



Traumatic right diaphragmatic rupture with pericardial laceration in a toddler: a case report

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Abstract

Traumatic diaphragmatic rupture is rare in children, particularly on the right side, due to the protective effect of the liver. Associated pericardial laceration further increases morbidity and mortality and is frequently missed. We report a 23 month old male toddler who presented with severe respiratory distress after being struck by a slow-moving truck. Clinical examination revealed asymmetric chest movement, absent right-sided air entry, and leftward displacement of the cardiac apex. Chest radiography demonstrated bowel pattern lucencies in the right hemithorax with loss of the right diaphragmatic outline. Emergency exploratory laparotomy revealed a large right diaphragmatic laceration with associated pericardial tear and herniation of the liver and bowel into the thoracic cavity. Surgical reduction and repair were performed with good postoperative recovery. This case highlights the importance of maintaining a high index of suspicion for right diaphragmatic rupture with pericardial injury in paediatric trauma, especially in resource-limited settings.

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Introduction

Traumatic diaphragmatic rupture (TDR) is a rare, life-threatening injury resulting from a tear in the diaphragm caused by trauma. The diaphragm is a fibromuscular partition separating the thoracic from the abdominal cavity. It is the primary muscle of respiration, with the dome at the level of the fifth and sixth intercostal spaces at rest. It spans approximately 5-12 cm transversely and 3-8cm antero-posteriorly in young children. Due to significant anatomical and physiological differences between children and adults, TDRs are less common in paediatric patients, occurring in only 4%–6% of trauma cases, compared to 8%–9% in adults^{1,2}. Diaphragmatic injuries are three times more common on the left side, which is largely attributed

to the structural/congenital weakness of the diaphragm on the left side that renders it more vulnerable. Additionally, the 'absorber effect' of the liver on the right side provides greater resistance to traumatic forces^{3,4}.

Consequently, right-sided diaphragmatic ruptures are often more challenging to detect in children and are frequently associated with other severe injuries, such as hepatic lacerations, bowel herniations, lung damage, and pericardial lacerations⁵. Right diaphragmatic ruptures accompanied by pericardial laceration are relatively uncommon. Diagnosing a right diaphragmatic rupture can be particularly challenging due to the lack of specific symptoms, especially in cases of blunt trauma. Consequently,



determining whether there is concurrent pericardial damage, particularly on the right side, may be difficult prior to surgery⁶. We present a case of right diaphragmatic rupture with an accompanying pericardial laceration in a child, resulting from blunt trauma following a road traffic accident.

Case Report

A 23-month-old male Yoruba toddler (Yoruba refers to an ethnolinguistic group indigenous to south-western Nigeria and neighbouring parts of West Africa) was brought to the emergency paediatrics unit by his parents due to difficulty breathing, two hours after being hit by a slow-moving truck. Although there were no obvious external injuries to the chest, examination revealed a child in respiratory distress who was tachycardic and diaphoretic. The chest wall was asymmetric, and the apex beat was markedly displaced leftward. Percussion notes were dull in the right hemithorax, and air entry was absent. The abdomen was scaphoid, with no palpable organomegaly. The Blantyre Coma Scale (BCS) score was 5. His blood pressure was 101/66 mmHg, heart rate was 174 beats/minute, respiratory rate was 56/min, and oxygen saturation was in the mid-90% range.

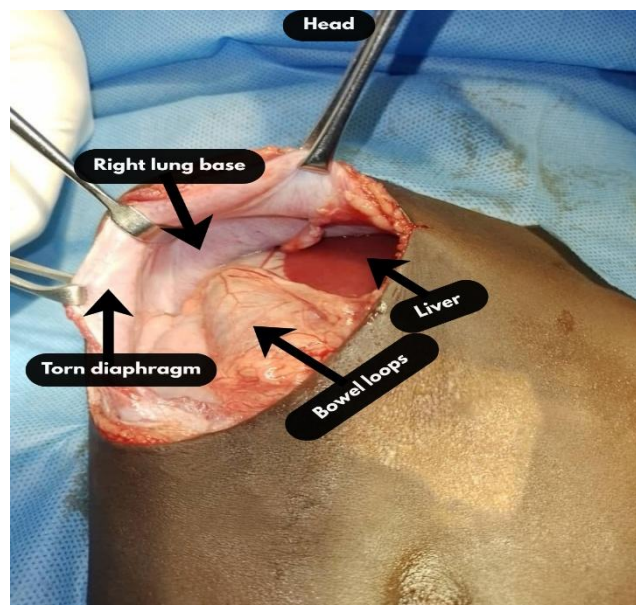
The child was resuscitated, with chest x-ray showing an obscured right diaphragmatic outline, bowel pattern lucencies in the right hemithorax, and a tracheal-mediastinal shift to the left. These findings were suggestive of a ruptured right hemidiaphragm and tension viscerothorax (figure 1)

Figure 1: Obscured right hemidiaphragm outline with bowel pattern lucencies in the right chest



The child had an emergency laparotomy following resuscitation. Findings at surgery included a 12 cm laceration in the right hemidiaphragm, a 5 cm laceration in the pericardium, and a herniated right lobe of the liver, the transverse colon, and loops of the small bowel (figure 2).

