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Post-Traumatic Right Diaphragmatic: A Case Report and Review of Diagnostic and Surgical Challenges

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ABSTRACT: Post-traumatic diaphragmatic rupture (PTDR) is a rare but life-threatening injury, often delayed in diagnosis. This case report describes a 60-year-old male presenting with respiratory distress one month after blunt thoracoabdominal trauma. Imaging revealed right diaphragmatic rupture with intrathoracic herniation of the liver, colon, and stomach. The discussion highlights diagnostic pitfalls, surgical management, and the importance of multidisciplinary care. Early recognition and tailored surgical intervention are critical to reducing morbidity and mortality.

INTRODUCTION

PTDR occurs in 0.8–5% of blunt traumas, with right-sided ruptures accounting for only 15–24% of cases. Delayed diagnosis increases risks of visceral herniation, strangulation, and respiratory compromise. This report emphasizes imaging strategies, surgical decision-making, and the role of minimally invasive techniques in PTDR management.

CASE PRESENTATION

Patient: 60-year-old male, blunt thoracic/abdominal trauma (assault with a stick).

Clinical Findings:

- Tachypnea (RR 22/min), hypoxia (SpO_2 90% on room air).
- Right hemithorax ecchymosis, abdominal tenderness.

Figure 1: Chest X-ray demonstrating right basal opacity and pleural effusion.

Figure 2: Axial CT image showing intrathoracic herniation of the liver and colon.

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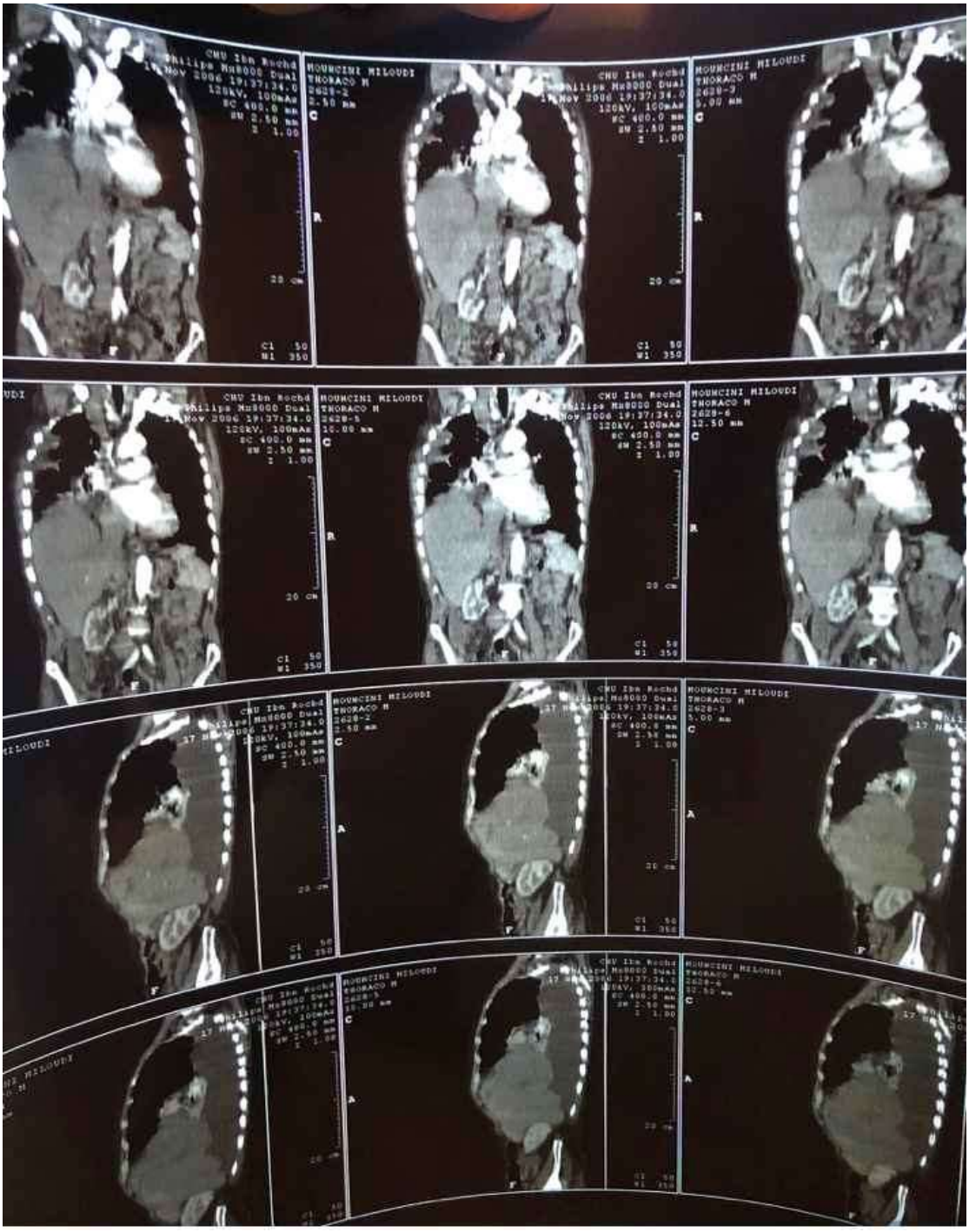

Figure 3: Coronal CT reconstruction confirming diaphragmatic defect and visceral displacement.

- Chest X-ray (Fig. 1): defined right basal opacity, pleural effusion.
- CT Thorax/Abdomen (Fig. 2–3): Right diaphragmatic rupture with liver, colon, and stomach herniation; pulmonary contusion.

