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Late-Presenting Bochdalek Hernia in a 36-Year-Old: Navigating Anaesthetic Risks and Lung Isolation

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Abstract

Background: Congenital diaphragmatic hernia (CDH) presenting in adulthood is uncommon and often poses significant diagnostic and anaesthetic challenges. Bochdalek hernia, the most frequent variant, may remain asymptomatic for years and present later with nonspecific gastrointestinal or respiratory symptoms. We report the anaesthetic management of an adult female with late-presenting left-sided Bochdalek hernia requiring surgical repair.

Case-Presentation: A 36-year-old female presented with abdominal pain and breathlessness for 15 days. She had a history of two lower-segment caesarean sections but no prior diagnosis of diaphragmatic defect. Pre-operative evaluation revealed NYHA Grade II dyspnoea. Chest radiography showed left lower lobe collapse, and HRCT demonstrated a posterolateral diaphragmatic defect with herniation of bowel loops and mesentery, consistent with a Bochdalek hernia. Baseline investigations and ECG were normal, and echocardiography showed an ejection fraction of 60%. Pre-operative pulmonary optimization with Duolin and Budecort nebulisation was advised.

Anaesthesia was induced after full preparation and preoxygenation. A 35 Fr double-lumen endotracheal tube was placed for lung isolation. Invasive monitoring, including arterial line and triple-lumen central venous catheter, was instituted due to the anticipated complexity of surgery. Anaesthesia was maintained with controlled ventilation and sevoflurane. The six-hour procedure was uneventful with stable haemodynamics. At completion, the double-lumen tube was exchanged for a single-lumen tube, and the patient was transferred intubated to the SICU for elective postoperative ventilation. She was successfully extubated on postoperative day three, and imaging confirmed good lung expansion.

Conclusion: Adult Bochdalek hernia requires meticulous anaesthetic planning, lung isolation strategies, and vigilant perioperative monitoring to ensure favourable outcomes.

Keywords: Adult congenital diaphragmatic hernia, Anaesthetic management, Bochdalek hernia, Lung isolation.

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Introduction

Congenital diaphragmatic hernia (CDH) is a rare congenital malformation characterized by a defect in the diaphragm that allows abdominal viscera to pass upwards into the chest cavity.[1,2] This condition carries significant implications for cardiopulmonary function.[2,3] Based on previous epidemiological studies, the incidence of diaphragmatic hernia is approximately 1 in 2000 to 4000 live births, or about 1 in 3000 births.[1,2,4] The primary cause of CDH is the abnormal development of the diaphragm, arising from defects in the septum transversum, pleuroperitoneal folds, body wall, and dorsal mesentery.[1] Although the specific etiology is unknown in over 70% of individuals, resulting herniation invariably causes cardiopulmonary dysfunction, which is typically driven by pulmonary hypoplasia and pulmonary hypertension.[1,2]

CDH encompasses several variants, with the Bochdalek hernia (BH) being the most common, accounting for approximately 90% or over 95% of cases.[1,2] BH is characterized by a posterolateral defect, usually occurring on the left side.[1,2] In the majority of BH cases (85%), an actual hernial sac is not present due to the non-formation of the pleura-peritoneal membrane.[1] The second major variant is the Morgagni hernia (MH), which is located anteriorly (anteromedial subcostosternal defect) and constitutes only 2% to 4% of all diaphragmatic hernias.[1,5]

CDH is typically diagnosed in neonates as an emergency condition,[1,2] with symptoms—such as the classic triad of cyanosis, dyspnea, and dextrocardia—emerging within minutes or hours after birth.[2] In this population, the severity of pulmonary hypoplasia and associated congenital

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abnormalities dictates the survival rate.[2] However, a subset of patients may present beyond the neonatal period, known as Late-Presenting CDH (LPCDH), which accounts for 5% to 30% of total CDH cases.[1,3,4] Adult presentations are uncommon and often present with nonspecific gastrointestinal or cardiopulmonary symptoms.[1,4] In adults, LPCDH is often discovered incidentally,[1,6] though symptomatic adult patients may present with vague complaints such as abdominal pain or chronic postprandial shortness of breath.[1,3,6] Acute presentation in adults usually results from incarceration, obstruction, or strangulation of the herniated viscera.[7] These patients, even those initially well, may deteriorate rapidly once their compensatory mechanisms are exhausted.[1,7] Diagnosis relies initially on Chest X-ray, showing intrathoracic gas-filled bowel loops and/or mediastinal shift, followed by Computed Tomography (CT) scans to confirm the defect and herniated contents.[2,4,5,7]

