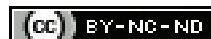


Laparoscopic-assisted Open Surgery for Bochdalek Hernia with Gastric Volvulus Involving Multiple Organs: A Case Report

XINXI YANG¹, SHIHONG LI², PAN NIE³, KEHAO LIU⁴, KANG HOU⁵

ABSTRACT

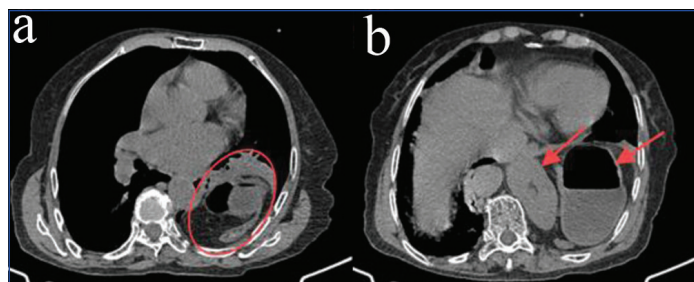
Bochdalek hernias are a rare form of diaphragmatic hernia that are usually asymptomatic and typically observed in children. In adults, they are rare and often detected incidentally through imaging. Acute gastric torsion is an uncommon condition in clinical practice, and without timely intervention, life-threatening complications such as gastric strangulation, perforation, and shock may ensue. This case report describes a 74-year-old female patient who presented with abdominal pain and bloating. Following a physical examination and Computed Tomography (CT) scan, the patient was diagnosed with gastric volvulus due to a left Bochdalek hernia. The stomach, spleen, colon, and left kidney were also affected. The patient underwent a successful laparoscopic-assisted open surgical procedure, showing a positive recovery with no complications, and was discharged one week after the operation. At the six-month follow-up, there were no signs of hernia recurrence or other discomfort. During the surgical procedure, it was ascertained that the patient exhibited organ-axial gastric torsion, a condition characterised by the rotation of the stomach around the axis connecting the pylorus and the oesophageal junction. The combination of Bochdalek hernia with gastric volvulus obstruction represents a rare clinical entity, particularly when complicated by the involvement of multiple organs within the hernial sac. Any therapeutic delay in such cases may result in organ necrosis and potentially fatal outcomes. This case emphasises the necessity for meticulous diagnostic and management strategies for Bochdalek hernias, particularly in instances involving multiple organs, to avert complications such as organ necrosis.

Keywords: Congenital diaphragmatic hernia, Kidney, Splenic flexure, Surgical mesh

CASE REPORT

A 74-year-old female patient was admitted to the centre for gastrointestinal and minimally invasive surgery with a chief complaint of abdominal pain persisting for two days. The patient had presented two days prior with episodes of subxiphoid pain of unclear aetiology, which had remained untreated. The pain was sharp and cramping, radiating to the chest. Her medical history included over 10 years of myocardial ischaemia, cataract surgery performed 10 years ago, and laparoscopic cholecystectomy for gallbladder stones five years ago. However, the patient had no history of hypertension or diabetes mellitus and was not currently prescribed any chronic medications.

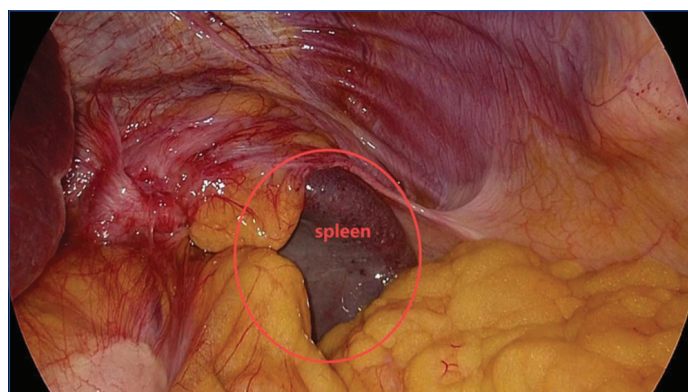
Upon examination, the patient displayed tenderness and pain in the subxiphoid and supraumbilical regions, along with diminished breath sounds in the left lower lung on auscultation. A Computed Tomography (CT) scan suggested the presence of a diaphragmatic hernia accompanied by gastric torsion/volvulus [Table/Fig-1].



[Table/Fig-1]: a) Tissue herniated into the thoracic cavity; b) Gastric tissue and displaced left kidney. (The arrow on the right indicates a dilated stomach and the organoaxial gastric volvulus.)

Based on the patient's physical examination and the CT scan, pleural effusion and tumours at the base of the lung or within the mediastinum were excluded. The established diagnosis was a diaphragmatic hernia accompanied by acute gastric volvulus.

