

Traumatic Rupture of the Left Hemidiaphragm with Intrathoracic Herniation of the Stomach, Hydropneumothorax and Gastric Perforation: A Case Report

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ABSTRACT

Traumatic Diaphragmatic Rupture (TDR) is a rare but also serious sequela of high-energy blunt thoracoabdominal trauma, which is frequently associated with concomitant thoracic as well as intra-abdominal injuries. Delayed or missed diagnosis can result in life-threatening complications because of visceral herniation and strangulation. A 28-year-old male from India presented after a motorcycle-related fall with chest pain, dyspnea and left hypochondrial tenderness. Initial imaging of the patient showed left-sided diaphragmatic rupture with herniation of the entire stomach into the thoracic cavity, which was associated with hydropneumothorax, near-complete lung collapse, multiple rib fractures, and a grade III splenic injury. Contrast-Enhanced Computed Tomography (CECT) of the patient further confirmed a large posterior diaphragmatic defect measuring approximately 7 cm. Emergency exploratory laparotomy showed a left diaphragmatic rupture, also having herniated stomach and bowel, gastric perforation, and significant splenic laceration. Surgical management included reduction of herniated viscera, primary diaphragmatic repair, splenectomy, and closure of the gastric perforation, along with intercostal drainage. The present case underscores the importance of early recognition, comprehensive imaging, and adequate surgical management of TDR to prevent severe morbidity and mortality.

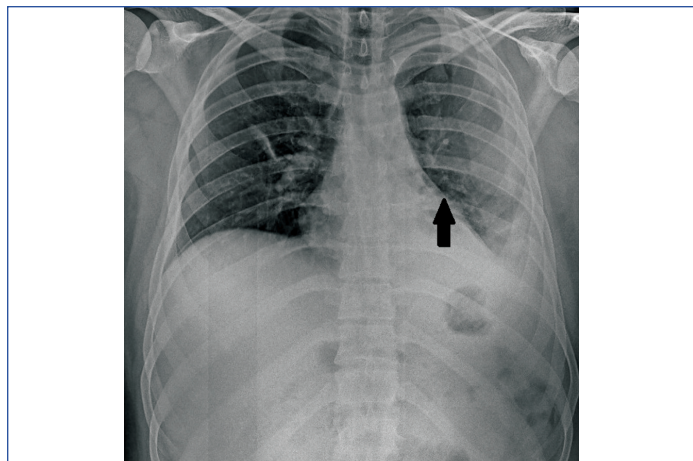
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CASE REPORT

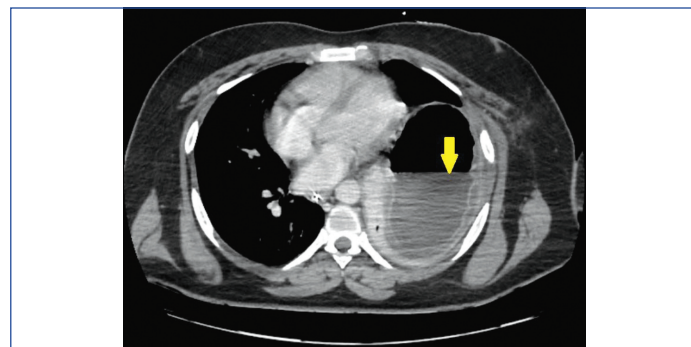
A 28-year-old Indian male was brought to the emergency department having a history of a slip and fall from a motorcycle at night, following which he sustained blunt trauma to the chest as well as abdomen, along with a long-bone injury. He presented with complaints related to trauma, but also denied nausea, vomiting, bleeding from the ear, nose, or throat, head injury, loss of consciousness, seizures, bowel and bladder disturbances. The patient had no prior history of diabetes mellitus, hypertension, tuberculosis, bronchial asthma, epilepsy, or previous surgical interventions. He had initially received treatment at another centre where he was diagnosed with Traumatic Diaphragmatic Rupture (TDR) along with herniation of abdominal contents into the thoracic cavity that was associated with left-sided pneumothorax and left lung collapse following trauma to the chest and abdomen, as shown in [Table/Fig-1].

