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A unique case of matching diaphragmatic herniation simultaneously sustained by a married couple following trauma

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Abstract

This case describes two patients who simultaneously presented to a major trauma centre (MTC) with a shared finding of a traumatic diaphragmatic injury (TDI) with herniation. The patients were a married couple involved in a road traffic collision, with significant intrusion into their vehicle. They each presented with signs of injury to the chest wall but no direct suspicion of diaphragmatic injury until imaging, which was then explored further and managed operatively. They were both transferred directly from resus to theatre and underwent trauma laparotomies. Both had a successful recovery and had no long-term complications as a consequence of the injury. This very rare finding led to a comparison of their injuries and subsequent analysis of our current understanding of TDI with herniation and its management.

Key words: traumatic diaphragmatic injury, traumatic diaphragmatic hernia, diaphragmatic injury, diaphragmatic repair.

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Introduction

A married couple presented as two patients involved in a road traffic collision who were taken to a major trauma centre (MTC) with significant injuries. Both underwent initial primary survey, imaging, and a trauma laparotomy, with a key shared finding of a left traumatic diaphragmatic injury (TDI) and herniation. Though fairly uncommon, it is considered a risk with significant direct trauma, with road traffic accidents being a high-risk mechanism, particularly on an individual's unilateral side to the applied force. Both sustaining an equal injury lends focus to examining our current understanding of detection and management of diaphragmatic injuries, reflecting on our current practices. It also raises the question of what led to both parties sustaining this injury; simply a coincidence or an underappreciated force on both sides of the vehicle.

Case Reports

We report the cases of two patients, a married couple, who were involved in a road traffic collision in January 2024. The wife was the driver, while the husband was the front-seat passenger. The scene report advised there had been a significant intrusion on the left side of their vehicle, and both eventually presented to the MTC.

Patient 1

The first patient was a male in his late 50s who presented as a red trauma call directly to the MTC. He had been the front-seat passenger in the incident. He was previously fit and well, with no sig-

nificant past medical history, and was not taking any regular medication. He arrived at the MTC with a left Kendrick splint *in situ*, which had been put in place pre-hospital due to limb deformity and tenderness leading to suspicion of left midshaft femoral fracture.

On primary survey, the patient was noted to have right-sided chest wall tenderness with a normal respiratory rate and oxygen saturation of 100% on 15 L *via* a non-rebreather mask. Air entry was equal bilaterally on auscultation. He was mildly tachycardic but normotensive. A Kendrick boot was *in situ*, with mid-shaft femoral tenderness and visible deformity. Overall, the patient was tachycardic with features consistent with class II shock and a suspected femoral fracture.

Pre-hospital management included administration of 1 g of tranexamic acid (TXA). In the resuscitation area, the major haemorrhage protocol was activated and the patient received a further 1 g of TXA, 2 units of red blood cells (RBC), and 2 units of fresh frozen plasma. He was taken directly from resus for imaging, and following these findings, he was transferred straight from resus to theatre.

Patient 2

The second patient was the driver, a female in her mid-50s, who arrived as an amber trauma call following inter-hospital trauma transfer a few hours after Patient 1. She had initially been taken to a district general hospital (DGH) close to the scene of the incident. She was previously well, mobilised with a walking stick, and required some assistance with activities of daily living.

Imaging was performed at the DGH, and due to the significance of the findings, the patient was subsequently transferred to the MTC.

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On primary survey at the MTC, the patient was noted to have bruising over the right anterior chest wall. She was ventilating on 4 L of oxygen *via* nasal cannulae, with a respiratory rate of 19 and equal air entry bilaterally on auscultation. She was normotensive with a normal heart rate. Mild abdominal tenderness was present in the left upper quadrant. Overall, the patient was stable on arrival and required analgesia only. No interventions were required in the resuscitation area.