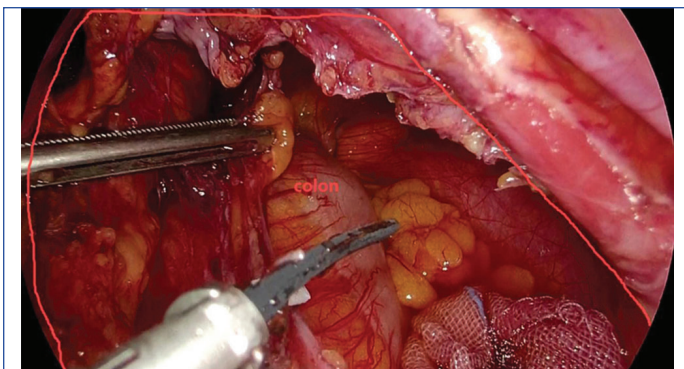
The patient underwent gastrointestinal decompression, nasal oxygenation, fluid replacement, and maintenance of water and electrolyte balance, which successfully alleviated the abdominal pain. The patient was advised to undergo laparoscopic surgery. Intraoperative exploration revealed that the stomach had returned to the abdominal cavity following gastrointestinal decompression, whereas the spleen had herniated into the hernia sac [Table/Fig-2].



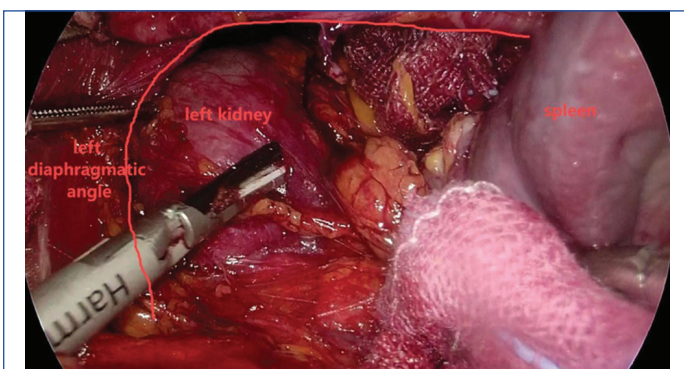
[Table/Fig-2]: The hernia ring and visible spleen in the hernia sac.

Further dissection revealed that the splenic flexure of the colon was within the hernia sac [Table/Fig-3]. Furthermore, the left kidney was also located within the hernia sac [Table/Fig-4].

The patient initially underwent laparoscopic surgery aimed at repositioning the organs within the hernia sac back into the abdominal cavity and releasing the hernia ring opening. However, as the procedure advanced, the field of view and available operating space became restricted, necessitating a conversion to open surgical techniques. Further dissection of the retroperitoneum was performed up to the midline of the spinal periosteum. Subsequently, the hernia contents were returned to the peritoneal cavity, and the left kidney was repositioned and securely affixed within the abdominal

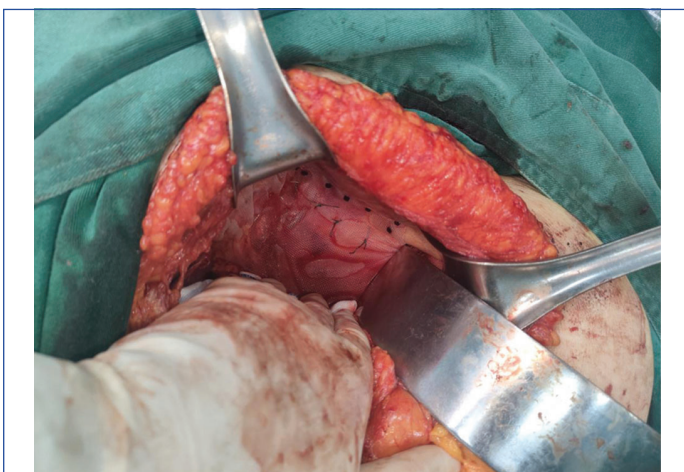


[Table/Fig-3]: Intraoperative free hernia content shows part of the colon in the hernia sac.



[Table/Fig-4]: The left kidney is visible within the hernia sac.

cavity. This surgical approach allowed for complete exposure of the defect, which was then sutured and closed. The retroperitoneum, diaphragm, and spinal vertebrae were also sutured and reinforced, effectively sealing the defect. A properly sized titanised mesh (TiLENE Mesh from PFM) was employed to cover the initial defect, and the mesh was secured to both the vertebrae and diaphragm [Table/Fig-5].



[Table/Fig-5]: Hernia repair with titanised mesh (TiLENE® Mesh from PFM medical).

After the surgery, the patient was administered cefotaxime (1.5 gm every 12 hours) as part of an anti-infective regimen. Measures were taken to maintain water and electrolyte balance, and regular dressing changes and additional supportive treatments were provided. The patient showed a positive recovery with no complications and was discharged one week after the operation. At the six-month follow-up, there was no hernia recurrence or other discomfort.

