

Case report



MINIMALLY INVASIVE MANAGEMENT OF CHRONIC POST-TRAUMATIC DIAPHRAGMATIC HERNIA WITH DELAYED CLINICAL MANIFESTATION

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ABSTRACT

Background: Post-traumatic diaphragmatic hernia (PTDH) is a rare condition that can transition from acute to chronic states, often eluding immediate diagnosis due to obscured symptoms in the emergency setting. The delayed manifestation of PTDH can lead to severe complications such as intestinal obstruction and respiratory distress associated with high rates of morbidity and mortality.

Case description: We report a case involving a 74-year-old female patient with delayed onset of symptoms of chronic PTDH (CPTDH) with a history of traffic accident three years before presentation, successfully treated with a minimally invasive laparoscopic approach.

Conclusion: Early recognition and adequate management of CPTDH are crucial for minimizing morbidity and mortality. Minimally invasive techniques provide notable benefits in patient care, underscoring the ongoing advancement in surgical approaches.

Keywords: diaphragmatic hernia, post-traumatic, laparoscopic, minimally invasive,

BACKGROUND:

Diaphragmatic hernias (DH), defined as a protrusion of an organ or tissue through an opening or a defect in the diaphragm into the thoracic cavity, highlight the intricate interplay between structural integrity and functional adaptability of the human body. Post-traumatic diaphragmatic hernia (PTDH) represents a rare spectrum of conditions that can transition from an acute to a chronic state, occurring in approximately 0.8 to 6% of blunt trauma cases and over 17% of thoraco-abdominal-penetrating trauma cases [1]. In the emergency setting, PTDH often eludes initial diagnosis as the symptoms may be obscured by other associated life-threatening injuries (cerebral, musculoskeletal, or thoraco-abdominal) [1, 2]. If the diaphragmatic rupture remains undiagnosed, it may enlarge over time and progress to chronic PTDH (CPTDH). The delayed manifestation of post-traumatic diaphragmatic hernia often impedes early diagnosis as it can range from months to years following the initial injury. The clinical presentation encompasses a broad array of symptoms, such as dyspepsia, acid reflux syndrome, dyspnea, shortness of breath, and chronic anemia. Potential complications arising from the herniation of abdominal contents into the thoracic cavity include intestinal obstruction, strangulation, perforation and cardiopulmonary compression, ultimately leading to peritonitis, mediastinal shift, respiratory distress, and shock [2]. Early recognition of CPTDH remains crucial for minimizing morbidity and mortality.

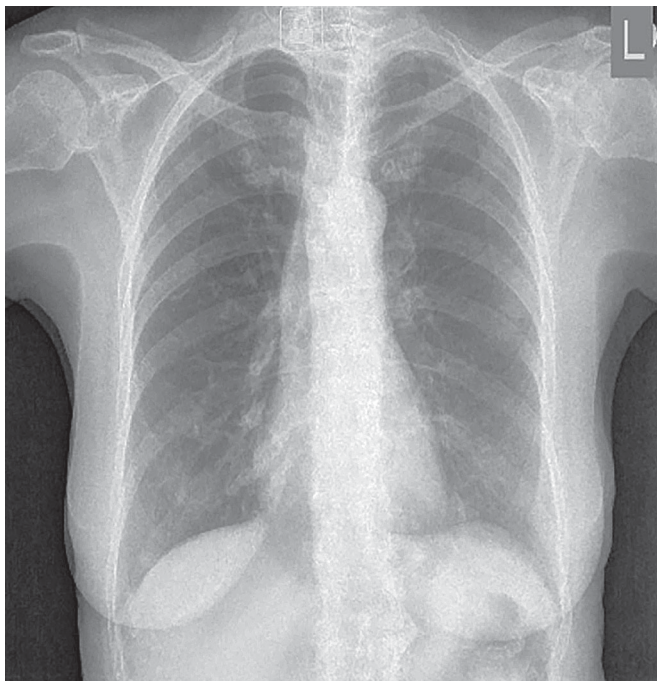
Herein, we report a minimally invasive approach to a case involving a 74-year-old female patient who exhibited delayed symptoms of CPTDH three years after a traffic accident.