After clinical examination, the patient was conscious, well-oriented, haemodynamically stable, but tachycardic. Respiratory system examination showed reduced air entry on the left-side, while his right lung fields were clear. Cardiovascular examination of the patient showed normal heart sounds. Abdominal examination revealed a soft abdomen with tenderness localised to the left hypochondrium without guarding, rigidity, rebound tenderness, or distension. The bowel sounds were present in all quadrants. Neurological examination was not remarkable. Local examination of the patient showed an abrasion over the left elbow and an intercostal drainage tube in situ with visible air column movement; there was no active bleeding, pus discharge, or foreign body. Musculoskeletal and spinal examination were within normal limits.

Radiological evaluation of the patient using Contrast-Enhanced Computed Tomography of the abdomen and pelvis showed a large defect in the left hemidiaphragm that measured approximately 7 cm with herniation of the entire stomach into the left thoracic cavity, suggestive of traumatic diaphragmatic injury along with hernia, as shown in [Table/Fig-2].

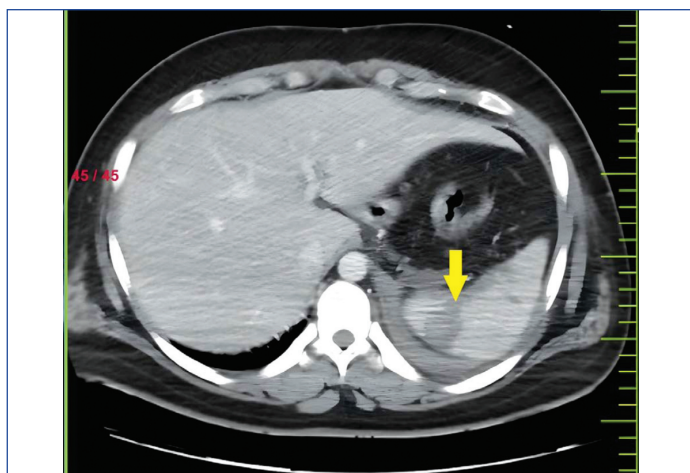


[Table/Fig-1]: Radiograph of the chest showing a traumatic diaphragmatic hernia with herniation of the entire stomach into the left thoracic cavity (black arrow).

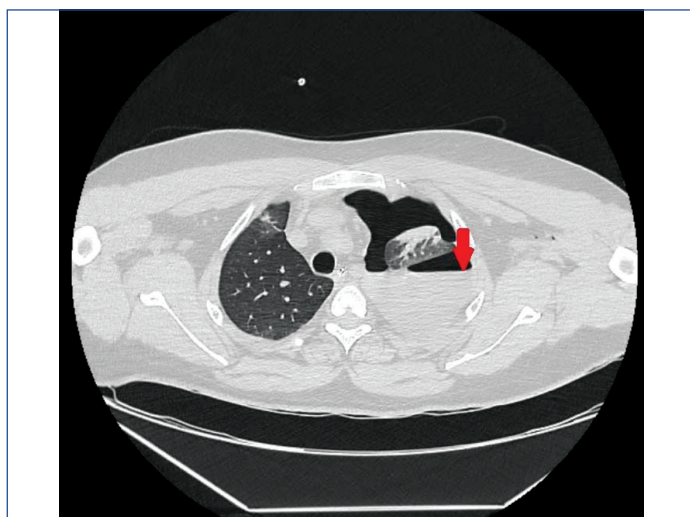


[Table/Fig-2]: Contrast-enhanced CT (CECT) of the abdomen and pelvis showing traumatic diaphragmatic hernia with herniation of the entire stomach into the left thoracic cavity (yellow arrow).