DISCUSSION

Pleuroperitoneal foramen hernia, commonly referred to as Bochdalek hernia, was initially described by Bochdalek in 1948. This hernia occurs at the Bochdalek foramen, situated between the costal and lumbar portions of the diaphragm bilaterally. The pathophysiology involves the incomplete fusion of the pleuroperitoneal folds, resulting

in the persistence of the pleuroperitoneal canal and the formation of Bochdalek hernias. These hernias represent the most prevalent category of congenital diaphragmatic hernia, with an incidence in newborns estimated at approximately 1 in 2,200 to 2,500 live births [1]. The incidence of Bochdalek hernia in adults is estimated to range from approximately 0.17% to 6% [2,3]. Currently, there are around 300 cases of Bochdalek hernias reported in the literature [4]. This condition arises from the failure of the pleuroperitoneal ducts to close during the eighth week of gestation [5,6]. In adults, approximately 70% of Bochdalek hernias occur on the left side, while the remaining 30% are on the right side. Most adult patients with Bochdalek hernias are asymptomatic and do not experience discomfort related to the hernia until they develop abdominal pain, which leads to diagnosis [7]. Bochdalek hernias are uncommon in adults and are often found incidentally [8]. Clinically, adult patients exhibit a wide range of symptoms. In a systematic review involving 192 Bochdalek hernia patients over the age of 16 years, it was noted that nine of these patients were asymptomatic. Among those who did experience symptoms, abdominal pain was the most prevalent, affecting more than 60% of cases. This was followed by pulmonary and cardiac symptoms, while bowel obstruction and dysphagia were relatively rare. Some patients experienced multiple symptoms, and there were no significant differences in the types of symptoms presented between left and right Bochdalek hernias [7]. It is suggested that the liver may help support the right diaphragm, potentially preventing bowel herniation into the Bochdalek foramen. This support might reduce both the frequency of associated symptoms and the risk of acute complications such as bowel obstruction [8].

In the present case, the patient was admitted for abdominal pain. Although the abdominal examination appeared normal, there was tenderness under the xiphoid process, as well as diminished breath sounds in the left lower lung upon auscultation. These findings were nonspecific, indicating that before identifying a Bochdalek hernia, such cases might be misdiagnosed as simple digestive or respiratory issues. Matsudera S et al., reported a case of a young female patient diagnosed with Bochdalek hernia due to the presence of abdominal pain. The patient exhibited a combination of symptoms, including the protrusion of the stomach, spleen, small intestine, and the left side of the colon into the hernia orifice. However, the onset of symptoms appeared to be earlier in this case, possibly attributable to the patient's young age [9]. Notably, the absence of hernial sac formation at the time of initial detection not only indicates potential opportunities for early therapeutic intervention but also underscores the necessity of comprehensive differential diagnostic protocols in the clinical evaluation of abdominal pain.

For diagnosing Bochdalek hernias, imaging studies are the first line of approach. A standard anteroposterior chest X-ray can reveal a large hernia sac, and if abdominal organs are involved, gas or fluid-filled organs may be visible. However, when the hernia sac is small, it can easily be mistaken for a pneumothorax or pleural effusion. In such instances, a CT scan is more adept at detecting small or asymptomatic Bochdalek hernias [10]. In the preoperative CT scan of the patient in the present case, part of the stomach was found in the hernia sac along with a portion of the colon, and the left kidney was positioned higher than normal. During the surgery, it was discovered that both the kidney and spleen tissues had also entered the hernia sac, which was not fully captured in the preoperative imaging. This case is exceptionally rare, as the hernia sac contained portions of the stomach, colon, left kidney, and spleen. In 2021, Peri V et al., reported a similar case of a Bochdalek hernia involving these organs; however, the patient in that case chose conservative management [11]. The intrathoracic kidney is an extremely rare occurrence, with an incidence of less than 1 in 10,000 [5].

Surgery is the preferred treatment for Bochdalek hernias. Most experts recommend surgery even for asymptomatic cases or those discovered incidentally, regardless of the side of the diaphragm

affected, to prevent potential acute complications such as intestinal strangulation leading to necrosis [8,12-14]. The choice of surgical approach should be individualised based on imaging findings and the patient's presentation [12]. The abdominal approach is the most commonly used, while the thoracic approach may be more suitable for right-sided Bochdalek hernias in the absence of liver atrophy. The combined thoracoabdominal approach, although not routinely chosen, should be selected carefully based on specific surgical conditions. Research indicates that patients who undergo laparoscopic surgery may reduce their postoperative hospital stay by five days [7]. However, laparoscopic surgery may not always be feasible, and a combination of open laparotomy or thoracotomy may be necessary, especially if the defect is large. In the present case, we initially attempted laparoscopic surgery but converted to open surgery due to a limited field of view and restricted operating space with the laparoscope. In such cases, the diaphragm or mesh may be secured to the spine or vertebral body to prevent recurrence.