CASE DESCRIPTION:

A 74-year-old female patient was admitted to the Clinic of Surgery at University Hospital Alexandrovska for diagnostic evaluation due to complaints of postprandial discomfort and abdominal pain predominantly in the left hypochondriac region with concomitant gradually progressive dyspnea and chest tightness for several months. The patient had a history of vehicle accident 3 years ago, during which no intra-abdominal trauma was identified. Standard and contrast-enhanced chest radiography showed no

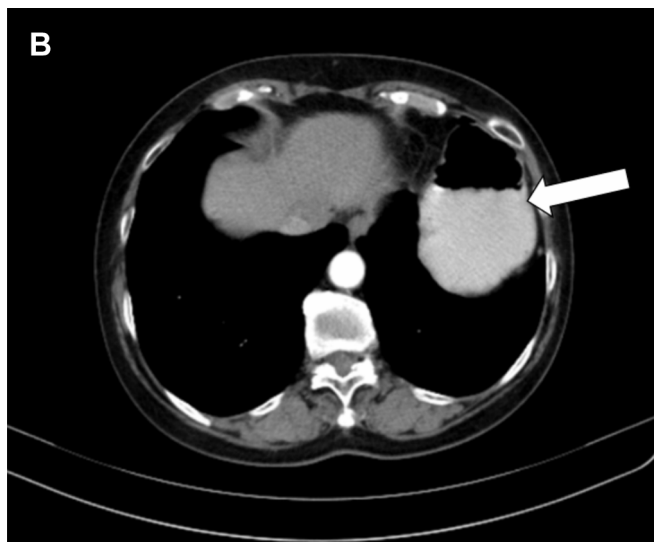
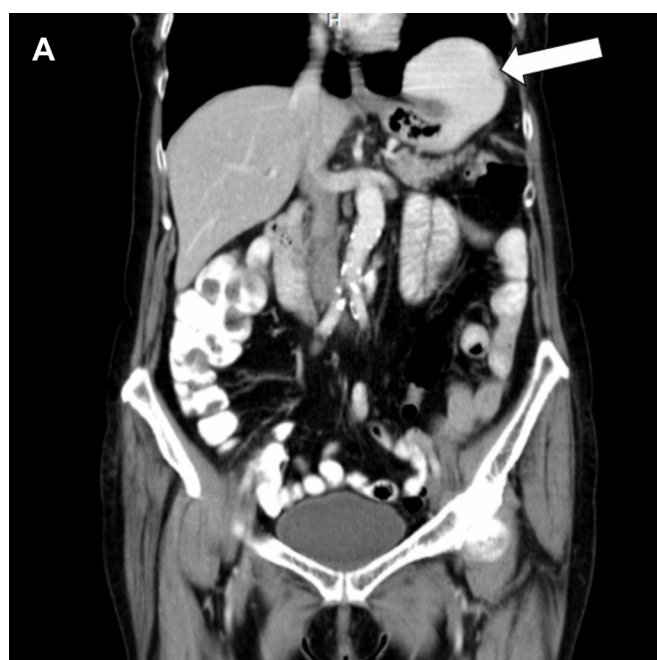
signs of hiatal hernia and impaired contrast flow through the esophagogastric junction (Figure 1). We further performed esophagogastroduodenoscopy (EGD), which uncovered no pathological findings or aberrations in the upper gastrointestinal tract.

Fig. 1. Chest X-ray.



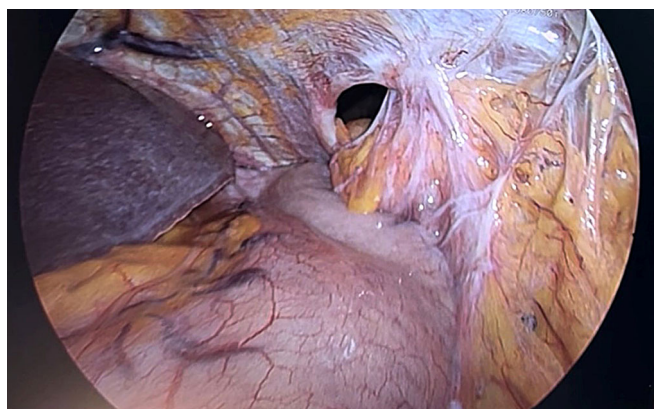
Contrast-enhanced computed tomography (CECT) revealed the presence of a diaphragmatic hernia along the left diaphragmatic dome with a 2/3 herniation of the stomach (Figure 2).

Fig. 2. CECT. Coronal (A) and axial (B) plane. (Arrows depict the herniation of the stomach into the thoracic cavity).



