



Case report

Delayed hepatothorax: An unusual presentation case report

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ABSTRACT

Introduction and importance: We are reporting a case of a delayed hepatothorax due to a right-sided diaphragmatic rupture 13 years after a blunt trauma due to a motor vehicle accident, who presented as isolated gastritis without any type of respiratory symptomatology.

Case presentation: Patient refers that his symptoms remained refractory to medical treatment and had gotten worse over time. Chest wall inspection showed asymmetric thoracic expansion and a decreased movement of right hemithorax when compared to the left. Cardiorespiratory auscultation was significant for growling sounds on the right second intercostal space and reduction of breath sounds on the right lower lobe region of the lung when compared to the left side.

Clinical discussion: Thoracotomy was indicated since patient presented late. Meanwhile, laparotomy would have been appropriate if the patient had presented immediately after trauma. After the procedure, the patient presented in great condition and all the gastrointestinal symptoms associated with the traumatic diaphragmatic hernia had resolved. We propose that the absence of respiratory symptoms in our patient could be due to the progressive adaptation of small, cumulative changes in decreasing breathing capacity through time.

Conclusion: A case like ours has not been reported in the literature and clinicians should take this case report into consideration when suspecting a possible diagnosis of a delayed traumatic diaphragmatic hernia that may be complicated by a hepatothorax. We recommend maintaining a high index of clinical suspicion for hepatothorax due to delayed traumatic diaphragmatic hernia for all patients with a history of trauma.

1. Introduction

Traumatic diaphragmatic rupture is an uncommon lesion resulting from penetrating or blunt trauma to the abdomen or chest [1]. Up to 66% of traumatic diaphragmatic ruptures are undiagnosed during initial workup [2]. In cases of delayed presentation, the diagnosis becomes increasingly difficult over time due to a reduced index of suspicion [3]. The estimated prevalence of traumatic diaphragmatic hernia is 3–7% of all abdominal and thoracic trauma; meanwhile, the incidence is approximately 0.8–8% of trauma presentations [4], with the left-sided hernias being more common than right-sided [5]. This discrepancy in incidence is attributed to the cushioning effect of the liver, increased strength of the right hemidiaphragm, underdiagnosis of right-sided ruptures, and congenital weakness of the left hemidiaphragm [6]. Hepatothorax is defined as an intrathoracic displacement of the liver caused by right-sided traumatic diaphragmatic rupture [7]. There are

several reports about misdiagnosed hepatothorax, primarily since the chest radiography or computed tomography (CT) scan does not reveal a specific sign [7]. Furthermore, they present later with symptoms due to herniation of abdominal organs into the thoracic cavity [4]. Usually, the clinical presentation of an hepatothorax is dyspnea and chest pain, but may also include upper abdominal pain, cyanosis, cardiac arrhythmias, and hypotension [4,6,8,9]. Once hepatothorax has been diagnosed, current literature establishes that the standard of care is surgical repair.

We are reporting a case of a delayed hepatothorax that arrived at our academic hospital due to a right-sided diaphragmatic rupture 13 years after a blunt trauma due to a motor vehicle accident, who presented as isolated gastritis without any respiratory symptomatology. This presentation makes our case unique and should aid in the early diagnosis and management of patients with a similar clinical picture. The case has been reported in line with the SCARE criteria [10].

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2. Case presentation

A 32-year-old male graphic designer arrived at the general surgeon outpatient clinic referred by his gastroenterologist with symptoms of epigastric pain and abdominal discomfort that have been intermittent for about 13 years. The patient's psychosocial history reveals past substance abuse, including alcohol and cannabis. Surgical history is significant for lithotripsies, parathyroidectomy, open reduction with internal fixation, and hemorrhoidectomy. Past medical history is notable for a motor vehicle accident that occurred 13 years ago. At arrival to the emergency department, a thoraco-abdominopelvic CT-scan showed four fractured right lower ribs and a three-part acetabular fracture. CT-scan at that time did not show evidence of other pertinent pathologies.

The patient's gastritis had remained refractory to treatment and had gotten worse, encouraging the patient to address the complaint with a general surgeon. Patient was in no acute distress at the moment. Chest wall inspection showed asymmetric thoracic expansion. Notably, the right hemithorax had decreased movement compared to the left. Cardiorespiratory auscultation was significant for growling sounds on the right second intercostal space and reduction of breath sounds on the right lower lobe region of the lung when compared to the left side. Abdominal examination revealed active bowel sounds on all four quadrants and tenderness to palpation on the right upper quadrant. A new thoracoabdominal CT-scan was ordered and showed air spaces with haustral folds in the right hemithorax and a displaced liver in the thoracic cavity (Figs. 1 and 2).

