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Case Report

Laparoscopic Repair of Large Recurrent Bochdalek Hernia: Case Report with Review of Literature

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ABSTRACT

Congenital diaphragmatic hernia (CDH) is a birth defect involving improper formation of the diaphragm, leading to the protrusion of abdominal organs into the chest cavity. The CDH is classified depending on the location of the defect as postero-lateral, central and anterior. Depending on the side, it is classified as right, left and bilateral. A majority of CDH defects are postero-lateral defects and are commonly referred to as Bochdalek hernias (BH). Herein, the authors present the case of a 29 years old male patient diagnosed with a large left recurrent Bochdalek hernia. He was operated for it in another hospital by another surgeon 5 months back. That previous surgical intervention was initially planned via laparoscopy. But, intraoperatively, it had to be converted to open surgery due to technical difficulty. Post the first surgery, after about 1.5 months, he started developing pain in the back of his left chest. However, due to financial constraints, he did not seek any consultation with anyone at that time. The authors successfully performed a laparoscopic repair of this difficult condition. The rationale for reporting this case is to underscore the relative ease of a laparoscopic over open surgical intervention, on the 'roof' of the abdomen and also the lower chest. Also, it hopes to highlight that laparoscopic repair of BH is feasible even in challenging, difficult and recurrent scenarios, in an advanced setup backed up by the requisite surgical expertise.

KEYWORDS

• Congenital • Diaphragmatic • Hernia • Laparoscopic • Open repair • Postero-lateral

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CASE REPORT

A 29 years old male patient presented to the surgical out patients department with complaint of pain in left upper quadrant since 7 days. The pain was colicky, non radiating, persistent and had worsened over last 2 days. He had been prescribed routine pain killer (tablet Voveran) by his general practitioner for the same, but to no lasting relief. He gave history of having undergone a surgery laparoscopic converted to open repair of left BH 5 months back in another hospital. On examination, his pulse was 92 per minute, blood pressure was 130/90 mms of Hg and respiratory rate was 14 breaths per minute. On per abdomen examination, he had tenderness in left hypochondriac region. Also, the scars of his previous surgery for the same condition were noted. He had no air entry in the lower 2/3^{rds} of his left lung. A plain X-ray chest in standing position was then done and it revealed a large gas shadow, complete obliteration of left costo-phrenic angle and complete opacification over and non-visualization of left lower lung field (*Figure 1A*). This suggested a recurrence of the left diaphragmatic hernia. He was advised to get a contrast enhanced computed tomography of chest and abdomen done. The same revealed a recurrent left BH with the proximal half of stomach, the entire spleen and pancreas, a large stretch of small bowel and upper half of left kidney being its contents (*Figure 1B-D*). He was then advised to undergo redo surgery for the large recurrent left BH, after due investigational workup. A laparoscopic approach was planned. He was given a supine position with both lower limbs kept straight and split up. The surgeon stood between his legs, the camera surgeon on his right side and the 2nd assistant surgeon, on his left side. A 5 trocar approach was adopted. The optic 10mm trocar was on the midline at the junction of upper 2/3rd and lower 1/3rd of the xiphisternum to umbilicus line. One 5 mm trocar was inserted just below the xiphoid process. Two 5 mm trocars were inserted one on each side on anterior axillary line, subcostal area. Dense adhesions of omentum and small bowel to parietes and edges of hernial defect were noted and gently lysed (*Figure 1E*). The intra-thoracic stretch of the stomach was then gently mobilized and reduced (*Figure 1F, 2A,B*). The spleen was found to be in torsion ie medial to the stomach (*Figure 2C*). It had adhesions to the pericardium, pleura and the aorta (*Figure 2D-F*). These adhesions were lysed and the spleen was eventually delivered into the abdomen along with the pancreas (*Figure 3A-C*). The intra-thoracic small bowel loops were reduced. The upper pole of the left kidney was then mobilized and reduced into the abdomen (*Figure* 3D,E). The previously inserted mesh was found to be rolled up and had formed a dense fibrotic mass along the parietes. This mass was excised. After complete reduction of intra-thoracic contents, an attempt was made to suture close the large defect using barbed suture (*Figure 3F*). But the sheer size of the defect made it impossible. An intercostal drain (ICD) was then inserted in the left pleural cavity under laparoscopic vision through the defect (*Figure 4A*). Hence a darning was then performed using the barbed suture (*Figure 4B,C*). After this, a 30 x 30 cm dual mesh was rolled and inserted inside. This was then opened up and placed optimally over the defect and the darning sutures and tacked to the parietes along the entire perimeter, in 2 concentric rows (*Figure 4D,E*). A Jackson-Pratt drain was placed in the left sub diaphragmatic space (*Figure 4F*). His immediate postoperative recovery was uneventful. The ICD and abdominal drains each drained about 300-400 ml blood tinged sero-sanguinous fluid per day over 1st 4-5 postoperative days. Thereafter it reduced and both the drains were removed on post operative day (POD) 8. He was discharged from the hospital on POD 10. On his POD 14 OPD visit, all his wounds had healed well. At the time of writing this paper, a telephonic interview was held with him. Six months after his 2nd surgery, he continues to be asymptomatic. Serial monthly X-ray chest films have ruled out any early recurrence (*Figure 5*). He has been instructed to avoid any strenuous exercise, picking heavy weights etc for a period of 1 year.

