

Case Report

Rare Right-Sided Posterolateral Diaphragmatic Hernia in an Adult Presenting as an Incarcerated Large Bowel Obstruction: A Case Report

Tanya J T Starr, DO, MS¹; Andrew G Nicholson, MD¹;
Maximilian J H Starr, DO, MS¹; Jessica A Traxler, MD¹; Peter Y Chu, MD¹

Author affiliations are listed at the end of this article.

Correspondence to:
Tanya J T Starr, DO, MS
(Tanya.Starr@hcamidwest.com)

Abstract

Introduction

A diaphragmatic hernia (DH) is a defect within a part of the diaphragm that allows intra-abdominal contents to enter the thoracic cavity. Diaphragmatic hernias can be congenital or acquired later in life. The most common congenital DH is the Bochdalek hernia (posterolateral hernia), but the most commonly acquired DH is due to traumatic injury. These hernias are rare in adults and are typically diagnosed incidentally. Surgical repair is the standard of care; however, data regarding the surgical approach is scarce. We report a case of a rare right posterolateral DH in an adult female patient who presented with acute abdominal pain.

Case Presentation

A 69-year-old female presented with recurrent epigastric pain that had acutely worsened, nausea, vomiting, and food intolerance. A computed tomography (CT) scan demonstrated a right posterolateral DH containing the hepatic flexure of the colon. The patient was taken urgently to surgery due to concern for strangulation. Reduction of the hernia was attempted laparoscopically but was converted to an open procedure with a subcostal incision due to poor visualization. This approach revealed adequate exposure of the defect and subsequent reduction of the herniated abdominal contents. The defect was easily closed without tension or the use of mesh. The patient was discharged on postoperative day 3.

Conclusion

Chronic DH can have severe life-threatening sequelae when left untreated. This case demonstrates the importance of thorough history-taking and raises awareness of missed diaphragmatic injuries in trauma situations. Since patients who present with a symptomatic DH often need urgent repair, it is important for surgeons working in the acute care setting to understand the surgical options available and when mesh placement may benefit the situation. Our case outlines a successful primary defect repair, without mesh, of a right-sided DH in which a minimally invasive technique was attempted but converted to laparotomy for patient safety.

Keywords

posterior diaphragmatic hernia; diaphragmatic hernia; congenital diaphragmatic hernias; Bochdalek hernia; congenital abnormalities; bowel obstruction

Introduction

Diaphragmatic hernias (DHs) are most commonly due to congenital abnormalities. However, they can present later in life secondary to trauma or iatrogenic causes. The most common congenital DH is known as the Bochdalek

or posterolateral hernia and is exceedingly rare in adults, with an estimated incidence of 0.17% to 6%.^{1,2} It is typically seen on the left side (85%) compared to the right (8%-10%), given the protective effects of the liver and earlier closure of the right pleuroperitoneal canal.³ In



Figure 1. A sagittal view of a computed tomography scan demonstrated the colon above the diaphragm, posterior to the liver. Prominent proximal dilation of the ascending colon was present. A diaphragmatic opening demonstrated inflammation along with prominent scarring on the diaphragmatic hernia site.

acquired DHs, both penetrating and blunt trauma can lead to the development of either a left or right DH, with the left being more common. The incidence of diaphragmatic injury ranges from 3% to 7% out of all thoracoabdominal trauma, though the true incidence is unknown as literature reports 12% to 66% of these injuries go undiagnosed.^{4,5} Patient history, such as past involvement in motor vehicle accidents (MVAs) or trauma involving the thoracoabdominal region, can help point to an acquired etiology over an incidentally discovered congenital hernia. Typically, adults are asymptomatic. However, in rare instances, these hernias can lead to the incarceration of abdominal organs into the thoracic cavity, with the potential for life-threatening complications. Given the rarity of both congenital and acquired hernias, with only approximately 100 cases described in the literature and less than 20 of those being right DH, the surgical approach and technique remain variable.⁶

Case Presentation

Our patient was a 69-year-old female with a past medical history of hypertension, hyperlipidemia, gastroesophageal reflux disease, obe-

sity, and chronic back pain. She reported being involved in a motor vehicle accident (MVA) over 20 years earlier. She had a past surgical history of hiatal and lumbar hernia repair, appendectomy, 3 cesarean sections, and spinal surgery.