Associated findings included a grade III splenic injury, characterised by wedge-shaped hypodense areas in the upper pole, linear lacerations, and a minimal perisplenic haematoma [Table/Fig-3]. High-resolution CT of the thorax also demonstrated left-sided hydropneumothorax with near-complete collapse of the left lung, multiple left rib fractures, a minimally displaced fracture of the left clavicle, and features that were suggestive of pulmonary contusion in the right upper lobe [Table/Fig-4].

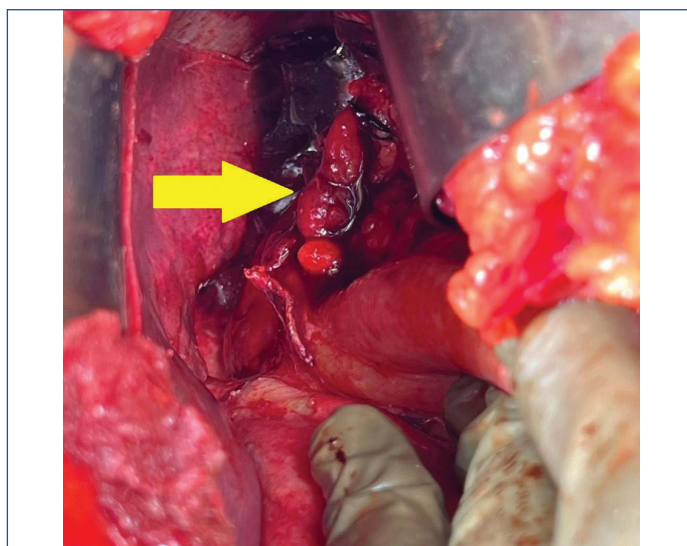


[Table/Fig-3]: Axial abdominal CECT scan showing wedge-shaped area of hypoattenuation with apex towards the hilum noted in the upper pole, having maximum depth of 3.3 cm, suggestive of Grade III splenic injury (laceration) according to the American Association for the Surgery of Trauma (AAST) Organ Injury Scale (OIS) for splenic injury.

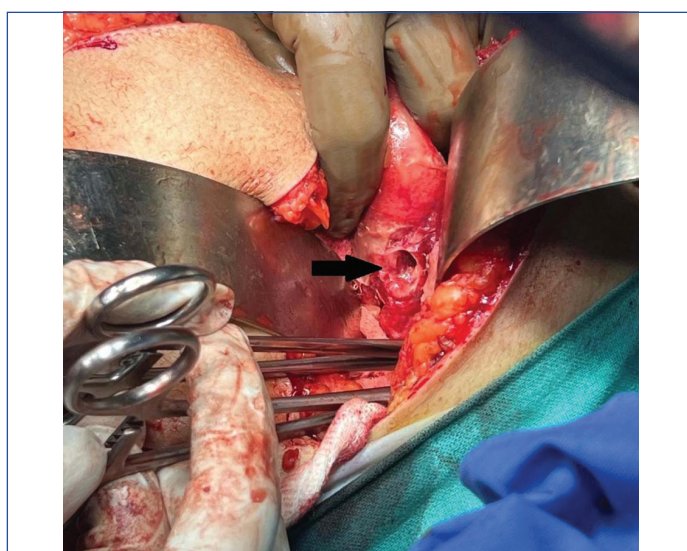


[Table/Fig-4]: High-Resolution CT (HRCT) of the thorax demonstrating thoracic injuries (red arrow).

Routine laboratory investigations were also done, which reported leukocytosis with neutrophilic predominance. Renal function parameters were within normal limits, while transient electrolyte and liver enzyme derangements were noted and managed conservatively. After an adequate pre-anaesthetic evaluation, the patient underwent exploratory laparotomy under general anaesthesia. Intraoperatively, a posterior defect of approximately 7 cm was identified in the left hemidiaphragm along with herniation of bowel contents, which were reduced into the peritoneal cavity as shown in [Table/Fig-5]. A perforation was also noted in the body of the stomach. [Table/Fig-6]. Significant splenic lacerations were identified, and splenectomy was performed after careful dissection and ligation of the splenic hilum. The diaphragmatic defect was thus repaired using non absorbable sutures, and gastric perforation was closed primarily. An intercostal drainage tube was placed in the left fifth intercostal space along with an abdominal drain. Adequate haemostasis was thereby achieved, and the abdomen was closed in layers. The procedure was uneventful, and the patient received an intraoperative blood transfusion without any adverse reaction.