Figure 2: Intraoperative findings



The herniated right lobe of the liver and transverse colon were reduced, and the diaphragm and pericardium were repaired using Polydioxanone (PDS) 0 and Vicryl 4.0 sutures, respectively. A Valsalva manoeuvre was performed intraoperatively to generate positive end-expiratory pressure (PEEP) and expel residual air from the pleural space. Subsequently, a right chest tube was inserted to ensure adequate pleural drainage and maintenance of negative intrathoracic pressure. The chest tube was left in situ for 48 hours and removed after confirming satisfactory lung expansion and stable respiratory function (Figure 3)

The postoperative period was uneventful, without the need for ICU care. Postoperative chest radiograph showed centralization of the cardiac silhouette, expanded lungs, and clearly outlined hemidiaphragms on either side (Figure 4). The child was discharged five days postoperatively and has been followed up at the clinic multiple times with no complaints.



Figure 3: post-repair of the diaphragmatic and pericardial laceration

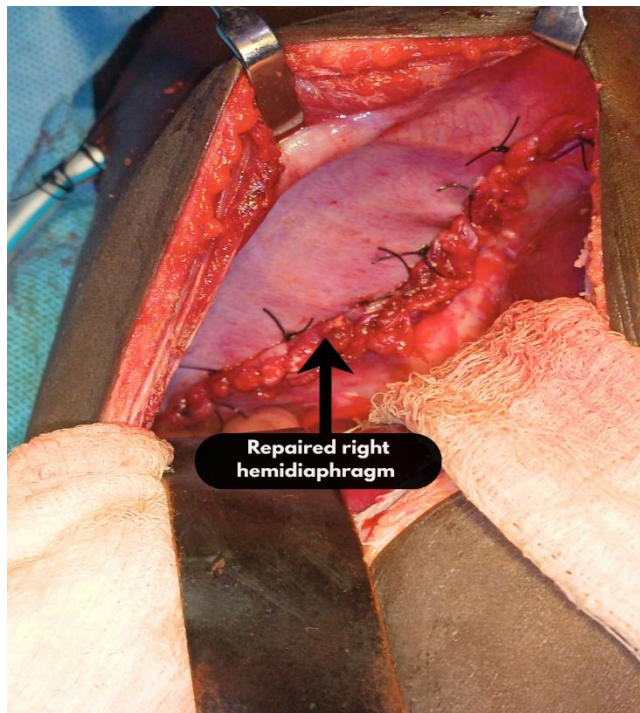


Figure 4: Chest radiograph two days post-op showing return of cardiac silhouette, diaphragmatic continuity, and clear lung fields



Discussion

Traumatic diaphragmatic rupture (TDR) is a rare but life-threatening injury in children. In this case, the presence of a pericardial laceration indicated a severe injury involving the heart. This defect was significant and, if not identified early, could have resulted in cardiac herniation or herniation of abdominal contents into the pericardial sac⁷. Computed Tomography (CT), Magnetic Resonance

Imaging (MRI), ultrasound, upper gastrointestinal contrast studies, laparoscopy, and thoracoscopy have all been utilized in the diagnosis of TDR, while the diagnosis of a pericardial rupture relies on a chest CT and transthoracic or transesophageal echocardiography⁸. CT remains the gold standard for establishing a preoperative diagnosis, particularly in cases of right diaphragmatic rupture with pericardial laceration, with a sensitivity of 80% and a specificity of 75% to 100%⁹.

In the acute setting of injury, an exploratory laparotomy is recommended, as it allows for thorough exploration of the abdominal cavity to exclude injuries not detected on imaging. Surgical repair of the pericardium should be performed urgently to prevent cardiac herniation. Intrathoracic placement of chest tubes are recommended for optimal outcome.

A thoracoabdominal CT scan was not performed due to financial constraints. This limited the ability to fully assess the extent of the injury and preoperative planning. Furthermore, continuous electrocardiogram (ECG) monitoring is a necessary tool for perioperative care due to the cardiac complications that can occur because of the pericardial laceration. However, its use was limited to the theatre alone in our case.

In conclusion, this case highlights the rarity of traumatic diaphragmatic rupture with pericardial laceration in children and the challenges in diagnosis. Early recognition, prompt surgical intervention, and thorough intraoperative exploration are crucial to prevent life-threatening complications. Increased awareness and documentation of similar cases are essential for improving paediatric trauma management.

Ethics Approval and Consent to Participate: Ethical approval was obtained from the University of Ilorin Teaching Hospital Institutional Ethics Committee.

Consent for Publication: Written informed consent was obtained from the patient's legal guardian for publication of this case report and any accompanying images, held by the authors.

Competing Interests: The authors declare that they have no competing interests.

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