Investigations and imaging findings

Patient 1 underwent computed tomography (CT) imaging, including a CT head, plain CT cervical spine, and a bastion protocol CT of the chest, abdomen, and pelvis. Imaging demonstrated a left diaphragmatic injury (Figure 1), with a defect in the left hemidiaphragm and herniation of a large portion of the stomach, which was distended and fluid-filled, consistent with a traumatic diaphragmatic hernia. There was also evidence of an extensive splenic laceration with associated haemoperitoneum. Multiple rib fractures were identified, including right-sided anterior undisplaced fractures of the 3rd and 4th ribs, left-sided lateral minimally displaced fracture of the 3rd rib, and left-sided lateral undisplaced fractures of the 4th and 7th ribs. An oblique, undisplaced fracture of the sternal body was present, along with a left segmental clavicular fracture. Complex pelvic injuries were noted, including bilateral sacral ala fractures and bilateral superior and inferior pubic rami fractures. In addition, there was a left-sided femoral fracture with an associated greater trochanter fracture, as well as a spinal injury in the form of a left L5 transverse process fracture.

For Patient 2, imaging was performed at the DGH prior to trauma transfer and included a CT head, plain CT cervical spine, and a bastion protocol CT of the chest, abdomen, and pelvis. Imaging findings demonstrated fractures of the left 3rd and 4th ribs involving the posterior elements, left diaphragmatic injuries (Figure 2), a small left-sided haemopneumothorax with partial lung collapse, and herniation of the stomach and left lobe of the liver.

Treatment

Patient 1 underwent a trauma laparotomy. Intra-operatively, he received an additional 2 units of RBC, 1 unit of platelets, and 2 units of cryoprecipitate.

Operative findings included a pelvic haematoma extending from zone 1 into zone 2 bilaterally and a 12 cm rupture of the left hemidiaphragm, with herniation of the stomach and spleen. Three liver capsular lacerations were identified, although there was no active splenic bleeding. Oozing was noted from an anterior retroperitoneal haematoma. A 3 L chest washout was performed, and a left-sided 28 Fr intercostal drain was inserted. Haematuria was observed intra-operatively, and a cystogram was suggested but not performed.

The patient returned to theatre the following day with the orthopaedic team for open reduction and internal fixation of the left clavicle, placement of an internal fixator (INFIX) device, bilateral sacroiliac screws, and intramedullary nail fixation.

Patient 2 was transferred directly from the resuscitation area to the theatre once surgery for Patient 1 had been completed, and underwent a trauma laparotomy. She remained haemodynamically stable throughout the procedure and did not require any blood products. Intra-operative findings included a 15 cm tear of the left hemidiaphragm (Figure 2), with herniation of the stomach, liver segments II and III, spleen, and left colon. A capsular tear of liver segments II and III was identified. There was a possible grade 1 lung



Figure 1. Patient 1: CT scan of the chest, abdomen, and pelvis showing diaphragm injury and herniation of the spleen and stomach (red arrows indicate area of herniation).

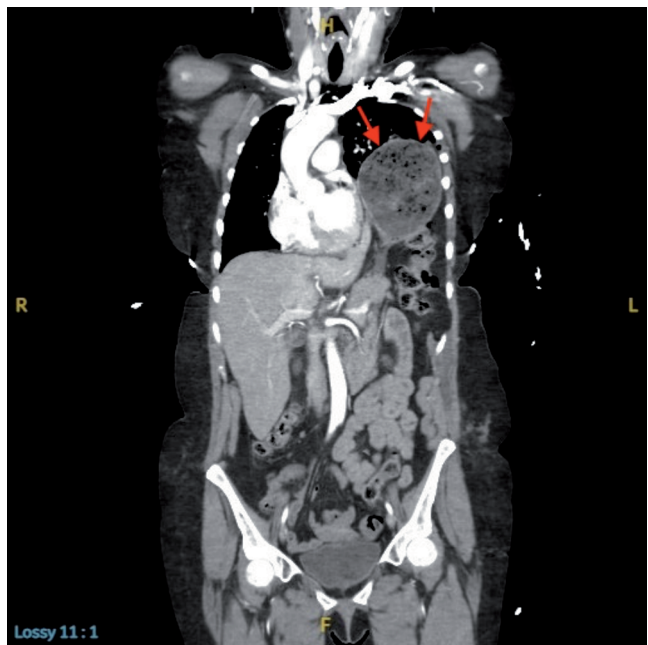


Figure 2. Patient 2: CT scan of the chest, abdomen, and pelvis showing diaphragm injury and herniation of the spleen, stomach, lobe of liver, and left colon (red arrows indicate area of herniation).

injury, for which TachoSil® was applied. A 1 L chest washout was performed, and a left-sided 28 Fr intercostal drain was inserted.

