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Right Hemidiaphragm Rupture After Blunt Trauma with Near-Complete Prolapse of The Liver into the Chest: A Combined Approach

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Abstract

Traumatic diaphragmatic injuries are rare but pose significant diagnostic and management challenges, particularly in acute cases involving blunt trauma. These injuries often present non-specific symptoms, leading to misdiagnosis or delayed intervention. The right hemi diaphragm is less commonly affected than the left, and its involvement is frequently associated with liver herniation and concomitant abdominal or thoracic injuries. We present the case of a 28-year-old female who sustained a blunt thoracoabdominal trauma after being struck by a moving vehicle. She arrived at the emergency department with complaints of pain in the neck, left shoulder, left side of the chest, and right arm. Initial assessments revealed hemodynamic stability, a Glasgow Coma Scale (GCS) score of 15/15, and decreased breath sounds in the right lung field. Imaging studies, including chest X-ray, CT scan, and MRI, confirmed the right diaphragmatic rupture with liver herniation, lung contusion, and a liver laceration. Given the extent of the injury, the patient underwent a combined surgical approach: a right thoracotomy for lung and diaphragmatic repair and a median laparotomy for liver laceration management. The diaphragm was repaired with suturing and mesh placement. Postoperatively, she remained stable, requiring bronchoscopy for lung collapse before successful recovery and discharge on postoperative day 20. This case highlights the importance of early recognition, accurate imaging, and a tailored surgical approach for diaphragmatic rupture. A combined thoracoabdominal approach provides optimal exposure and repair, ensuring favorable outcomes. Further research is necessary to establish standardized guidelines for managing complex diaphragmatic injuries.

Keywords: *Blunt Trauma, Hemi Diaphragm Rupture, Liver Prolapse.*

Introduction

Traumatic diaphragmatic rupture (TDR) was first described by Sennertus in 1541. It remains a rare condition, challenging to diagnose, particularly in acute settings. Epidemiological studies indicate that TDR accounts for less than 0.5% of all trauma cases. While penetrating injuries constitute approximately 67% of cases, blunt trauma accounts for 33% [1,2]. The left diaphragm is more commonly affected, with intra-abdominal organ herniation (e.g., stomach, spleen) into the thoracic cavity being a frequent finding [3]. Motor vehicle accidents remain the leading cause of blunt diaphragmatic rupture [4].

Clinically, TDR presents with dyspnea, chest pain, abdominal distension, and diminished air entry on the affected side [5]. Reduced breath sounds may be misdiagnosed as pneumothorax, potentially leading to unnecessary chest tube placement. A high index of suspicion is crucial for early and accurate diagnosis.

We present a case of severe diaphragmatic injury with transthoracic liver herniation, liver

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laceration, and lung collapse, successfully managed via a combined thoracic and abdominal surgical approach. Given the limited literature on diaphragmatic rupture, further research is necessary to enhance diagnostic accuracy and optimize surgical outcomes.

Case Report

A 28-year-old female was involved in a motor vehicle accident, sustaining blunt thoracoabdominal trauma after being struck by a moving vehicle. She was transported to the emergency department by emergency medical services, presenting with pain in the neck, left shoulder, left side of the chest, and right arm. She denied loss of consciousness, headache, or dizziness.

Medical and Surgical History

1. Past surgical history: Open reduction and internal fixation (ORIF) of an ankle fracture (2013).
2. Past medical history: Unremarkable.

Initial Assessment

On Primary Survey

1. Airway: Patent
2. Breathing: Spontaneous
3. Circulation: Stable (HR: 81 bpm, BP: 95/63 mmHg)
4. Glasgow Coma Scale (GCS): 15/15
5. Exposure: Abrasions on the left forehead, face, abdomen, right elbow, and bruising on the right buttock. Deformity of the left clavicle was noted.

On Secondary Survey

1. Respiratory system: Decreased breath sounds on the right lung field.
2. Abdomen: Soft, non-tender.
3. The urine pregnancy test was positive. Urinalysis revealed 2+ glucose, 2+ proteins, and 4+ bloods.

Table 1. Vital Signs Monitoring During Emergency Room Admission

Time	**2037**	**2200**	**0005**	**0030**
Mobility	Stretcher	Stretcher	Stretcher	Stretcher
Respiration	19	18	19	18
Pulse	81	92	104	94
Temp	36	36	36	35.9
BP	95/63	104/64	116/75	102/70
MAP	76	80	87	82
SpO2	91	99	99	98
Blood sugar	6.4	6.4	6.4	6.4