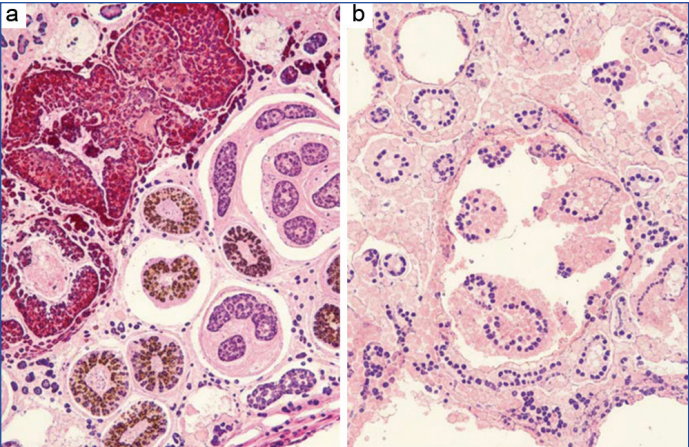
[Table/Fig-5]: Intraoperative photograph showing traumatic diaphragmatic defect (yellow arrow).



[Table/Fig-6]: Intraoperative photograph showing gastric perforation (black arrow).

Postoperatively, the patient was managed in the surgical intensive care unit using intravenous fluids, broad-spectrum antibiotics, analgesics, antiemetics, and supportive care. The patient also initially required ventilatory support; he was later successfully extubated. Respiratory medicine and internal medicine consultations were obtained for postoperative respiratory management and for transient blood pressure elevation, respectively. Oxygen supplementation, chest physiotherapy, intermittent non invasive ventilation, and antihypertensive therapy were administered to the patient as advised. Antihypertensive management was initiated to control postoperative transient hypertension, which is likely related to sympathetic activation following major thoracoabdominal trauma and surgery. Serial wound inspections of the patient showed a healthy suture line having minimal soakage and no evidence of surgical site infection. The intercostal drainage tube was removed on postoperative day 6 after an adequate radiological confirmation of lung re-expansion, and the patient maintained satisfactory oxygen saturation on room air thereafter. Histopathological examination of the excised spleen and gastric specimens confirmed changes consistent with traumatic injury, and no evidence of underlying malignancy or chronic pathology. Also, wound cultures showed no growth, as shown in [Table/Fig-7].

At the time of discharge on postoperative day 12, the patient was in stable condition, having a healthy surgical scar and no active complaints. At 6-month follow-up, the patient was asymptomatic, with a well-healed surgical wound and normal respiratory function.



[Table/Fig-7]: Histopathological image of excised splenic and gastric specimens (H&E, 100x): a) Splenic specimen showed parenchymal disruption with haemorrhage and congestion; b) Gastric specimen revealed transmural necrosis with acute inflammatory infiltrate, consistent with traumatic perforation.

DISCUSSION

The TDR is known as an uncommon but also clinically significant entity that most often arises following high-energy blunt thoracoabdominal trauma, including road traffic collisions or falls from height [1]. The overall incidence of diaphragmatic injury in the setting of thoracoabdominal trauma is very low, which is estimated at approximately 0.8-8% of blunt trauma cases [2]. Due to the relative rarity of the condition, the non specific nature of its initial clinical signs, TDR remains a diagnostic challenge, even imaging can fail to diagnose diaphragmatic defects acutely, thereby resulting in delayed recognition, increased morbidity associated with visceral herniation, and strangulation [3].