Taking into consideration this patient's symptomatology, clinical findings on physical examination, and incidental findings on imaging; in combination with a significant traumatic event that occurred 13 years ago, which coincides with the patient's symptom onset, it was concluded that this patient's presentation was consistent with the diagnosis of a delayed right traumatic diaphragmatic hernia with hepatothorax. Once the diagnosis was established, a thoracotomy with right-sided diaphragmatic hernia repair was recommended to the patient.

Given his stable clinical picture, lack of obstructive symptoms, and respiratory difficulties, the patient was scheduled for an elective surgical repair with the general surgeon.

Under general anesthesia, a lateral chest incision was done on the right seventh intercostal space. Intraoperatively, the cavity was entered, and the right traumatic diaphragmatic hernia with hepatothorax was confirmed. The diameter of the diaphragmatic rupture was about 13 cm, and reduction of the liver from the thoracic cavity back to the abdominal cavity was performed through the diaphragmatic defect (Fig. 3). The defect was closed using a medial-lateral via thorax approach. A 15 × 25 cm mesh patch was used to reinforce the suture line. A 36 french tube

was left in place and fixed to skin. The chest tube was removed on the second postoperative day. The postoperative chest X-ray revealed complete expansion of the lung. Since no complications developed during the recovery period, the patient was discharged on the seventh postoperative day. Three months later, a follow-up abdominopelvic CT-scan was performed and revealed the absence of herniated abdominal contents inside the thoracic cavity. Six months later, the patient has been in great condition and reported that all the gastrointestinal symptoms associated with the traumatic diaphragmatic hernia have resolved.

3. Discussion

Traumatic diaphragmatic rupture is a rare but severe condition in which patients can remain undiagnosed for weeks, months, and even years. Our literature review revealed that most delayed traumatic diaphragmatic ruptures occurred within one year of the inciting event. Nonetheless, 17 cases were reported between 2 and 8 years after initial injury, 7 cases between 10 and 20 years, and 3 cases over 20 years, with the left side hernia being more common than right sided [2]. To the best of our knowledge, we present the fourth-longest delayed right-sided traumatic diaphragmatic rupture, presenting 13 years after the trauma incident [2] (Table 1). Also, it is the only case of hepatothorax in the scientific literature that has presented with gastrointestinal symptoms without the classic respiratory symptomatology.

It is important to note that hepatothorax represents a rare and severe complication of right diaphragmatic ruptures [9]. Herniation of the liver in the thoracic cavity may compromise pulmonary functions by causing atelectasis and cardiovascular compromise by compressing the mediastinum [9]. Signs and symptoms of hepatothorax vary depending on the degree of herniation into the thoracic cavity. Patients may present dyspnea, respiratory distress, upper abdominal pain, cyanosis, cardiac arrhythmias, and hypotension [9]. Nonetheless, our patient presented with isolated gastrointestinal symptoms, despite the liver compressing the right lung. We propose that the absence of respiratory symptoms could be due to the progressive adaptation of small, cumulative changes in decreasing breathing capacity through time. Also, we suggest that the gastrointestinal symptoms could result from irritation of abdominal structures adjacent to the displaced liver, thus mimicking features of the patient's diagnosed gastritis.

In most traumatic diaphragmatic ruptures, the diagnosis may be evident with only chest radiography or CT-scan by revealing gas-filled viscera in the thoracic cavity. Nonetheless, the diagnosis of hepatothorax is troublesome since both chest radiography and CT-scan do not disclose specific signs [7]. Additionally, chest radiographs have a low sensitivity for detecting delayed diaphragmatic hernias. Current