The patient presented to the emergency department with complaints of recurrent epigastric pain that had acutely worsened. Her pain was sharp in nature and radiated to her back with associated nausea, vomiting, and food intolerance. She denied any shortness of breath or difficulty with respiration. Vitals and labs were within normal limits. A computed tomography (CT) scan demonstrated a right posterolateral DH containing the hepatic flexure of the colon (**Figures 1 and 2**). The distal end of the colon was decompressed, while the proximal colon was fluid-filled and dilated, indicating an obstruction. The patient was scheduled for urgent surgical intervention given concern for possible strangulation of hernia contents. It was discussed with the patient that an attempt at a laparoscopic surgery would be made, but with the location of the DH, conversion to an open procedure was likely. The patient was taken to the operating room

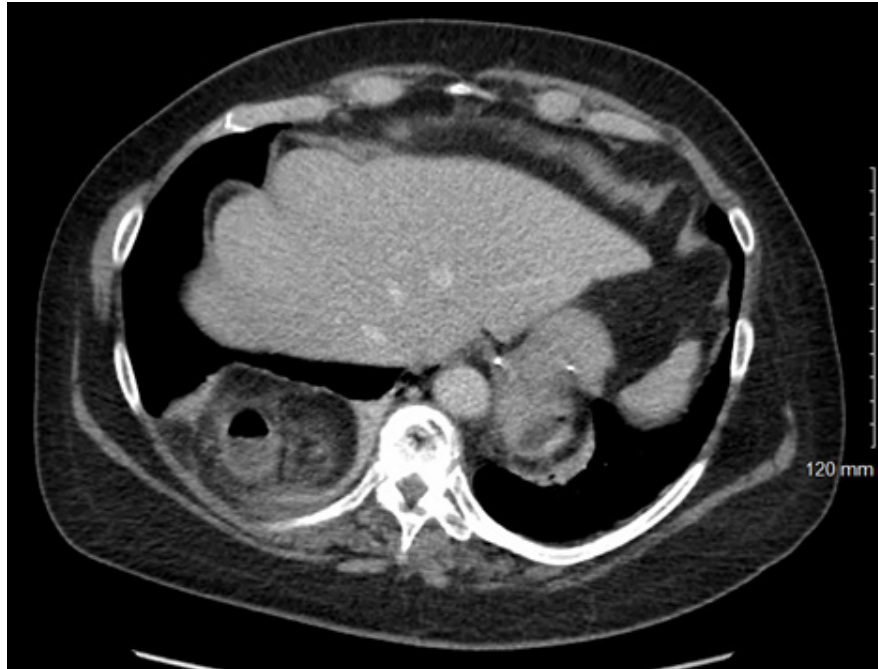


Figure 2 . A coronal view of a computed tomography scan demonstrated epiploic appendages medially to the area of the incarcerated colon.

and placed in a supine position while under general anesthesia. Access to the abdomen was performed supraumbilically with the Hassan technique. Under direct view, 2 more ports were placed, 1 in the right upper quadrant and 1 in the left upper quadrant. The patient was then placed in reverse Trendelenburg. The liver was retracted medially, and the colon was identified going up into the diaphragmatic defect. The rim of the hernia defect was unable to be visualized, and the decision was made to convert to an open laparotomy. A subcostal incision was made, and the rib cage was retracted superiorly. The liver was mobilized medially after taking down the lateral attachments. The defect in the diaphragm was approximately 4 cm in size. The transverse colon appeared to be incarcerated in a Richter type hernia fashion, with only the antimesenteric lumen involved. The diaphragm defect was extended medially with a scalpel to allow for further reduction of contents and to free the hernia in a circumferential manner from the rim of the diaphragm. Along with the colon, a large epiploic appendage was reduced. This appendage was roughly 6-7 cm in size. It was divided on the back table and was found to have concentric rings of calcification interspersed with dense necrotic fat tissue. This appendage was presumably chronically incarcerated and had gone through mul-

tiple episodes of fat necrosis with calcification and subsequent enlargement. This appendage appeared to be the lead point through the hernia. The colon demonstrated venous congestion that resolved shortly after reduction. The defect was inspected and was approximately 6 cm in size. It was closed primarily without tension, utilizing a 0-Prolene suture in an interrupted figure eight fashion. Prior to complete defect closure, a 19-French Blake drain was placed into the pleural space and attached to suction to evacuate the air during closure.