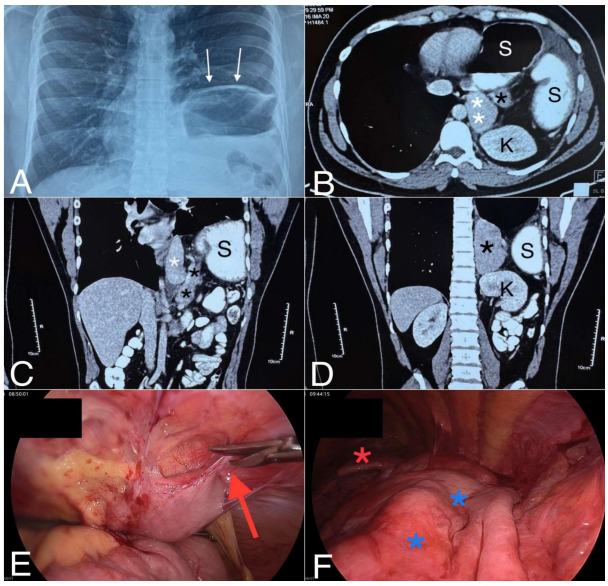

Figure 1: (A) Plain X-ray chest showing herniated contents thru left BH(white arrows), **(B)** CECT chest axial view herniated stomach ('S'), left kidney ('K'), spleen (white asterisks) & pancreas(black asterisk), C) CECT oblique view herniated stomach, spleen(white asterisk) & pancreas (black asterisks), **(D)** CECT coronal view showing herniated stomach, kidney and spleen(black asterisk), **(E)** Operative pic showing lysis of small bowel adhesions to parietes (blue arrow), **(F)** shows view of left chest thru BH with large stretch of stomach (blue asterisks) & left lung (red asterisk)