After obtaining informed consent for surgical treatment and perioperative risk assessment, we performed laparoscopic diaphragmatic hernia repair with three trocars. Intraoperatively, a defect measuring approximately 10 cm/d was identified on the left diaphragmatic dome with concomitant herniation of the gastric fundus and body and multiple adhesions to adjacent structures and tissues (Figure 3).

Fig. 3. Intraoperative finding of a defect in the left diaphragmatic dome.



Adhesiolysis was performed with repositioning of the hernia contents. The defect was closed using single silk sutures (Figure 4). A composite dual-side mesh, fixed with resorbable tackers, was utilized to reinforce the repaired defect (Figure 5). The operative time was 65 minutes with 10 mL of measured blood loss. In the postoperative period, a follow-up chest and abdomen CT scan confirmed the integrity of the left diaphragmatic surface, with no signs of recurrence. A minimal amount of reactive pleural effusion was observed without the need for intervention. The patient tolerated enteral feeding on the first postoperative day (POD) and was discharged on the second POD without any complications, reporting subjective improvement. After 6 months in a follow-up examination, the pleural effusion was completely resolved, and the patient indicated the absence of any complaints.

Fig. 4. A) Repositioning of hernia contents after adhesiolysis. B) Closure of the defect.

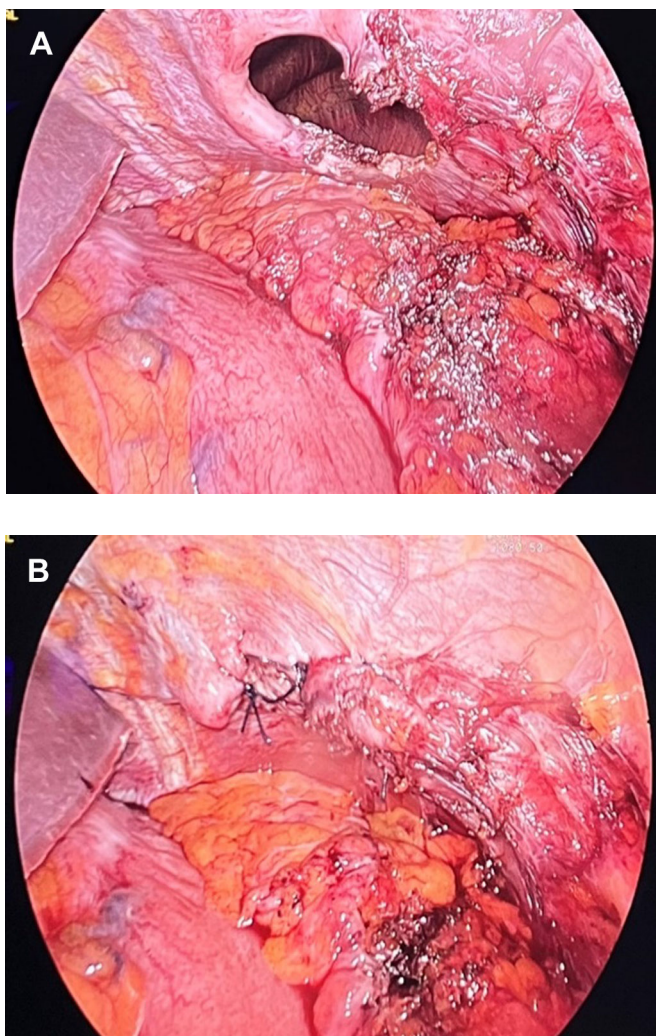


Fig. 5. Fixation of the composite dual-side mesh with tackers.



DISCUSSION:

The diaphragm represents a resilient barrier protecting vital organs and a dynamic interface essential for respiration and digestion. Post-traumatic diaphragmatic rupture was initially documented in the sixteenth century by Sennertus and Pare. Riolfi and Naumann reported the first

