



Gastro Surgery

BLUNT TRAUMATIC DIAPHRAGMATIC HERNIA WITH GASTRIC HERNIATION AND ASSOCIATED SOLID-ORGAN INJURIES: A CASE REPORT

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ABSTRACT **Background:** Traumatic diaphragmatic injury is an uncommon but potentially life-threatening consequence of thoracoabdominal trauma. Because clinical manifestations are nonspecific and radiographic findings may be obscured by associated injuries, the diagnosis can be missed or delayed. **Case presentation:** An 18-year-old male presented to the emergency department approximately 16 hours after a road traffic collision in which he was the rider of a motorcycle involved in a collision with a truck. He had left-sided chest and upper abdominal pain and dyspnea. On examination, pulse was 110/min, respiratory rate 32/min and blood pressure 110/70 mmHg, with reduced left-sided breath sounds and abdominal tenderness in the right lumbar and left hypochondrial regions. Chest radiography demonstrated a left hemothorax with collapse of the left lung, a suspicious gastric shadow in the left hemithorax and mediastinal shift to the right. After Ryle's tube and intercostal drainage insertion, the Ryle's tube was seen within the stomach in the left hemithorax. Contrast-enhanced CT of the thorax, abdomen and pelvis demonstrated a 4-cm posterior left diaphragmatic defect with herniation of the stomach up to the left hilum and associated subsegmental atelectasis. The patient also had a grade IV right renal injury with contrast extravasation and a grade III liver injury. Emergency laparotomy revealed the stomach herniated into the left hemithorax; it was reduced into the abdomen and the diaphragmatic defect was repaired with interrupted 1-0 polypropylene sutures. Postoperative radiographs showed restoration of mediastinal position and subsequent lung re-expansion with the stomach in its normal abdominal position. **Conclusion:** A high index of suspicion is essential for diagnosing traumatic diaphragmatic rupture in patients with blunt thoracoabdominal trauma, particularly in the presence of multiple associated injuries. Chest radiography can provide important clues, whereas multidetector CT is valuable for confirming the diagnosis and defining associated injuries. Early operative repair in an appropriate polytrauma setting can restore diaphragmatic continuity and prevent complications related to herniated abdominal viscera.

KEYWORDS : Traumatic diaphragmatic injury; diaphragmatic rupture; traumatic diaphragmatic hernia; blunt trauma; gastric herniation; road traffic accident; polytrauma; laparotomy

INTRODUCTION

Traumatic diaphragmatic injury (TDI) is an uncommon consequence of thoracoabdominal trauma and may result from either blunt or penetrating mechanisms. The clinical spectrum ranges from an occult radiological finding in an otherwise stable patient to acute respiratory compromise caused by herniation of abdominal viscera into the thoracic cavity. Delayed presentations can manifest with intestinal obstruction, strangulation, perforation or respiratory symptoms. The diagnosis is therefore challenging because the clinical and radiological manifestations may be dominated by associated thoracic, abdominal or skeletal injuries. Systematic reviews indicate that left-sided injuries are more frequently recognized and that multidetector computed tomography (CT) is currently the principal imaging modality in patients who are stable enough to undergo cross-sectional imaging; however, false-negative examinations can occur, and persistent clinical suspicion remains important. Chest radiography may demonstrate indirect signs such as an elevated or abnormal hemidiaphragm, intrathoracic abdominal viscera, unexplained hemothorax or a nasogastric tube projecting above the diaphragm. [1–4]

The mechanism of blunt diaphragmatic rupture is thought to involve a sudden increase in intra-abdominal pressure against a closed glottis and/or shearing forces across the diaphragm. Associated injuries are common because the energy required to rupture the diaphragm is substantial. Consequently, diagnostic evaluation should encompass the entire thoracoabdominal injury pattern rather than focusing on the diaphragm in isolation. [1,3,5]

Management depends on the patient's physiology, associated injuries, timing of diagnosis and the abdominal or thoracic viscera involved. In acute blunt trauma requiring abdominal exploration, laparotomy provides the additional advantage of allowing systematic inspection and treatment of intra-abdominal injuries. Direct suture repair is commonly used for defects that can be closed without tension, whereas prosthetic or biologic reinforcement may be considered for large defects or when primary closure is not feasible. [5,6]

We present an acute left-sided traumatic diaphragmatic hernia with gastric herniation in an 18-year-old male following a road traffic collision, associated with major right renal and liver injuries. The case emphasizes recognition of radiographic clues, the value of CT in defining the injury, and the role of emergency laparotomy and primary diaphragmatic repair in a patient with multiple injuries.