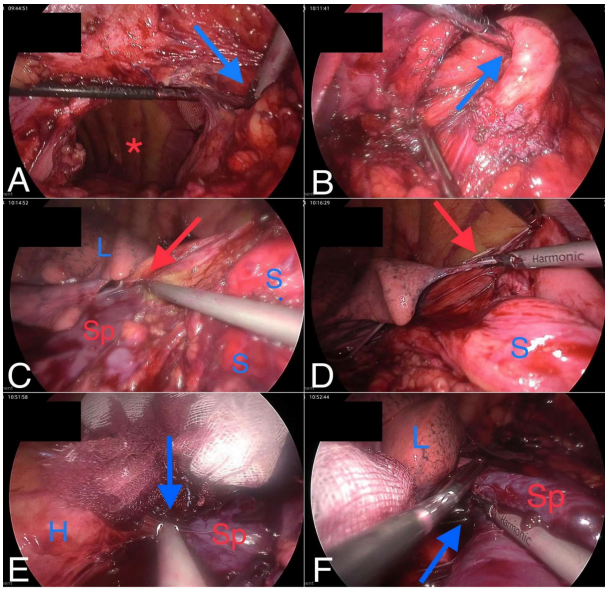

Figure 2: (**A)** shows left chest cavity thru BH(red asterisk) & lysis of lateral chest wall adhesions, (**B)** Lysis of adhesions betn stomach & diaphragm, **(C)** Lysis of adhesions betn spleen & stomach(red arrow) which are in volvulus, also seen is lower part of left lung, **(D)** Lysis of adhesions betn lung & stomach(red arrow), **(E)** Lysis of adhesions betn heart & spleen(blue arrow), **(F)** Lysis of adhesions betn upper pole of spleen & surrounding structures(blue arrow)

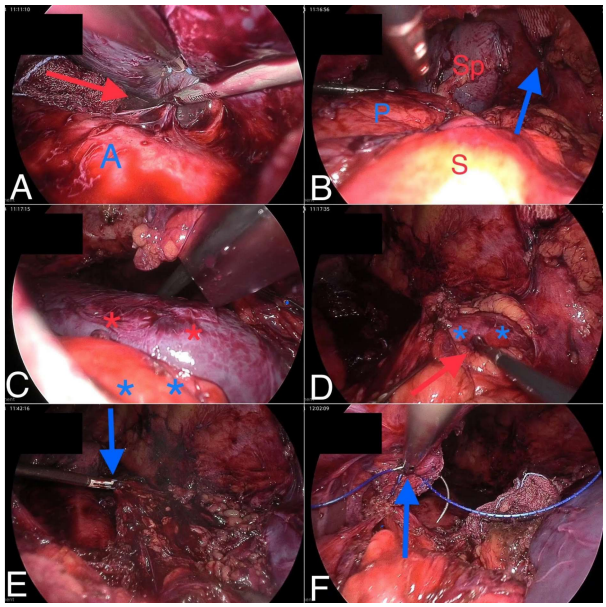

Figure 3: (A) Lysis of adhesions betn spleen & thoracic aorta, **(B)** Mobilised spleen, pancreas & stomach after adhesiolysis & correction of volvulus, **(C)** Delivery of spleen (red asterisks) & stomach (blue asterisks) into the abdomen frm left chest, **(D)** Lysis of adhesions betn left kidney(blue asterisks) & surroundings (red arrow), **(E)** Assessment of large muscle defect for closure (blue arrow), **(F)** Suture repair commenced frm right side of defect (blue arrow)

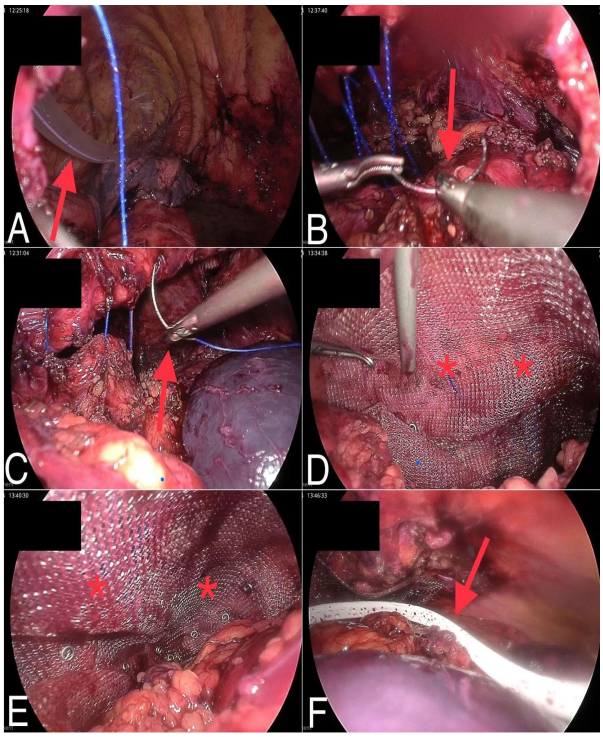

Figure 4: A) Left ICD inserted (red arrow), **B, C**) Suture-darning performed after inability to close defect, **D & E**) Mesh (red asterisks) placed over the defect, thereafter & tack-fixed to the edges of the defect, **(F)** Flat drain placed in situ (red arrow)