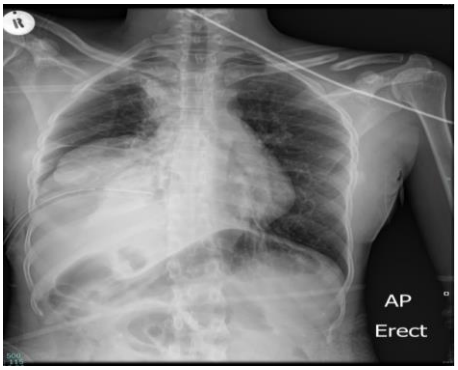

Figure 1. chest X-Ray

Figure 2. CT Scan

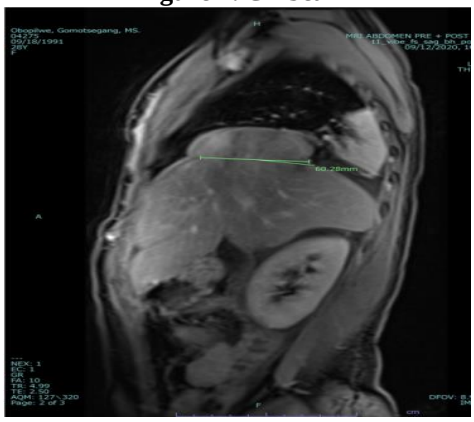

Figure 3. MRI

Imaging and Diagnosis

1. Chest X-ray (CXR): Elevated right hemi diaphragm with right lower lobe collapse, suggestive of diaphragmatic rupture.
2. CT scan and MRI: Confirmed the diagnosis.

Final Diagnosis

1. Right lung contusion
2. Suspected hemothorax
3. Suspected sub-abdominal hematoma at the isthmic point of the uterus
4. Liver laceration

Management and Surgical Intervention

The patient was admitted to the ICU for stabilization, fluid resuscitation, pain control, and intravenous antibiotics. Consultations were made with obstetrics, orthopedics, and general surgery.

Once stabilized, a combined thoracic and abdominal surgical approach was performed:

Right Thoracotomy (7th Intercostal Space):

Findings: Right lung collapse, 10–15 cm diaphragmatic laceration, intrathoracic liver prolapse with a 5 cm liver laceration causing post-traumatic bleeding.

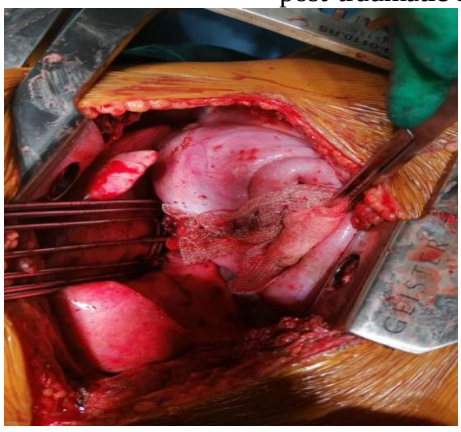

Figure 4. Laparotomy

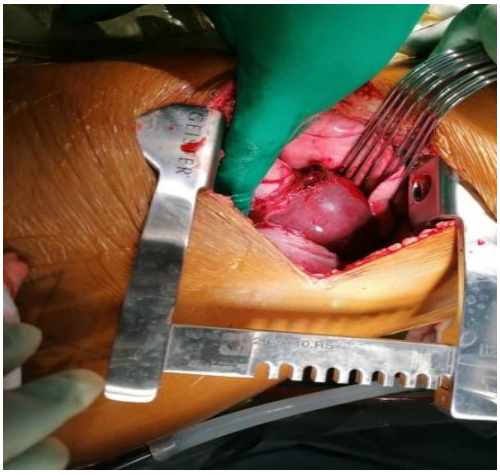

Figure 5. Liver Laceration

Median Laparotomy

1. Sectioning of the ligamentum teres hepatis and falciform ligament.
2. Liver laceration repair with 2-0 Vicryl and surgical glue application.
3. Diaphragmatic rupture repair via suturing and mesh placement.
4. Postoperatively, two thoracic and two abdominal drains (subhepatic and Douglas pouch) were inserted. The thoracic and abdominal cavities were closed in layers.

Postoperative Course

1. The patient was hemodynamically stable and extubated the following day.
2. Managed with respiratory physiotherapy, IV fluids, IV antibiotics, and analgesia.
3. On postoperative day 10, she developed persistent chest pain and discomfort.
4. CT chest: Revealed lung collapse.
5. Bronchoscopy: Performed to release lung collapse.
6. She continued with physiotherapy and was discharged on postoperative day 20.

Discussion

Diaphragmatic traumatic injuries remain uncommon and are challenging to diagnose in the acute phase [6]. Blunt trauma accounts for 0.8%–1.6% of all trauma cases, while penetrating trauma can constitute 10%–15% of cases [7].

Motor vehicle collisions are the most frequent cause, with direct impact forces leading to diaphragm rupture at the rib attachments or transverse tears [8].

Surgical Approaches

The abdominal approach (laparotomy) is preferred in cases of associated intra-abdominal injuries [9]. Studies have shown that laparotomy remains the primary method for diaphragmatic repair [10].

Conversely, thoracotomy is favored for delayed presentations or when diaphragmatic rupture is associated with severe thoracic injuries [11]. In this case, a combined approach was necessary to provide optimal exposure for repairing both the diaphragm and liver.

Postoperative Complications

Atelectasis is a common postoperative complication, as seen in this case [12]. It necessitates bronchoscopy and intensive respiratory physiotherapy to prevent long-term pulmonary dysfunction [13].

Conclusion

Early and accurate diagnosis of diaphragmatic rupture in trauma patients remains challenging. A thorough Intraoperative assessment is essential to prevent missed injuries.

This case underscores the importance of a combined thoracoabdominal approach in

complex diaphragmatic injuries involving liver herniation. While this technique resulted in a favorable outcome, further research is necessary to establish standardized guidelines for optimal management.

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