The left hemidiaphragm is disproportionately affected in traumatic injury, and herniation of abdominal organs, including the stomach, omentum, as well as bowel into the thoracic cavity, is frequently encountered following diaphragmatic rupture. Left-sided injury was observed in the majority of patients due to the liver's protective effect on the right side [4,5]. Associated thoracic and intra-abdominal injuries, including pneumothorax, lung contusion, splenic lacerations and hollow viscus perforations, are present in most patients with TDR because significant force is required to breach the diaphragm, thereby highlighting the multisystem nature of high-velocity trauma [6].

The surgical management of TDR usually involves the reduction of herniated abdominal contents, which is followed by the repair of diaphragmatic defect [7]. The type of closure depends mainly upon the size of the defect, tissue quality and presence of tension across the repair [7]. In most acute diaphragmatic injuries with small to moderate

defects, primary repair is done using non absorbable sutures, which is considered a standard technique as it provides durable closure along with minimal recurrence [7]. The diaphragmatic defects are usually repaired using interrupted non absorbable sutures, including polypropylene or polyester, thereby ensuring watertight and tension-free approximation of the diaphragmatic edges [7].

However, in cases where the defect is large, chronic, and associated with significant tissue loss preventing tension-free closure, prosthetic reinforcement mesh can be required [8]. Synthetic meshes such as polypropylene and dual-mesh prostheses have been used successfully for the repair of extensive diaphragmatic defects in cases when primary suturing is not actually feasible [8]. In addition, biologic meshes derived from acellular dermal matrices, porcine dermis, have been proposed as an alternative in contaminated fields or in cases where infection risk is high, as they further allow tissue integration while reducing the risk of prosthetic infection [7,9]. In the present case, the diaphragmatic defect measured approximately 7 cm and was successfully repaired with primary closure using non absorbable sutures.

A case series reported by Porojan VA et al., highlighted that TDR is frequently associated with severe thoracoabdominal injuries, thereby underscoring the importance of early diagnosis as well as prompt surgical intervention [10].

Naik Mude N et al., underscore the importance of maintaining a high index of suspicion for diaphragmatic and pericardial injuries in blunt thoracoabdominal trauma, as early diagnosis as well as adequate surgical intervention are critical for prevention of morbidity and ensuring favourable outcomes [11]. In a case reported by Guevara-Kissel MF et al., a 31-year-old male presented with acute left-sided chest pain and intractable vomiting one year after a penetrating thoracoabdominal stab injury, highlighting the delayed presentation of traumatic diaphragmatic hernia [12].

In a case reported by Xiao JC et al., a 28-year-old male from China presented with an acute left subcostal pain, dyspnoea, nausea, and vomiting two years after sustaining blunt thoracic trauma from a road traffic accident, illustrating a delayed presentation of TDR [13]. Subsequent endoscopic and CECT evaluation of the patient further showed partial herniation of the stomach through a posterior-medial defect in the left diaphragm with features of ischemic necrosis [13].

Shakya YL et al., highlight the importance of early radiological evaluation and timely surgical repair in traumatic diaphragmatic hernia for the prevention of respiratory compromise, along with visceral strangulation [14]. Comparative analysis of reported cases of traumatic diaphragmatic hernia is depicted in [Table/Fig-8] [6,10-15].