Management:Stabilization with oxygen therapy, urgent thoracotomy for diaphragmatic repair and organ reduction.

DISCUSSION

Traumatic diaphragmatic rupture (TDR) is a rare but potentially life-threatening condition, requiring heightened clinical and radiological vigilance. The presented case illustrates the diagnostic and therapeutic challenges associated with a right-sided TDR complicated by multivisceral herniation (liver, colon, stomach), occurring one month after a blunt thoracoabdominal trauma. This discussion is structured around three main themes: etiological and anatomical peculiarities, diagnostic challenges, and therapeutic strategies.

Etiological and Anatomical Peculiarities:

TDR primarily occurs following high-energy trauma (e.g., road traffic accidents, falls). Right-sided injuries, accounting for only 15–24% of cases, are less common than left-sided ones due to the partial protective effect of the liver. However, in this case, a localized blunt mechanism (a blow from a stick) was sufficient to cause a complete rupture, suggesting direct force transmission to the diaphragm. This observation aligns with data from Patel *et al.* (2021), who emphasize that penetrating or localized blunt trauma can bypass the liver's "buffer" effect, particularly in elderly patients with less elastic diaphragms.

The observed multivisceral herniation (liver, colon, stomach) is a feared complication of untreated TDR. The one-month delay between trauma and diagnosis likely explains the gradual migration of organs, facilitated by thoracoabdominal pressure gradients. This phenomenon is described in the series by Al-Thani *et al.* (2022), where 40% of right-sided TDR cases presented with liver herniation at a late stage.

Diagnostic Challenges: From Delay to Doubt

The diagnosis of TDR is often delayed, as in this case, due to nonspecific initial symptoms (chest pain, dyspnea) and limitations of conventional imaging techniques.

- **Chest X-ray:** Although the first-line imaging tool, its sensitivity is low (30–50%), particularly for right-sided injuries. In this case, the right basal opacity and pleural effusion were initially attributed to pulmonary contusion, masking the diaphragmatic hernia. The use of a gastric tube, as suggested by Coccolini *et al.* (2021), could have improved detection by visualizing abnormal stomach positioning.
- **Thoracoabdominal CT scan:** This remains the gold standard, with a sensitivity >90%. Coronal reconstructions (Fig. 3) allowed identification of the diaphragmatic discontinuity and liver herniation, consistent with the criteria of Mahmood *et al.* (2022) (diaphragmatic defect, "collar" sign, absent diaphragm sign).
- **Role of MRI and laparoscopy:** Although not used here, MRI is valuable for chronic cases with diagnostic uncertainty (Bala *et al.*, 2023), while laparoscopy offers direct evaluation of injuries in stable patients (Dogan *et al.*, 2022).

Therapeutic Strategies: Between Urgency and Precision

Surgical management is essential to prevent complications (e.g., volvulus, strangulation). In this case, a thoracotomy was preferred, guided by:

- **Extent of injuries:** Multivisceral herniation and lung collapse required manual organ reduction and direct diaphragmatic repair.
- **Hemodynamic stability:** Although the patient was stable, persistent hypoxia (SpO_2 90%) justified a rapid approach.

However, minimally invasive techniques (thoracoscopy/laparoscopy) deserve particular attention. According to Kuo *et al.* (2023), thoracoscopy reduces postoperative morbidity (pain, hospital stay) in stable patients without severe associated injuries. In this case, relative respiratory instability likely favored thoracotomy.

The use of a prosthesis (synthetic mesh) for large defects (>10 cm) was not necessary here but is recommended to prevent recurrence (Wu *et al.*, 2021).

Complications and Prognosis

Delayed diagnosis exposes patients to significant risks:

- **Volvulus and visceral ischemia:** Observed in 15–20% of untreated diaphragmatic hernias (Goh *et al.*, 2022).
- **Chronic respiratory dysfunction:** Linked to lung compression and phrenic nerve injuries.

In this case, the absence of volvulus and early surgical reduction led to a favorable prognosis. However, long-term monitoring is essential to detect potential recurrences or adhesions.

Clinical Lessons and Perspectives

This case highlights:

1. **The imperative of systematic suspicion:** Any post-traumatic thoracoabdominal pain, even minor, should include TDR in the differential diagnosis.
2. **Optimization of imaging:** Multiphasic CT with 3D reconstructions should be performed early in cases of doubt.
3. **Multidisciplinary approach:** Collaboration between anesthesiologists-intensivists (preoperative hypoxia management), radiologists (detailed image interpretation), and surgeons (choice of surgical approach) is crucial.

Limitations and Future Directions

This report is limited by its single-center nature and lack of long-term follow-up. Prospective studies comparing thoracotomy and thoracoscopy in right-sided TDR would help refine decision-making algorithms. Additionally, integrating AI into image analysis could improve early detection of subtle diaphragmatic injuries.

CONCLUSION

this case illustrates the complexity of right-sided TDR, where a delayed diagnosis did not compromise the prognosis thanks to appropriate surgical intervention. It underscores the importance of a rigorous diagnostic approach and interdisciplinary collaboration in managing thoracoabdominal trauma.

PTDR requires a high index of suspicion in thoracoabdominal trauma. CT imaging is pivotal for timely diagnosis. Surgical repair, tailored to defect size and patient stability, improves outcomes. This case underscores the need for systematic screening in trauma protocols.

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Ethics Statement:

Informed consent was obtained from the patient for publication. Institutional review board approval was waived for this case report.

Competing Interests:

The authors declare no conflicts of interest.