Case Presentation

An 18-year-old male presented to the emergency department at approximately 06:00 on 20 September 2023. He had sustained a road traffic accident at approximately 14:00 on 19 September 2023 while riding a motorcycle and colliding with a truck. Following the accident, he developed pain over the left side of the chest and upper abdomen and difficulty breathing.

On arrival, his pulse rate was 110 beats/min, respiratory rate 32 breaths/min and blood pressure 110/70 mmHg. Clinical examination revealed decreased breath sounds on the left side of the chest. Abdominal examination demonstrated diffuse tenderness involving the right lumbar and left hypochondrial regions. Given the combination of respiratory symptoms and thoracoabdominal trauma, imaging was undertaken.

Table 1. Summary of Presentation and Investigations

Parameter	Finding
Age / sex	18-year-old male
Mechanism	Road traffic accident; motorcycle rider struck by truck
Time of presentation	~06:00 on 20/09/2023; trauma at ~14:00 on 19/09/2023
Symptoms	Left chest pain, upper abdominal pain, dyspnea
Initial vitals	Pulse 110/min; RR 32/min; BP 110/70 mmHg
Examination	Decreased left breath sounds; right lumbar and left hypochondrial tenderness
Chest radiograph	Left hemothorax, left lung collapse, suspicious gastric shadow in left hemithorax, rightward mediastinal shift
Post-tube radiograph	Ryle's tube visualized within stomach in left hemithorax
CT diaphragm	Posterior left diaphragmatic rupture; defect ~4 cm
Herniation	Stomach herniated into left thorax up to left hilum; subsegmental atelectasis
Associated injuries	Grade IV right renal injury with contrast extravasation; grade III liver injury; pulmonary ground-glass opacities
Operation	Emergency laparotomy; reduction of stomach; primary diaphragmatic repair with interrupted 1-0 polypropylene

Investigations

The initial chest radiograph demonstrated a left hemothorax with collapse of the left lung, a suspicious gastric shadow within the left hemithorax and mediastinal shift towards the right. After insertion of a Ryle's tube and intercostal drainage tube, the Ryle's tube was visualized within the stomach located in the left hemithorax, providing a strong radiographic clue to diaphragmatic rupture with gastric herniation.

Contrast-enhanced CT of the thorax, abdomen and pelvis demonstrated ground-glass opacities in the apicoposterior segment of the left upper lobe and the superior segment of the left lower lobe. A traumatic rupture was identified in the posterior aspect of the left hemidiaphragm, with a defect measuring approximately 4 cm. The stomach had herniated through the defect into the left thoracic cavity up to the level of the left hilum, producing subsegmental atelectasis of the adjacent lung.

The CT also identified a grade IV right renal injury with contrast extravasation from the right renal pelvis and a large right perinephric hematoma, together with a grade III liver injury. Thus, the patient had a significant polytrauma pattern in addition to the diaphragmatic rupture.

Operative Management

The patient was taken for emergency laparotomy. A midline abdominal incision was used. On entering the abdomen, the stomach was not identified in its expected abdominal position because it had herniated through the diaphragmatic defect into the left hemithorax. The stomach was reduced back into the abdominal cavity. The left diaphragmatic defect was identified and closed with interrupted 1-0 polypropylene (Prolene) sutures.

A right-sided retroperitoneal hematoma measuring approximately 8 × 6 cm was noted. The intra-abdominal organs were inspected, peritoneal lavage was performed and abdominal drains were placed. The abdomen was then closed in layers.

The supplied presentation does not describe thoracic exploration, mesh reinforcement, intraoperative blood loss, transfusion requirement, duration of ventilation, or detailed management of the grade IV renal and grade III liver injuries. These details should be incorporated from the operative and inpatient records before submission.

Postoperative Course and Follow-up

An immediate postoperative chest radiograph demonstrated correction of the mediastinal shift. A follow-up radiograph at approximately two weeks showed adequate expansion of the left lung and the gastric shadow in its normal abdominal position.

Figures



Figure 1. Initial chest radiograph demonstrating left-sided thoracic opacity/hemothorax with collapse of the left lung and mediastinal shift. The gastric shadow in the left hemithorax raises suspicion of diaphragmatic rupture.



Figure 2. Chest radiograph after Ryle's tube and intercostal drainage

placement. The Ryle's tube is visualized within the stomach positioned in the left hemithorax, providing a strong radiographic clue to left traumatic diaphragmatic hernia.