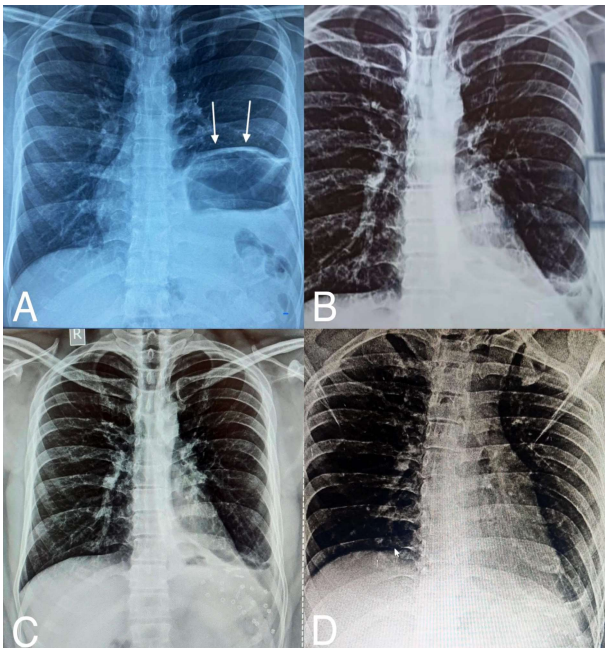

Figure 5: Serial X-ray Chest films. A) Preopfilm showing Lt BH (white arrows), **B, C, D) 1, 3 & 5** months post-op films respectively, showing left costo-phrenic angle getting progressively clearer

DISCUSSION

Congenital diaphragmatic hernia occurs in approximately 1 in every 2,000 to 3,000 live births. The majority of CDH cases about 70% to 75% are classified as posterolateral defects, which are commonly referred to as Bochdalek hernias (BH). Less frequently, anterior defects, known as Morgagni hernias, account for about 23% to 28% of cases. The rarest form, central hernias, comprise only 2% to 7% of the occurrences.[1] Initially noted in an infant by McCauley in 1754, Bochdalek hernia was thoroughly detailed by Czech pathologist Vincenz Alexander Bochdalek in 1848.[2]

The BH is a form of congenital diaphragmatic hernia which arises from an incomplete closure of the pleuro-peritoneal membranes, resulting in a defect in the posterolateral portion of the diaphragm. Such a defect allows abdominal organs to migrate into the chest cavity, which can significantly hinder normal lung development[3]. Majority of BH are found on the left side (approximately 85%), primarily because the right pleuroperitoneal canal tends to close earlier during fetal development (around 8 weeks of gestation), and the liver provides additional structural support to the right diaphragm. Right-sided hernias are less common, occurring in about 13% of cases, while bilateral occurrences are rare, accounting for around 2%[2]. This congenital anomaly is observed in roughly 1 in every 2,200 to 2,500 live births, with a male predominance resulting in a male to female ratio of 3:1[4].

The intra-abdominal organs most frequently involved in herniation into the thoracic cavity include the stomach, ileum, colon, and spleen. In uncommon cases where the BH is located on the right side, structures such as the liver, gallbladder, right kidney, and omentum are more typically displaced into the chest[5]. In adults, the clinical presentation of BH is highly variable, ranging from incidental findings in asymptomatic individuals to chronic, vague complaints or acute abdominal emergencies. The most frequently observed symptoms involve the respiratory system such as shortness of breath, persistent coughing, occasionally even hemodynamic instability with respect to the gastrointestinal tract symptoms include abdominal discomfort, bowel obstruction, or signs indicative of perforation[6]. Contributing factors that may precipitate symptom onset in adults include conditions that elevate intra-abdominal pressure, such as pregnancy, prolonged constipation, blunt abdominal trauma, repeated laparoscopic procedures within a short time frame, or chronic coughing[6].