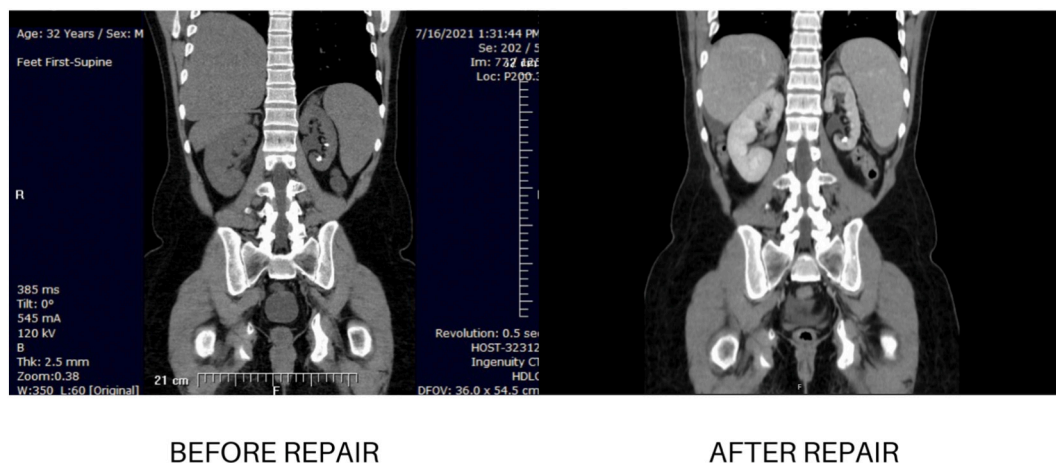


Fig. 1. Coronal thoracoabdominopelvic CT-scan showing massive liver displacement through the diaphragmatic defect before surgical repair (left) and regression of the liver into abdominal cavity after surgical correction (right).

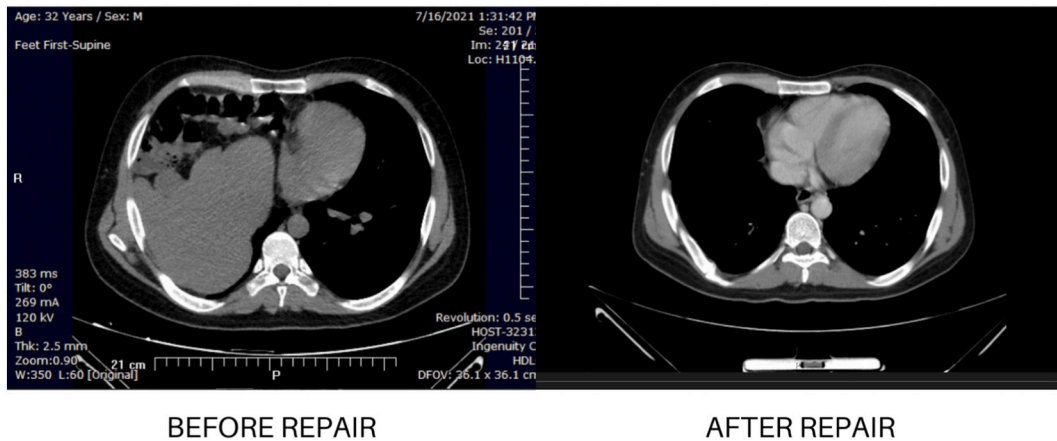


Fig. 2. Transverse view of the thoracic cavity, where liver and colonic haustra are observed at the posterolateral and anterolateral wall of the thoracic cage before surgical repair (left), and absence of herniated contents after surgical correction (right).

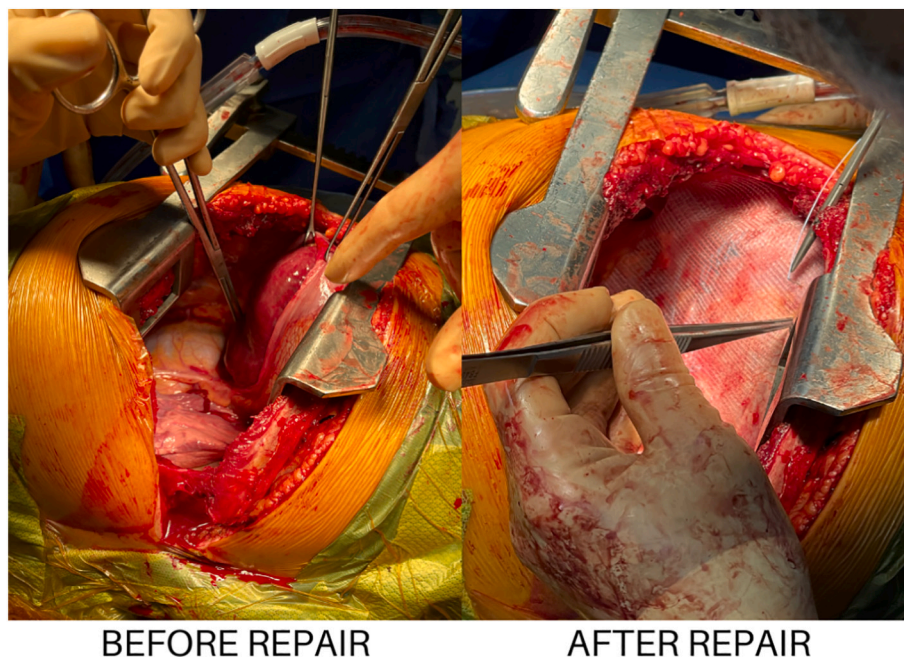


Fig. 3. View of the diaphragmatic defect after reducing the liver and bowel back into the abdominal cavity, before (left) and after (right) surgical correction.