Diaphragmatic defects are typically repaired using sutures; however, if the reconstructed diaphragm is insufficiently strong to withstand the pressure of breathing, the repair may fail or recur. To minimise the risk of failure and recurrence, mesh is often utilised to reinforce the repair [13]. Currently, there are no clear guidelines on which type of mesh, synthetic or biological, is superior. In our patient, we opted to use mesh for the repair due to the large size of the diaphragmatic defect. Common postoperative complications include pneumonia, pleural effusion, respiratory failure, surgical site infection, and cardiac complications, with a recurrence rate of approximately 1.6% and a mortality rate of around 4.4% [7,12,14]. Despite being an elderly patient, the present case showed a good postoperative recovery without complications, and there was no recurrence after six months of follow-up.

CONCLUSION(S)

Bochdalek hernia is a relatively uncommon condition, with the majority of patients remaining asymptomatic. In instances where symptoms do present, the clinical manifestations are often non-specific, which can lead to misdiagnosis. Therefore, precise differentiation through imaging techniques is essential. Typically, patients undergoing surgical

intervention for Bochdalek hernia exhibit herniation of a single organ or tissue. However, the case under discussion is notable for the simultaneous herniation of the stomach, spleen, colon, and left kidney—an exceedingly rare phenomenon. In the present case, the patient did not display any signs of organ or tissue necrosis. This case underscores the necessity for meticulous attention in both the diagnosis and surgical management of Bochdalek hernia.

REFERENCES

[1] Cruz EJG, Jiménez AL, Rosas JMP, de la Cruz LG, Pacheco SC, Guzmán NIB. Bochdalek hernia: A comprehensive review of pathophysiology, clinical presentation, diagnostic modalities, and contemporary management strategies. *Int J Med Sci Clin Res Stud*. 2023;03(09):1901-06.

[2] Gale ME. Bochdalek hernia: Prevalence and CT characteristics. *Radiology*. 1985;156(2):449-52.

[3] 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):363-66.

[4] Li B, Liu F, Wu G, Ma Q. Retroperitoneal totally endoscopic prosthetic (R-TEP) repair of a rightsided Bochdalek hernia. *Asian J Surg*. 2023;46(7):2808-09.

[5] Farwati R, Ghedda SA, Aboudan R, Ataya J, Abdulhakim H. Bochdalek's hernia in adults: A unique case with gastric volvulus and intrathoracic kidney. *Int J Surg Case Rep*. 2024;121:110006. Doi: 10.1016/j.ijscr.2024.110006. Epub 2024 Jul 4. PMID: 38972105; PMCID: PMC11277729.

[6] Tasnim S, Bribiesco AC, Sudarshan M. Surgical diaphragm: Anatomy and physiology. *Thorac Surg Clin*. 2024;34(2):111-18.

[7] Katsaros I, Giannopoulos S, Katelani S, Vailas M, Sotiropoulou M, Papaconstantinou D, et al. Bochdalek hernias in the adult population: A systematic review of the literature. *ANZ J Surg*. 2022;92(9):2037-42.

[8] Lau NS, Crawford M, Sandroussi C. Surgical management of symptomatic right-sided Bochdalek hernias in adults: When is a minimally invasive approach appropriate? *ANZ J Surg*. 2020;90(6):1075-79.

[9] Matsudera S, Nakajima M, Takahashi M, Muroi H, Kikuchi M, Shida Y, et al. Laparoscopic surgery for a Bochdalek hernia triggered by pregnancy in an adult woman: A case report. *Int J Surg Case Rep*. 2018;48:10-15. Doi: 10.1016/j.ijscr.2018.04.028. Epub 2018 May 1. PMID: 29763850; PMCID: PMC6066472.

[10] Wilbur AC, Gorodetsky A, Hibbeln JF. Imaging findings of adult Bochdalek hernias. *Clin Imaging*. 1994;18(3):224-29.

[11] Peri V, Jiang M, Kabir T. Dyspnea caused by Bochdalek hernia associated with intrathoracic kidney. *Clin Gastroenterol Hepatol*. 2021;19(8):A21.

[12] Machado NO. Laparoscopic repair of bochdalek diaphragmatic hernia in adults. *N Am J Med Sci*. 2016;8(2):65-74.

[13] Predescu D, Achim F, Socea B, Ceaușu MC, Constantin A. Rare diaphragmatic hernias in adults-experience of a tertiary center in esophageal surgery and narrative review of the literature. *Diagnostics (Basel)*. 2023;14(1):85.

[14] Bridges CJ, Hasson RM. Congenital hernias in adults: Bochdalek hernias. *Thorac Surg Clin*. 2024;34(2):155-62.

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