Comparison of the two diaphragmatic injuries

Both patients had evidence of chest wall trauma on primary survey, but no clear signs of diaphragmatic injury or herniation. CT confirmed diaphragmatic injury and herniation for both, yet it was only on intra-operative exploration that the extent of the defects was fully established.

Comparatively, they had a very similar size of defect (Figures 1 and 2). The husband sustained a herniation of the stomach and spleen, and the wife's herniation involved the stomach, spleen, left lobe of liver (II/III), and left colon. Both were managed with trauma laparotomies involving one midline incision only. They also had a left intercostal drain placed intra-operatively, which was removed in the following days once x-ray imaging confirmed appropriate lung expansion and no evidence of diaphragm dehiscence.

Fortunately, the involved intra-abdominal organs were successfully repaired, and although there was no conclusive evidence of lung injury, proactive treatment of a suspected injury in Patient 2 helped eliminate any uncertainty.

Both patients recovered and were discharged home. They were followed up at 6 weeks post-discharge in the clinic and remained well with no evidence of sequelae. The passenger returned for the removal of the INFIX from the pelvis 3 months following fixation. There were no complications from diaphragmatic injury or herniation for either patient.

Discussion

TDIs can occur from both blunt and penetrating trauma and are classified according to location, severity, and degree of herniation. They are generally considered uncommon injuries due to the significant force required to cause them. Consequently, motor vehicle collisions represent the most common cause of blunt diaphragmatic injury,¹ with an estimated incidence of 1-5% among vehicle crashes.²

TDI with herniation can be highly variable in presenting symptoms and can be particularly difficult to identify in the context of polytrauma. They may, however, be more apparent depending on the extent of the tear, side of suspicion, and both the presence and extent of abdominal viscera displacement.³ It is key, therefore, to ascertain signs and symptoms based on primary survey and correlate with an index of suspicion based on mechanism.

Symptoms reflect the function of the diaphragm, as a key component of respiration and as a partition between the thoracic and abdominal cavities. As such, signs of impaired oxygenation and ventilation are often present, as well as intra-abdominal organ compromise, including strangulation, herniation, and bleeding. In addition, the diaphragm contributes to the generation of intra-thoracic and intra-abdominal pressure; therefore, a less overt acute finding may be an impaired ability to generate and effectively utilize these pressures, such as during the Valsalva manoeuvre. The necessity of detecting and managing this injury is therefore vital in preventing serious morbidity and mortality.⁴

In the context of these two patients, the key findings on primary survey included hypoxia and clinical evidence of chest trauma with unilateral tenderness; in one patient, unilateral chest wall bruising was also noted. While these findings are common in trauma and appropriately raised concern for rib fractures or pulmonary injury,

they did not initially prompt suspicion for TDI. For TDI, including cases with associated herniation, there is no single gold-standard diagnostic modality; however, CT imaging and intra-operative exploration are widely accepted as the definitive means of diagnosis.

A study found that with imaging, 73.7% of TDI diagnoses were made, supporting the concept that with a high degree of suspicion, it is prudent not to exclude this injury at this point, and intra-operative exploration is recommended to conclusively rule in or out.⁵ The authors also found that a higher risk of mortality was present in those with a right-sided TDI compared to the left.

When comparing the frequency of injury by site, left-sided injuries are more common than right-sided ones. One retrospective study reported that 75% of cases occurred on the left side.⁶ This predominance is thought to result from reduced anatomical support on the left, which lacks the protective effect of the liver and has a relatively weaker diaphragmatic membrane, particularly in the posterolateral region.²

Research suggests that, irrespective of side, these patients should be treated as high risk, largely because this injury is associated with significant trauma, and the likelihood of other significant injuries is high.⁷ Another retrospective study concluded that the most common associated injuries are rib fractures, followed by intra-abdominal injuries.⁸ Interestingly, this is highlighted in our case: although the second patient had a greater degree of herniation in terms of organ displacement, it was the first patient who presented in shock and required more intensive support, including additional blood products, likely reflecting the presence of other injuries sustained.

