with hemoperitoneum, left mild to moderate pneumothorax with collapse in left lower lobe. Crowding of vessels are seen within the collapsed lung. The patient was emergently shifted for exploratory laparotomy.

Firstly, a left intercostal drainage tube was placed and intra-operatively, left-sided diaphragmatic rent of about 3 cm, with stomach herniation was noted [Figure 1D] and grade III splenic injury is noted. The stomach was successfully reduced into the abdominal cavity and splenectomy was done. The diaphragmatic rent was closed with non-absorbable sutures.



Fig.1A



Fig.1B



Fig.1C

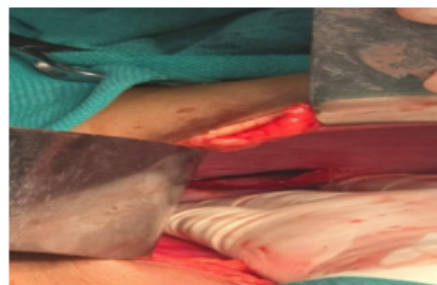


Fig.1D

Case Report- 2: A 24-year-old man was brought to the emergency department following a road traffic accident between divider and a four-wheeler. There was no history of loss of consciousness, seizure activity or vomiting at the scene.

He was conscious and hemodynamically stable on arrival. The patient had complaints of severe abdominal pain and dyspnoea. On abdominal examination, abdomen was distended, with diffuse tenderness and guarding.

X-RAY suggestive of absence of fundic bubble in abdomen [Figure 2A]. Appropriate resuscitation measures were taken, and once stabilized, the patient was shifted for radiological investigations. CT thorax revealed consolidatory changes with air bronchogram involving the left lower lobe and sparing of superior segment. Crowding of vessels

were seen within the collapsed lung. Contrast CT of the abdomen revealed splenic lacerations with intrasplenic vessel injury—corresponding to Grade IV AAST splenic injury, intraperitoneal bladder rupture.

Left diaphragmatic rupture of size 5.5 cm with herniation of stomach in left thoracic cavity [Figure 2B].

Mild hemoperitoneum and comminuted displaced fractures of pelvis is noted. Left intercostal drainage was done.

An exploratory laparotomy was done left-sided diaphragmatic rent of about 5.5 cm noted with gastric herniation [Figure 2C]. Stomach was successfully reduced into the abdominal cavity, primary repair of dome of bladder was done and

the diaphragmatic rent was closed with non-

absorbable sutures.



Fig 2A:



Fig 2B:



Fig 2C:

Case Report- 3: A 24-year-old man was brought to the emergency department following fall from height around fourth floor.

There was no history of loss of consciousness, seizure activity or vomiting at the scene. He was conscious and hemodynamically stable on arrival. The patient had complaints of severe abdominal pain and dyspnoea. On abdominal examination, it was distended, with diffuse tenderness and guarding.

X RAY suggestive of multiple air bubble in left thoracic cavity [Figure 3A]. Appropriate resuscitation measures were taken, and once stabilized, the patient was shifted for CT abdomen and pelvis. CT thorax reported right sided moderate pneumothorax and multiple lung contusions. Contrast CT of the abdomen revealed left hemi-

diaphragmatic injury with large diaphragmatic rent with gastric herniation with mesenteroaxial volvulus & herniation of other abdominal contents (distal 1/3rd of transverse colon, splenic flexure, proximal part of ascending colon, spleen, distal body & tail of pancreas, small bowel loops likely jejunal loops and its mesentery and vessels) [Figure 3B] and moderate hemoperitoneum and comminuted fracture of pelvis is done.

An exploratory laparotomy was done, and 500ml of hemoperitoneum was evacuated. Left-sided diaphragmatic rent of about 12 cm noted with herniation of stomach, large bowel and spleen in to the left hemithorax [Figure 3C], these organs were successfully reduced into the abdominal cavity, and the diaphragmatic rent was closed with non-absorbable sutures.



Fig 3A:

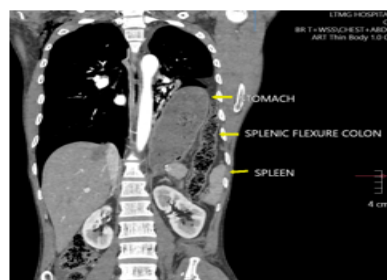


Fig 3B:

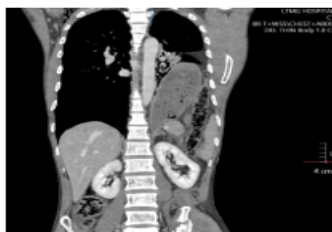


Fig 3C:

Case Report- 4: A 77-year-old man was brought to the emergency department with severe abdominal pain and 2 episodes of hematemesis in 2 weeks with h/o fall from height 7 months back. He was conscious and hemodynamically stable on arrival. Appropriate resuscitation measures were taken, and once stabilized, the patient was shifted for CT abdomen and pelvis. CT thorax and abdomen suggestive of left hemi-diaphragmatic injury with diaphragmatic rent with gastric and duodenal herniation with mesenteroaxial volvulus (Fig.4A, Fig.4B) and bilateral aspiration. Patient died next day due to aspiration.

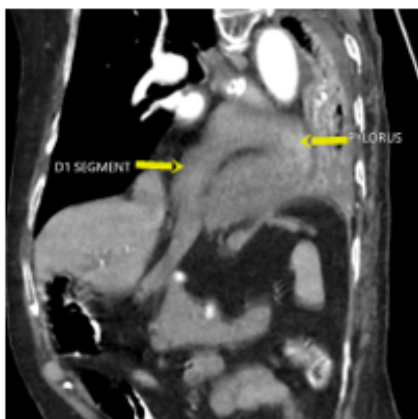


Fig.4A



Fig.4B

Discussion

Traumatic diaphragmatic rupture can lead to delayed and life-threatening complications such as visceral herniation, strangulation, and respiratory compromise if missed [9].

Despite clinical vigilance, chest radiographs are limited in sensitivity, particularly in acute trauma scenarios [5].

MDCT remains the diagnostic gold standard due to its superior spatial resolution and ability to detect subtle signs such as diaphragmatic discontinuity, the collar sign, and herniation of abdominal contents [4,7]. In our series, MDCT was able to accurately identify TDI in all four cases, with subsequent surgical confirmation, reinforcing findings from recent systematic reviews [1,6].

Our cohort included varied trauma mechanisms—blunt trauma in three patients (two RTAs, one fall) and penetrating trauma in two (stab injuries). This reflects the spectrum of presentations reported in recent literature [2,6].

The presence of the dependent viscera sign and collar sign in blunt trauma has been well documented as highly specific for diaphragmatic rupture [7,8]. Meanwhile, penetrating injuries require high index of suspicion and careful CT interpretation, as injuries may be occult or obscured by adjacent soft tissue damage [6,10].

Recent literature also emphasizes the importance of timely surgical repair to avoid complications, even in cases where diaphragmatic injuries are discovered incidentally or late [9,10]. The accurate and timely CT diagnosis in our series enabled early

operative intervention and prevented morbidity associated with delayed repair.

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