diaphragmatic hernia repair in the late nineteenth century. The incidence of PTDH continues to rise, linked to an increase in road traumatism, with blunt trauma being the most common etiology [4]. Delayed clinical presentation primarily results from the amplification of an initial minor injury with subsequent herniation of intra-abdominal organs and tissues facilitated by the negative pressure generated during the normal respiratory cycle [5]. Blunt or penetrating injuries more frequently affect the left hemidiaphragm. Numerous theories attempt to explain the propensity for left-sided injuries. The prevailing theory suggests that the liver plays a direct and indirect protective role on the right hemidiaphragm by mitigating some of the traumatic forces [6,7]. In blunt trauma, the most frequent site of injury occurs at the inherently vulnerable juncture where the lumbar and costal leaflets of the diaphragm merge during embryological development. The significant force necessary for such injuries often results in more extensive tissue defects compared to those caused by penetrating trauma [7]. The diagnosis of CPTDH often poses several challenges, including delayed clinical presentation, overlapping symptoms with other injuries, subtle radiographic findings, and lack of awareness among healthcare workers. PTDH is classified into three phases, delineating its natural evolution: (1) acute, (2) latent and (3) obstructive [3]. In cases of CPTDH, the morbidity and mortality exhibit significant variation depending on whether the surgery is performed during the latent or the obstructive stage. During the latent phase, perioperative mortality is anticipated to be less than 10% in contrast to patients presenting with obstructive symptoms (25-80%) [7]. This highlights the importance of early diagnosis to reduce associated morbidity and mortality.

Most CPTDH cases are diagnosed within one year after the initial injury [8]. However, there have been reports of delayed diagnosis up to 50 years after the initial traumatic event [9]. Usually, CPTDH manifests either clinically with intermittent non-specific pulmonary and gastrointestinal symptoms or is diagnosed incidentally [8]. There have been records of various atypical clinical presentations of CPTH related to the herniated content, such as upper gastrointestinal tract bleeding, resulting from splenic herniation to the left hemithorax, leading to isolated splenic vein thrombosis with left-sided portal hypertension [10]. In addition, late-onset PTDH has been documented to present with clinical signs of acute pancreatitis as a result of pancreas dislocation in the thoracic cavity, underscoring the broad range of possible atypical presentations of CPTDH [11].

The standard treatment of CPTDH is surgical, encompassing open or minimally invasive and transabdominal (TAA), transthoracic (TTA), and combined approaches [12]. A systematic review and proportional meta-analysis by Silva et al. reported that the TAA is the most commonly preferred, especially in the acute phase (75%). In addition, the Eastern Association for the Surgery of Trauma recommends the TAA rather than TTA for diaphragmatic repair in hemodynamically stable trauma patients with acute diaphragmatic injury [13]. Conversely, in cases of delayed

presentation, TTA is more frequent (69%), as it facilitates the adhesiolysis of long-standing herniated contents [4, 14]. However, there is no recommendation regarding the preferred operative approach for CPTDH [13]. Laparoscopy may be considered as a first option for elective surgery. In the emergency setting, factors like hemodynamic stability and associated injuries can be contraindications for minimally invasive methods [15]. Besides less trauma, faster recovery and shorter hospital stay, laparoscopic repair for CPTDH has additional advantages compared to other approaches. Firstly, it provides a complete exploration of the entire abdominal cavity, crucial for identifying adverse events following hernia content reduction, such as perforation, hemorrhage and intestinal ischemia. These complications can be managed laparoscopically, highlighting its superiority over thoracoscopy. Additionally, fixing the mesh to the thoracic surface of the diaphragm is more challenging than fixing it to the abdominal surface [16, 17]. In addition to direct suturing of the hernia defect, laparoscopic mesh placement is recommended for large defects (greater than 3 cm) and is associated with fewer adhesions compared to the open approach [17, 18].

In our case, CECT confirmed the diagnosis of PTDH, while chest X-ray and EGD showed no aberrations. Based on the clinical symptoms and physical examination we classified the patient in the latent phase of CPTDH. We performed laparoscopic repair of the diaphragmatic hernia with

direct suturing, followed by mesh reinforcement, yielding favorable postoperative outcomes. This underscores the benefits of employing a minimally invasive approach and the significance of early recognition of CPTDH. We suggest that detailed medical history collection and a high level of suspicion among clinicians are important for promptly identifying and initiating adequate treatment for diaphragmatic injuries.

CONCLUSION:

The adequate management of PTDH remains a challenge, emphasizing the importance of early diagnosis and intervention in minimizing morbidity and mortality. Minimally invasive approaches and appropriate patient selection offer significant advantages in patient care and highlight the continuous evolution of surgical techniques.

Abbreviations

DH - Diaphragmatic hernia
PTDH - Post-traumatic diaphragmatic hernia
CPTDH - Chronic post-traumatic diaphragmatic hernia
EGD - Esophagogastroduodenoscopy
CT - Computed tomography
CECT - Contrast-enhanced computed tomography
POD - Postoperative Day
TAA – Transabdominal approach
TTA – Transthoracic approach

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