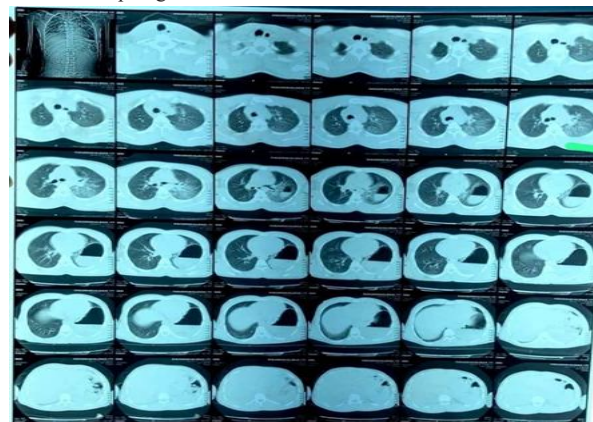


Figure 3. Axial CT images of the thorax demonstrating the left thoracic abnormality and associated lung changes.

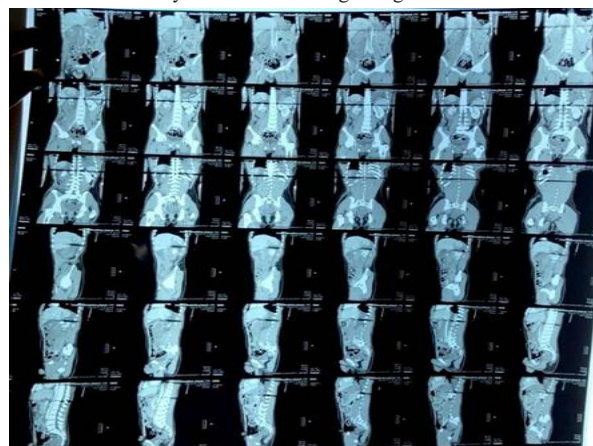


Figure 4. Coronal CT reconstruction demonstrating the left diaphragmatic defect with herniation of the stomach into the thoracic cavity.

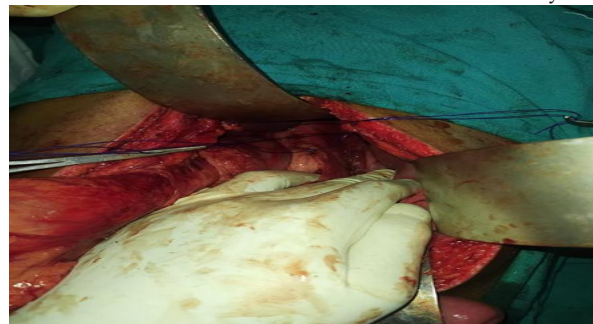


Figure 5. Intraoperative photograph demonstrating the traumatic rent in the left hemidiaphragm.



Figure 6. Immediate postoperative chest radiograph showing restoration of mediastinal position following reduction of the herniated stomach and diaphragmatic repair.

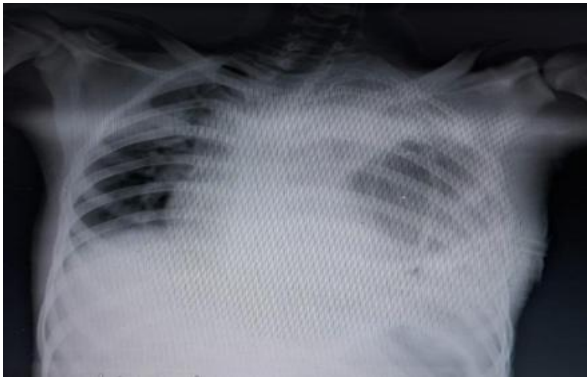


Figure 7. Chest radiograph approximately two weeks after surgery demonstrating adequate lung expansion and the gastric shadow in its normal abdominal position.

Discussion

This case illustrates the classic diagnostic challenge of traumatic diaphragmatic rupture in the setting of high-energy blunt trauma. The patient had respiratory symptoms, left-sided decreased breath sounds and radiographic evidence of a thoracic process, but the presence of multiple injuries could have obscured the diaphragmatic component. The finding of a gastric shadow in the left hemithorax and, particularly, a Ryle's tube within the stomach above the diaphragm were important clues to the diagnosis.

Plain chest radiography remains an important initial trauma investigation, but its sensitivity is imperfect. Historical surgical series have reported that only a proportion of diaphragmatic ruptures are diagnosed on the initial radiograph, with left-sided injuries more readily recognized than right-sided injuries. Modern systematic review evidence supports contrast-enhanced CT as the preferred cross-sectional modality in stable blunt-trauma patients, with pooled sensitivity around 80% and specificity around 98% for blunt TDI in the studies included in one meta-analysis. Importantly, CT can still be falsely negative, so imaging should be interpreted in conjunction with the mechanism and clinical findings. [1–4]

Several CT signs have been described, including discontinuity of the diaphragm, diaphragmatic thickening, the collar sign, dependent viscera sign, dangling diaphragm sign and herniation of abdominal organs. In the present patient, the most clinically decisive CT finding was direct visualization of the posterior left diaphragmatic defect with herniation of the stomach into the thorax. [3]