Author	Country	Age/ Gender	Mechanism of injury	Timing of presentation	Key clinical features	Imaging findings	Intraoperative findings	Management
Porojan VA et al., [10]	Romania	15 patients 8 Males and 7 Females	Predominantly blunt thoracoabdominal trauma	Mostly acute	Chest or abdominal pain, respiratory symptoms	CT: left-sided diaphragmatic defects with herniation of abdominal viscera	Diaphragmatic rupture with herniated abdominal organs	Laparotomy with reduction of contents and primary diaphragmatic repair
Naik Mude N et al., [11]	India	23/F	Road traffic accident (blunt thoracoabdominal trauma)	Acute	Respiratory distress, chest- abdominal pain	CXR: mediastinal shift, stomach in left hemithorax; CT: left diaphragmatic rupture, gastric herniation, haemothorax	Large left diaphragmatic defect with associated pericardial laceration	Reduction of stomach, primary diaphragmatic repair, pericardial repair, tube thoracostomy
Guevara- Kissel MF et al., [12].	USA	31/M	Penetrating thoracoabdominal stab injury	Delayed (1 year)	Acute chest pain, intractable vomiting	Initial CXR unremarkable; CT: distended stomach herniating through left posterolateral defect	Large diaphragmatic defect with a strangulated stomach and necrotic omentum	Laparoscopic reduction, gastric serosal repair, omentectomy, chest tube, primary closure
Xiao JC et al., [13]	China	28/M	Blunt thoracic trauma (RTA)	Delayed (2 years)	Left subcostal pain, dyspnoea, vomiting, sepsis	Initial CT: massive pleural effusion (misdiagnosed); later CT/endoscopy: gastric herniation with ischaemia	Large diaphragmatic rupture with ischemic, necrotic stomach and omentum	Total gastrectomy with diaphragmatic repair

Shakya YL et al., [14]	Nepal	44/M	Fall from height (blunt trauma)	Acute	Respiratory distress, chest pain	CXR: loss of diaphragmatic contour, mediastinal shift; CT: stomach and bowel in left hemithorax	Large diaphragmatic rent with herniated bowel loops	Left posterolateral thoracotomy, reduction, primary repair, chest drainage
Pace M et al., [15]	Italy	56/F	High-energy MVC (blunt trauma)	Acute + delayed	Respiratory compromise	CT: left-sided rupture with stomach & spleen; later CT: missed right-sided rupture (collar sign)	Left grade IV rupture initially; delayed right-sided diaphragmatic rupture with liver herniation	Emergency laparotomy + repair; delayed thoracotomy with mesh repair
Lu J et al., [6]	China	6 patients/M	Prior thoracoabdominal trauma (mostly RTA)	Delayed (2–11 years)	Abdominal pain, dyspnea, chest pain, nausea, vomiting	CXR and CT: herniation of abdominal viscera into thoracic cavity	Left-sided diaphragmatic defects with herniated viscera	Thoracotomy or laparotomy with reduction and primary repair
Present case	India	28/M	Slip and fall from a motorcycle (blunt thoracoabdominal trauma)	Acute	Chest pain, dyspnea, left hypochondrial tenderness	CXR & CT: entire stomach herniated into left hemithorax, hydropneumothorax, lung collapse; CT: 7 cm left diaphragmatic defect	Posterior left diaphragmatic defect with gastric perforation and grade III splenic injury	Exploratory laparotomy, reduction of contents, primary diaphragmatic repair, splenectomy, gastric perforation repair, ICD

[Table/Fig-8]: Comparative analysis of reported cases of traumatic diaphragmatic hernia [6,10-15].
Chest X-ray (CXR); CT (Computed Tomography); RTA (Road Traffic Accident); ICD (Intercostal Drainage)

The prognosis in cases of TDR mainly depends upon the presence and severity of associated thoracoabdominal injuries rather than the diaphragmatic defect itself [3]. Large clinical analyses have shown that mortality in TDR is mainly related to polytrauma as well as associated visceral injuries rather than failure of diaphragmatic repair, thus emphasising about importance of early diagnosis, prompt operative management [5].

CONCLUSION(S)

The present case highlights the rare co-existence of complete gastric herniation, hydropneumothorax, splenic injury, and gastric perforation, thereby emphasising the severity of force required to disrupt the diaphragm. Early clinical suspicion, prompt cross-sectional imaging, as well as adequate, timely surgical intervention are pivotal to prevent catastrophic complications such as visceral strangulation, ischaemia, sepsis, and respiratory compromise, thereby ensuring favourable patient outcomes.

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