On postoperative day 1, a chest X-ray revealed the patient was free from pneumothorax, her vitals were stable on room air, and she was tolerating a regular diet. She was discharged on postoperative day 3 in stable condition.

Discussion

In 1848, Vincent Alexander Bochdalek first described the posterolateral DH.⁷ This congenital hernia allows intra-abdominal contents to herniate through the diaphragm defect and into the thoracic cavity, often causing respiratory distress to affected infants. While this defect is one of the most common diaphragm defects diagnosed in infancy, it is extremely rare in adults, with a prevalence of 0.17% to 6%.^{1,2,8} Diaphragm defects seen in adulthood

can result from congenital hernias that were missed or hernias acquired from other causes, such as traumatic injury. Due to its rarity and the usual concomitant injuries in trauma situations, diaphragm injuries are one of the most commonly missed injuries in trauma, with available literature demonstrating 12% to 66% are undiagnosed at the time of initial presentation.^{4,5} Multiple mechanisms during a trauma can result in injury to the diaphragm, such as an acute increase in intra-abdominal pressure, rib fractures causing direct penetration, or avulsion of diaphragm attachments from the chest wall. In some reports, MVAs were the cause of 90% of diaphragmatic injuries, with roughly 68% to 75% being from blunt trauma and 25% to 32% being from a penetrating injury.^{9,10} The right diaphragm tends to be better-protected than the left during trauma given the energy absorbing effects of the liver, and, therefore, only 12% to 40% of injuries occur on the right.¹¹ Given the high morbidity and mortality (30% to 60%) of missed diaphragmatic injuries, suspicion must remain high in trauma patients or patients with a remote history of trauma who present with acute abdominal pain.¹²

Diaphragmatic hernias are typically asymptomatic in adults and often go undiagnosed. They can remain clinically silent for years until an acute change occurs, such as herniation of abdominal contents. This herniation, depending on its contents, can result in symptoms such as respiratory distress, chest pain, abdominal pain, nausea, vomiting, or constipation, with the majority (96%) presenting with chest or abdominal symptoms.^{8,13} In 2018, the Eastern Association for the Surgery of Trauma released recommendations favoring diagnostic laparoscopy over CT imaging when suspicion for diaphragmatic injury is high. When delayed presentation occurs and patients present with obstructive symptoms, CT imaging is usually obtained, showing visceral herniation through the defect. Studies demonstrate that CT imaging has a sensitivity of 50% for right-sided hernias and 78% for left.¹⁴⁻¹⁶ Of the cases reviewed in the literature, the most common organs involved are the small bowel (28%), omentum (39%), stomach (40%), and colon (63%).¹⁷

Once diagnosed, an operation is frequently indicated. Due to fibrosis and adhesions seen in chronic DH, a thoracic approach is typical-

ly recommended. However, surgeon training, facility capabilities, and the need for immediate intervention can dictate the approach. Options for a surgical procedure include video assisted thoracoscopic surgery (VATS), thoracotomy, laparoscopy, laparotomy, or combined chest and abdominal approaches.^{5,18,19} Some of the recent studies favor a laparoscopic approach, as it has been shown to result in shorter recovery time and hospital stay.^{19,20} If there is difficulty in reducing the bowel, bleeding, or injury to the surrounding viscera, an urgent laparotomy is necessary.