Left-sided traumatic diaphragmatic injuries are more readily detected because the liver partially protects the right hemidiaphragm and can obscure small right-sided defects. This is clinically relevant because delayed diagnosis can permit progressive herniation and adhesions and may eventually present with bowel obstruction, strangulation or perforation. The literature consistently emphasizes maintaining a high index of suspicion, particularly when a patient has persistent respiratory or abdominal symptoms that are not adequately explained by other injuries. [2,4,7]

The management of acute TDI is primarily operative when the diagnosis is established in a patient requiring exploration or when herniated viscera are at risk. In the present case, emergency laparotomy was particularly appropriate in the context of associated solid-organ injuries and allowed direct assessment of the abdominal viscera. The stomach was reduced from the thoracic cavity and the diaphragmatic defect was closed primarily with interrupted polypropylene sutures.

Primary repair is appropriate for many acute diaphragmatic defects when tension-free closure can be achieved. Mesh reinforcement is generally considered for larger defects or when primary repair is inadequate. The choice of abdominal versus thoracic access depends on timing, associated injuries and the location of the herniated organs. In acute abdominal polytrauma, laparotomy can offer the advantage of simultaneous treatment of abdominal injuries. [5,6]

The case also highlights the importance of post-repair imaging. The immediate postoperative radiograph documented restoration of the mediastinal position, while the two-week study demonstrated

adequate lung expansion and return of the gastric shadow to the abdomen. Although these findings are reassuring, longer clinical follow-up is needed to assess recurrence and late respiratory or gastrointestinal complications.

Current evidence supports a trauma imaging strategy based on mechanism, physiology and institutional protocols; plain radiography is useful for detecting clues but cannot exclude TDI. In patients who are stable enough for CT, multidetector CT provides a more comprehensive assessment of the diaphragm and associated thoracoabdominal injuries. [1,2]

Finally, this case demonstrates why the diaphragm should be deliberately assessed during both radiological interpretation and operative exploration in high-energy thoracoabdominal trauma. Early recognition permits repair before the development of delayed herniation, strangulation and other complications.

Clinical Timeline

Time	Event	Details
19 Sep 2023, ~14:00	Trauma	Motorcycle rider involved in collision with truck.
20 Sep 2023, ~06:00	Emergency presentation	Chest/upper abdominal pain and dyspnea; tachycardia and tachypnea.
Initial imaging	Chest radiography	Left hemothorax/collapse, gastric shadow in left chest and mediastinal shift.
After Ryle's tube + ICD	Radiographic clue	Ryle's tube visualized in stomach with in left hemithorax.
CT	Definitive anatomical assessment	4-cm posterior left diaphragmatic defect with gastric herniation; renal and liver injuries identified.
Emergency operation	Repair	Laparotomy; reduction of stomach; primary closure with interrupted 1-0 polypropylene.
Immediate postoperative period	Radiograph	Mediastinal position normalized.
~2 weeks	Follow-up radiograph	Left lung adequately expanded; stomach shadow in normal abdominal position.

Key Learning Points

1. Traumatic diaphragmatic rupture should be considered in high-energy blunt thoracoabdominal trauma, particularly when respiratory and upper abdominal symptoms coexist.
2. A gastric bubble or nasogastric/Ryle's tube projected into the thorax on chest radiography is an important clue to left-sided diaphragmatic rupture.
3. Contrast-enhanced CT is valuable for confirming diaphragmatic injury and simultaneously defining associated thoracic and abdominal injuries, but a negative CT does not completely exclude the diagnosis when clinical suspicion remains high.
4. Acute operative repair is indicated when traumatic diaphragmatic rupture is established in a patient undergoing abdominal exploration or when herniated viscera require reduction.
5. The diaphragm should be systematically inspected during laparotomy or thoracic exploration for significant thoracoabdominal trauma.

CONCLUSION

Blunt traumatic diaphragmatic rupture is uncommon and can be overlooked in patients with multiple associated injuries. In this young man, a combination of clinical suspicion, chest radiographic findings and CT demonstrated a left posterior diaphragmatic defect with substantial gastric herniation. Emergency laparotomy allowed reduction of the stomach, direct inspection of the abdominal cavity and primary repair of the diaphragmatic defect. The case reinforces the importance of deliberate assessment of the diaphragm in high-energy thoracoabdominal trauma and of integrating radiographic findings with the mechanism and clinical picture.

Declarations

- **Patient consent:** written informed consent for publication was taken.
- **Conflict of interest:** Authors declared no conflict of interests.
- **Author contributions:** Author 1: case conception/manuscript drafting, clinical, surgical contribution. Author 2: clinical contribution and surgical supervision.

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