literature suggests that the slightest suspicion should be confirmed with thoracoabdominal CT-scan, which is considered more reliable for diagnosis [4]. Magnetic resonance imaging (MRI) is also significant in determining the type of diaphragmatic rupture because diaphragmatic abnormalities can be detected from various images in axial, coronal, and sagittal planes [7]. However, an MRI cannot be performed in emergency situations, and it is not economically convenient in non-emergent scenarios where other imaging modalities can offer similar diagnostic accuracy [3].

Previous literature indicated that once hepatothorax has been diagnosed, the standard treatment is surgical repair. The surgical approach needs to be individualized for each case and each complication. Thoracic and abdominal access is commonly discussed in the current literature without a consensus about which technique is best. The actual agreement is that thoracotomy is indicated when the hernia presents late, meanwhile laparotomy is most appropriate immediately after trauma [11]. The main principles of hepatothorax repair due to traumatic diaphragmatic hernia include decompression, reducing the hernia back into the abdominal cavity, and ensuring secure closure of the diaphragmatic

defect [3]. Although the type of closure used for diaphragmatic hernias is still a matter of debate, it is generally accepted that most defects can be closed primarily with nonabsorbable sutures [12]. This is because, during closure of the diaphragm, as much as a 100 cm H₂O pleuro-peritoneal pressure gradient may occur during inspiration, which may pull apart a diaphragmatic repair and thereby force intraabdominal contents into the chest [13]. Traumatic diaphragmatic ruptures with larger defects can also be reinforced with a synthetic mesh placement to reduce tension during closure [3]. Mesh reinforcement is indicated in large defects where the diaphragmatic edges cannot be approximated, notably when there is significant tension after primary closure or when tissue appears weak [14].

4. Conclusion

The broad clinical nature of hepatothorax due to delayed diaphragmatic hernias requires that each case be managed individually. A high index of clinical suspicion for hepatothorax should be maintained for all patients with a history of trauma. Our patient had an unusual

Table 1
Longest delayed right traumatic diaphragmatic hernias with hepatothorax.

Years with delayed presentation	Case report
50 years	Singh, S., Kalan, M. M., Moreyra, C. E., & Buckman Jr, R. F. (2000). Diaphragmatic rupture presenting 50 years after the traumatic event. <i>Journal of Trauma and Acute Care Surgery</i> , 49(1), 156–159.
20 years	Sala, C., Bonaldi, M., Mariani, P., Tagliabue, F., & Novellino, L. (2017). Right post-traumatic diaphragmatic hernia with liver and intestinal dislocation. <i>Journal of Surgical Case Reports</i> , 2017(3).
20 years	Sauer Durand, A. M., Nebiker, C. A., Hartel, M., & Kremer, M. (2021). Bilateral delayed traumatic diaphragmatic injury. <i>Journal of Surgical Case Reports</i> , 2021(4).
13 years	Our case report titled:
	Delayed Hepatothorax: An Unusual Presentation Case Report
10 years	Hiew, L. F., Khairuddin, S., Aquili, L., Koh, J., Fung, M. L., Lim, W. L., & Lim, L. W. (2020). Behavioural responses of anxiety in aversive and non-aversive conditions between young and aged Sprague-Dawley rats. <i>Behavioural brain research</i> , 385, 112,559.

These case reports and years of presentation are limited to the date of article submission.

presentation of a hepatothorax that exhibited only gastrointestinal symptomatology and no respiratory distress or discomfort. A case like ours has not yet been reported in the literature. Clinicians should consider this case report when suspecting a possible diagnosis of a delayed traumatic diaphragmatic hernia that may be complicated by an hepatothorax.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Provenance and peer review

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Ethical approval

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Guarantor

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Research registration number

N/A.

CRediT authorship contribution statement

Sergio M. Maldonado-Chaar: Conceptualization, Investigation, Writing - Original draft, Writing - Review & editing, Project administration.

Ángel A. Miró-González: Conceptualization, Investigation, Writing - Original draft, Writing - Review & editing, Project administration.

Norman Ramírez-Lluch: Conceptualization, Methodology, Validation, Writing - Review & editing, Supervision.

Luis O. Ramírez Ferrer: Conceptualization, Investigation, Validation.

Declaration of competing interest

None.