Mesh use is also controversial, and there is no definitive protocol for when to use it. In a study by Liu et al, which followed 23 patients with chronic DH, the following parameters for repair were used: a hernia ring size of less than 5 cm underwent primary closure with permanent suture repair (no mesh), a hernia ring size of greater than or equal to 5 cm underwent suture repair and placement of non-adhesive mesh, and a hernia ring size of greater than or equal to 10 cm underwent muscle flap and placement of non-adhesive mesh. This study showed no recurrence at follow-up.¹⁰ Mesh-specific data is not available for the emergency setting, and more studies are warranted to develop guidelines for repair. However, data shows biological mesh to have the lowest risk of displacement compared to synthetic mesh, lower risk of hernia recurrence, and higher resistance to infections. Absorbable synthetic mesh is a popular option, given its lower cost, alternative sizes available, and reduced risk of bowel adherence. Due to its durability, polytetrafluoroethylene mesh is the most commonly used for repair.^{19,21}

In our case, an urgent laparoscopy was performed, given the acuity of our patient's symptoms, concern for bowel ischemia, as well as the surgeon and operating staff's familiarity with operating in the abdominal cavity over the thoracic cavity. It was discussed with the patient that we would have a low threshold to convert to an open abdominal or thoracic approach if the hernia contents could not be reduced safely. The decision to convert to an open abdominal approach was made after proper visualization of the hernia ring could not be obtained and palpation of the area was concerning for dense adhesions. A thoracic

approach did not have to be utilized during our case as there was no intrathoracic visceral perforation and visceropleural adhesions were easily taken down via the abdominal incision. The original hernia defect was less than 5 cm, and after reduction of the hernia contents and primary repair of the defect, there did not appear to be tension on the repair. Therefore, mesh was not used.

In our patient's case, she had significantly enlarged, incarcerated epiploic appendages that were acting to pull the colon into the diaphragmatic defect. Given the chronicity seen in the incarcerated appendages and her history of recurrent abdominal pain, it is likely she had intermittent bowel herniation into the chest cavity for many years. It is possible that this herniation began after her MVA, though a congenital defect could not be ruled out.

Conclusion

Chronic DH can have severe life-threatening sequelae when left untreated. This case draws attention to the importance of thorough history-taking and raises awareness of missed diaphragmatic injuries in trauma situations. Considering that patients who present with a DH often need urgent repair, it is important for general surgeons working in the acute care setting to understand the surgical options available for treatment and when mesh placement may be of benefit. Options for surgical procedure include video assisted thoracoscopic surgery (VATS), thoracotomy, laparoscopy, laparotomy, or combined chest and abdominal approaches. When the hernia ring is greater than or equal to 5 cm, suture repair and non-adhesive mesh placement have been shown to be successful in preventing recurrence. This case outlines a successful primary defect repair, without mesh, of a right-sided DH in which a minimally invasive technique was attempted but converted to laparotomy for patient safety.

Conflicts of Interest

The authors declare they have no conflicts of interest.

The authors are employees of Overland Park Regional Medical Center, a hospital affiliated with the journal's publisher.

This research was supported (in whole or in part) by HCA Healthcare and/or an HCA Healthcare-affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA Healthcare or any of its affiliated entities.