Regarding positions in the car, a small study found that in right-hand drive vehicles with unilateral intrusion, the incidence of right-side rupture was twice that of front-seat passengers,⁹ suggesting that in this case, the front-seat passenger faced a greater risk due to left-side intrusion.

Complications directly related to TDI include empyema, prolonged hospital stay, and respiratory failure, and those related to the management include surgical site infection and surgical approach-associated morbidity.¹ Immediate intervention is therefore recommended, as it reduces the risk of delayed or progressive herniation and related complications – a concern that guided the prompt management in both cases.

In considering the most appropriate management approach, it is understood that the likelihood of intra-abdominal organ compromise is greater than intra-thoracic damage. Therefore, in the acute setting, research supports that the preferred approach is intra-abdominal,^{5,10} likely negating the need for additional exploration with a second incision – an approach followed with these two patients.

Despite TDI being a very rare injury, the fact that both patients sustained it suggests a potential commonality between them. Yet, although the mechanism of injury was the same, the nature of the force likely differed between their respective positions in the car, raising the striking thought of what an extraordinary coincidence this was for the married couple.

Conclusions

The assessment process for both patients corroborated previous findings that clinical assessment and imaging have a significant but not conclusive role in the diagnosis of diaphragmatic injury and herniation. For both patients, the intra-operative phase played a key role in both diagnosis and management.

The risk of TDI with herniation from a road traffic collision is

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generally more recognized on the side of the vehicle intrusion – in this case, the passenger side. However, it is interesting that the driver also sustained this injury. This underscores the importance of the force involved and the susceptibility to injury for all occupants of a vehicle, regardless of their seating position.

TDIs are rare injuries that require prompt and proactive management. It is therefore advised that patients with a strong suspicion of TDI be referred to centres with expertise in the required surgical techniques and the appropriate post-operative care facilities to manage their recovery effectively.

References

1. McDonald AA, Robinson BRH, Alarcon L, et al. Evaluation and management of traumatic diaphragmatic injuries. *J Trauma Acute Care Surg* 2018;85:198-207.
2. Giuffrida M, Perrone G, Abu-Zidan FM, et al. Management of complicated diaphragmatic hernia in the acute setting: a WSES position paper. *World J Emerg Surg* 2023;18.
3. Sekusky AL, Lopez RA. Diaphragm Trauma (Archived) [Updated 2023 Apr 10]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025
4. Major EE, Chen B, Al Mahrizi AD, et al. Minimally Invasive vs. Open Surgical Repair in Traumatic Diaphragmatic Hernia: A Systematic Review of 8,990 Patients. *Cureus* 2025;17:e82371.
5. Lim KH, Park J. Blunt traumatic diaphragmatic rupture: Single-center experience with 38 patients. *Medicine (Baltimore)* 2018; 97:e12849.
6. Kruger VF, Calderan TAR, Hirano ES, Fraga GP. The silent threat: A retrospective study of right-sided traumatic diaphragmatic hernias in a university hospital. *Turk J Surg* 2023;39: 365-372.
7. Shaban Y, Elkbuli A, McKenney M, Boneva D. Traumatic Diaphragmatic Rupture with Transthoracic Organ Herniation: A Case Report and Review of Literature. *Am J Case Rep* 2020;21: e919442.
8. Deng X, Deng Z, Huang E. Surgical management of traumatic diaphragmatic hernia: a single institutional experience of more than two decades. *BMC Surgery* 2021;21.
9. Thakore S, Henry J, Todd AW. Diaphragmatic rupture and the association with occupant position in right-hand drive vehicles. *Injury* 2001;32:441-4.
10. Silva G, Catâneo D, Catâneo A. Thoracotomy compared to laparotomy in the traumatic diaphragmatic hernia. Systematic review and proportional methanalysis. *Acta Cir Bras* 2018;33: 49-66.

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Consent for publication: the patients gave their written consent to use their personal data for the publication of this case report and any accompanying images.

Availability of data and materials: all data underlying the findings are fully available.

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