Posteroanterior and lateral chest radiographs (CXR) serve as useful initial imaging modalities for the detection of BH. These hernias are often visualized as gas-filled bowel loops or soft tissue densities located above the diaphragmatic dome. However, the diagnostic utility of plain radiography can be limited, potentially leading to misinterpretation. The BH may be mistaken for other thoracic pathologies, including left middle lobe atelectasis, pulmonary consolidation, pericardial fat pads, pulmonary sequestration, mediastinal lipomas, or anterior mediastinal masses[7]. Computed tomography (CT) of the chest is essential for definitive diagnosis, as it allows for clear visualization of the diaphragmatic defect, identification of herniated abdominal contents, and any associated diaphragmatic thickening.[7]

A range of surgical techniques are available for the management of BH, including laparotomy, thoracotomy, and combined thoraco-abdominal approaches. In recent years, minimally invasive procedures such as laparoscopy and thoracoscopy have gained widespread acceptance and are

being employed with increasing frequency. Definitive surgical repair is recommended in all cases regardless of the presence or absence of symptoms to prevent potentially life-threatening complications such as visceral strangulation, which can result in substantial morbidity and mortality.

The surgical management of BH adheres to core principles analogous to those employed in the repair of other abdominal wall defects. These include reduction of herniated viscera, anatomical restoration of the diaphragm, excision of the hernia sac when present, and definitive closure of the diaphragmatic defect. In many cases, closure is achieved via primary suture repair using nonabsorbable sutures, particularly for smaller defects measuring less than 5 cm^2. For larger hiatal defects those exceeding 5 cm^2 in surface area current guidelines advocate for prosthetic reinforcement with synthetic mesh, assuming the defect margins can be approximated without undue tension[8]. When primary closure is not feasible due to extensive tissue loss or retraction, prosthetic substitution may be warranted. Furthermore, the use of mesh is strongly recommended in cases where diaphragmatic integrity is compromised, such as in patients with significant obesity or intrinsically attenuated tissue, to ensure durable repair and reduce the risk of recurrence[8]. The approach to repairing a BH is determined by several key factors, including the nature of the presentation (emergent or elective), the size and location of the defect, and the presence of any associated complications. In emergent situations, laparotomy is typically the preferred technique, with either a midline or subcostal incision. This method allows for superior visualization of the diaphragm on the left side, while on the right side, optimal exposure can be achieved through mobilization of the right hepatic lobe. Laparotomy has the added advantage of enabling assessment of the anatomical position of the abdominal viscera following the reduction of herniated contents, and allows for correction of any malrotation if present. On the other hand, thoracotomy offers distinct advantages in providing direct visualization for the separation of herniated abdominal organs from the thoracic and mediastinal structures. In particularly challenging cases, such as those with a large volume of herniated contents or when dense adhesions are anticipated common in recurrent hernias a combined thoracoabdominal approach is employed to ensure optimal exposure and safe reduction of the hernia[9]. Minimally invasive techniques, including laparoscopy and thoracoscopy, are associated with reduced morbidity, no reported mortality, and shorter hospital stays. The laparoscopic approach enhances the efficiency of hernia reduction, hemostasis, and adhesiolysis. However, it is generally contraindicated in cases of strangulation, as these patients typically require extensive resection of the herniated contents followed by reconstruction. Conversely, thoracoscopy allows for meticulous release of adhesions between the herniated viscera and thoraco-mediastinal structures under direct visualization prior to their reduction into the abdominal cavity. This method facilitates a comprehensive assessment of both the thoracic cavity and the herniated organs for signs of ischemia, necrosis, or perforation before reduction. Additionally, repairing right-sided hernias is often more straightforward with thoracoscopy, as the liver does not obscure the surgical field. A notable limitation of this approach, however, is the potential difficulty in manoeuvring the herniated organs into the abdominal cavity. In cases involving herniation of the spleen, there is an increased risk of bleeding during the reduction process[9]. Robot-assisted surgery has now become a viable option for the repair of diaphragmatic hernias. With the advancement of robotic platforms, both transabdominal and transthoracic robotic approaches have proven to be effective treatment modalities. These techniques improve surgical outcomes by providing surgeons with superior visualization, enhanced precision, and increased dexterity, especially in confined anatomical spaces[10].