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References

- [1] A. García-Navarro, J.M. Villar-Del Moral, K. Muffak-Granero, A. Palomeque-Jiménez, A. Mansilla-Roselló, D. Garrote-Lara, J.A. Ferrón-Orihuela, Traumatic diaphragmatic rupture, *Cir. Esp.* 77 (2) (2005) 105–107, [https://doi.org/10.1016/s0009-739x\(05\)70818-6](https://doi.org/10.1016/s0009-739x(05)70818-6).
- [2] B.W. King, J.G. Skedros, R.E. Glasgow, D.G. Morrell, Resolution of chronic shoulder pain after repair of a posttraumatic diaphragmatic hernia: a 22-year delay in diagnosis and treatment, *Case Rep. Orthop.* 2020 (2020), <https://doi.org/10.1155/2020/7984936>.
- [3] P.Y. Toh, S. Parys, Y. Watanabe, Traumatic diaphragmatic rupture: delayed presentation following a SCUBA dive, *BMJ Case Rep.* 13 (9) (2020), e234040, <https://doi.org/10.1136/bcr-2019-234040>.
- [4] S. Kesavaramanujam, M.C. Morell, D. Harigovind, C. Bhimmanapalli, S. Cassaro, Total thoracic herniation of the liver: a case of delayed right-sided diaphragmatic hernia after blunt trauma, *Surg. Case Rep.* 6 (1) (2020) 178, <https://doi.org/10.1186/s40792-020-00941-7>.
- [5] E.A. Aborajoo, Z. Al-Hamid, Case report of traumatic intrapericardial diaphragmatic hernia: laparoscopic composite mesh repair and literature review, *Int. J. Surg. Case Rep.* 70 (2020) 159–163, <https://doi.org/10.1016/j.ijscr.2020.04.077>.
- [6] A. Lim, J. Lim, J. Boldery, Hepatothorax: a rare presentation to the trauma surgeon, *ANZ J. Surg.* 87 (12) (2017) E314–E315, <https://doi.org/10.1111/ans.13172>.
- [7] H. Igai, H. Yokomise, K. Kumagai, S. Yamashita, K. Kawakita, Y. Kuroda, Delayed hepatothorax due to right-sided traumatic diaphragmatic rupture, *Gen. Thorac. Cardiovasc. Surg.* 55 (10) (2007) 434–436, <https://doi.org/10.1007/s11748-007-0158-y>.
- [8] G. Ebrahimi, F.W. Bloemers, A delayed traumatic right diaphragmatic hernia with hepatothorax, *J. Surg. Case Rep.* 2012 (1) (2012) [1], <https://doi.org/10.1093/jscr/2012.1.1>.
- [9] M. Kastanakis, D. Anyfantakis, I. Kokkinos, G. Petrakis, E. Bobolakis, Delayed post-traumatic diaphragmatic rupture complicated by total hepato-thorax: a case report, *Int. J. Surg. Case Rep.* 4 (6) (2013) 537–539, <https://doi.org/10.1016/j.ijscr.2013.03.027>.
- [10] Franchi T. Agha RA Sohrabi C, Guideline: updating consensus surgical Case Report (SCARE) guidelines, *Int. J. Surg.* 2020 (84) (2020) 226–230.
- [11] K.G. Da Costa, R.T.S. da Silva, M.S. de Melo, J.T.S. Pereira, J.E.R. Rodriguez, R.C. A. de Souza, I.A. de Oliveira Medeiros, Delayed diaphragmatic hernia after open trauma with unusual content: case report, *Int. J. Surg. Case Rep.* 64 (2019) 50–53, <https://doi.org/10.1016/j.ijscr.2019.08.030>.
- [12] C.C. Jadlowiec, L.U. Sakorafas, Delayed presentation of traumatic right-sided diaphragmatic hernia after abdominoplasty, *Case Rep. Surg.* 2014 (2014), <https://doi.org/10.1155/2014/949531>.
- [13] J. Rehman, J. Landman, K. Kerbl, R.V. Clayman, Laparoscopic repair of diaphragmatic defect by total intracorporeal suturing: clinical and technical considerations, *J. Soc. Laparoendosc. Surg* 5 (3) (2001) 287–291. PMID: PMC3015446 PMID: 11548837.
- [14] X. Senaki, K. Lasithiotakis, A. Andreou, E. Chrysos, G. Chalkiadakis, Laparoscopic repair of posttraumatic diaphragmatic rupture. Report of three cases, *Int. J. Surg. Case Rep.* 5 (9) (2014) 601–604, <https://doi.org/10.1016/j.ijscr.2014.07.007>.