Author Affiliations

1. Overland Park Regional Medical Center, Overland Park, KS

References

1. Mullins ME, Stein J, Saini SS, Mueller PR. Prevalence of incidental Bochdalek's hernia in a large adult population. *AJR Am J Roentgenol*. 2001;177(2):363-366. doi:10.2214/ajr.177.2.1770363
2. Alam A, Chander BN. Adult Bochdalek hernia. *Med J Armed Forces India*. 2005;61(3):284-286. doi:10.1016/S0377-1237(05)80177-7
3. Losanoff JE, Sauter ER. Congenital posterolateral diaphragmatic hernia in an adult. *Hernia*. 2004;8(1):83-85. doi:10.1007/s10029-003-0166-5
4. Chughtai T, Ali S, Sharkey P, Lins M, Rizoli S. Update on managing diaphragmatic rupture in blunt trauma: a review of 208 consecutive cases. *Can J Surg*. 2009;52(3):177-181.
5. Njem JM, Ugwu BT, Dung ED, Awodi J. Traumatic diaphragmatic hernia with intestinal obstruction in a child: a case report. *J West Afr Coll Surg*. 2018;8(1):100-109.
6. Laaksonen E, Silvasti S, Hakala T. Right-sided Bochdalek hernia in an adult: a case report. *J Med Case Rep*. 2009;3:9291. doi:10.1186/1752-1947-3-9291
7. Shah AD, Ajay S, Adalia M, Rathi A. Bochdalek hernia with intrathoracic kidney. *Lung India*. 2012;29(4):373-375. doi:10.4103/0970-2113.102837
8. Eldaabossi S, Al-Ghoneimy Y, Abish YG, et al. Late presentation of a congenital problem; complicated left-sided Bochdalek's hernia in an adult: a case report. *Respir Med Case Rep*. 2023;45:101903. doi:10.1016/j.rmcr.2023.101903
9. Dinc T, Kayilioglu SI, Coskun F. Late onset traumatic diaphragmatic herniation leading to intestinal obstruction and pancreatitis: two separate cases. *Case Rep Emerg Med*. 2015;2015:549013. doi:10.1155/2015/549013
10. Ndour O, Mustapha H, Ndoye NA, Faye Fall AL, Ngom G, Ndoye M. Traumatic right diaphragmatic hernia in children: diagnostic difficulties. *Afr J Paediatr Surg*. 2015;12(1):94-97. doi:10.4103/0189-6725.151004
11. Vilallonga R, Pastor V, Alvarez L, Charco R, Armengol M, Navarro S. Right-sided diaphragmatic rupture after blunt trauma. An unusual entity. *World J Emerg Surg*. 2011;6:3. doi:10.1186/1749-7922-6-3

12. Sekusky AL, Lopez RA. Diaphragm Trauma. In: StatPearls. StatPearls Publishing; 2023. Accessed October 18, 2023. <http://www.ncbi.nlm.nih.gov/books/NBK557647/>
13. Akita M, Yamasaki N, Miyake T, et al. Bochdalek hernia in an adult: two case reports and a review of perioperative cardiopulmonary complications. *Surg Case Rep*. 2020;6(1):72. doi:10.1186/s40792-020-00833-w
14. Killeen KL, Mirvis SE, Shanmuganathan K. Helical CT of diaphragmatic rupture caused by blunt trauma. *AJR Am J Roentgenol*. 1999;173(6):1611-1616. doi:10.2214/ajr.173.6.10584809
15. Shin MS, Mulligan SA, Baxley WA, Ho KJ. Bochdalek hernia of diaphragm in the adult. Diagnosis by computed tomography. *Chest*. 1987;92(6):1098-1101. doi:10.1378/chest.92.6.1098
16. Spiridakis KG, Flamourakis ME, Gkionis IG, et al. Right-sided strangulating diaphragmatic hernia in an adult without history of trauma: a case report. *J Med Case Rep*. 2021;15(1):372. doi:10.1186/s13256-021-02861-y
17. Machado NO. Laparoscopic repair of Bochdalek diaphragmatic hernia in adults. *N Am J Med Sci*. 2016;8(2):65-74. doi:10.4103/1947-2714.177292
18. Ebrahimi G, Bloemers FW. A delayed traumatic right diaphragmatic hernia with hepatothorax. *J Surg Case Rep*. 2012;2012(1):1. doi:10.1093/jscr/2012.1.1
19. Giuffrida M, Perrone G, Abu-Zidan F, et al. Management of complicated diaphragmatic hernia in the acute setting: a WSES position paper. *World J Emerg Surg*. 2023;18(1):43. doi:10.1186/s13017-023-00510-x
20. Tessely H, Journé S, Therasse A, Hossey D, Lemaitre J. A case of colon necrosis resulting from a delayed traumatic diaphragmatic hernia. *J Surg Case Rep*. 2020;2020(6):rjaa101. doi:10.1093/jscr/rjaa101
21. Shao G, Wu L, Li J, Dai C. Laparoscopic diaphragmatic hernia repair with mesh reinforcement. *Am Surg*. 2020;86(5):476-479. doi:10.1177/0003134820919735