The recurrence rate of BH remains a critical consideration. Statistical evidence indicates that the highest likelihood of recurrence occurs within the first postoperative year, with this risk progressively diminishing over time. The size of the diaphragmatic defect is a significant determinant of recurrence risk; larger defects are associated with a greater probability of recurrence. In cases requiring mesh reinforcement, the recurrence rate ranges from 27% to 41%, whereas for patients undergoing primary suture repair typically in instances of smaller, less complex defects the recurrence rate is approximately 4%. The surgical approach also influences

the recurrence rate: open surgery is linked to recurrence rates between 0% and 13%, whereas minimally invasive techniques, despite their clear advantages, are associated with recurrence rates between 6% and 39%[11]. In cases of minor recurrence, conservative management may be a suitable approach, thus avoiding the need for reoperation, provided the patient remains stable. Routine follow-up should include periodic plain chest X-rays and clinical evaluations for a minimum of five years[12]. Small defects are typically closed using interrupted non-absorbable sutures, with pledgets sometimes employed for additional reinforcement. Surgical intervention becomes necessary when a major recurrence is detected. A recurrence is considered major if it permits the stomach and/or bowel loops to re-herniate into the thoracic cavity or if the hernia worsens over time[12]. In the management of recurrent cases, the use of muscle or fascia flaps, in conjunction with prosthetic patch repairs, is critical. In certain instances, an additional patch may be placed without the need to replace the original prosthetic material. For complete or near-complete diaphragmatic defects, the surgical challenge is more formidable, as the entire defect must be replaced with a prosthetic mesh. In such cases, a dual-mesh strategy, incorporating both absorbable and non-absorbable surfaces, offers a highly effective solution. Despite the varied approaches, there is no definitive consensus regarding the optimal surgical method for managing recurrence. Some practitioners advocate for a so-called "virgin plane" approach, where the recurrence is addressed through the opposite body cavity from the initial surgery. This strategy aims to provide a more accessible surgical field with fewer adhesions and enhanced visibility[13]. A review of literature on published case reports on adult BH over the past 3 years is summarised (*Table* 1).

Table 1: Summary of published case reports on adult BH over past 3 years

Authors / Year of publication	Age(yrs)/ Sex (M/F)	Surgical Approach	Procedure Performed
Yao Z *et al*, 2025[14]	19 / M	Combined Laparoscopic and Thoracoscopic	Hernioplasty
Lochman P *et al*, 2024[15]	50 / M	Upper midline laparotomy	Herniorrhaphy
Huang YJ, 2024[16]	i) 31 / F ii) 72 / F	Robotic- Transabdominal Robotic-Transabdominal	Hernioplasty(Biodesign® Hernia Graft) Herniorrhaphy
Starr TJT *et al*, 2024[17]	69 / F	Laparoscopic converted to open (Laparotomy)	Herniorrhaphy
Farwati R *et al*, 2024[18]	21 / M	Midline Laparotomy	Herniorrhaphy
Mikami S *et al*, 2024[19]	45 / M	Combined Laparoscopic and Thoracoscopic	Hernioplasty (Bard Composix E/X Mesh®)
Hu S *et al*, 2024[20]	32 / M	Laparoscopic converted to open (Subcostal incision)	Hernioplasty
Das SS *et al*, 2023[21]	25 / M	Laparoscopy	Herniorrhaphy
Chae AY *et al*, 2023[22]	39 / F	Laparoscopic converted to open (Laparotomy)	Herniorrhaphy
Azhar A *et al*, 2023[23]	30 / M	Laparotomy	Hernioplasty (Composite Mesh)
Eldaabossi S *et al*, 2023[24]	43 / M	Posterolateral Thoracotomy	Hernioplasty (Prolene Mesh)
Moncy AA *et al*, 2023[25]	30 / F	Laparotomy	Hernioplasty (Composite mesh)
Ünlü MT *et al*, 2023[26]	24 / M	Laparotomy	Herniorrhaphy

CONCLUSION

As seen in this report, BH is a difficult condition to treat. Also as seen here, especially if the defect diameter is large, it is very difficult to optimally suture close the defect without undue tension. Lastly, this report shows that in an advanced setup ably complemented by requisite advanced laparoscopic skills, it is feasible to surgically repair even a large recurrent BH defect by minimal access surgery.

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