Surgical repair is the required management for both symptomatic and asymptomatic CDH cases to prevent organ damage.[1,5] The anaesthetic management of CDH patients, regardless of age, poses significant challenges to the anaesthesiologist at every stage.[3,5] Key considerations include managing pre-existing cardiopulmonary compromise and anticipating critical risks such as aspiration (patients must be considered "full stomach") and haemodynamic instability.[3-5] Specific anaesthetic strategies are crucial for successful outcomes.[4,5] Rapid Sequence Induction (RSI) with cricoid pressure is generally performed.[3,4] Lung isolation, often achieved using a Double-Lumen Tube (DLT), is necessary to allow deflation of the affected lung and prevent positive pressure ventilation from exacerbating the mass effect or causing a tension pneumothorax.[4,7] Intraoperatively, a ventilation strategy focused on low airway pressure and low tidal volume is recommended to mitigate the risk of decreasing venous return and cardiac output.[4,5,7] Furthermore, anaesthetic agents like Nitrous oxide (N_2O) must be strictly avoided, as N2O diffuses into the gas-filled bowel loops within the chest, potentially increasing visceral volume and worsening lung compression.[2-5] Successful management requires meticulous monitoring, including invasive blood pressure and Central Venous Pressure (CVP), and anticipation of a difficult airway.[3-5]

This case report details the anaesthetic management of a patient presenting with CDH, highlighting the complex planning and specialized techniques required to navigate the high-stakes intraoperative and perioperative periods.

Case Description

We present the case of a 36-year-old female patient with complaints of abdominal pain and breathlessness persisting for 15 days. The patient reported a past surgical history of two lower-segment Cesarean sections (LSCS). Despite these previous surgical interventions, the underlying diaphragmatic hernia remained undiagnosed until this presentation.

Upon preoperative assessment, the patient exhibited

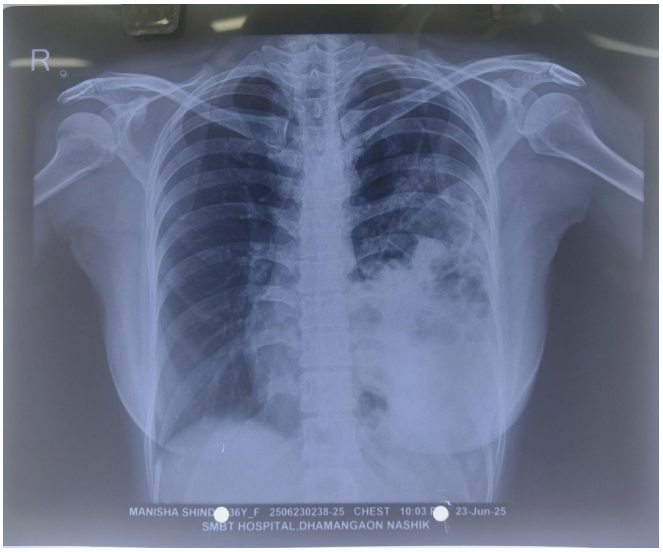

Figure 1: Pre-operative chest X-ray showing left lower lobe lung collapse.

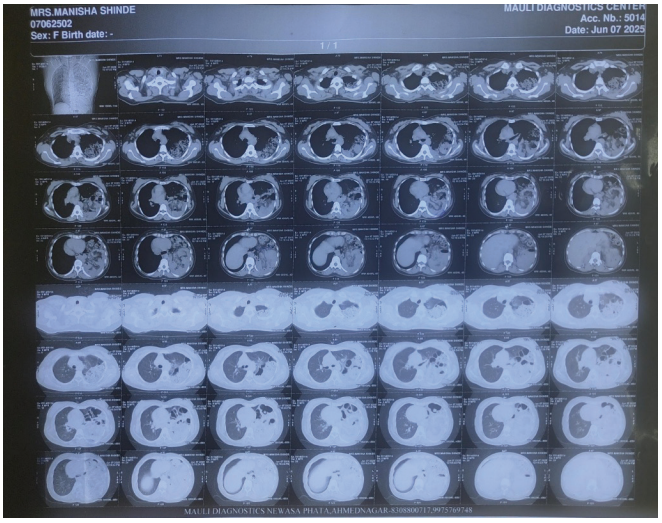

Figure 2: Pre-operative HRCT showing herniated bowel in mediastinum and left lung collapse.

breathlessness classified as NYHA Grade II. General physical examination revealed vital signs within normal limits on arrival to the operating theatre (OT): heart rate was 78 beats per minute, blood pressure was 110/70 mmHg, and oxygen saturation (SpO_2) was 97% on room air. The patient's 2D echocardiography showed an ejection fraction (EF) of 60% and good left ventricular systolic function. There was no reported history of chronic drug intake.

Initial investigations provided crucial diagnostic information. A chest X-ray (Figure 1) was suggestive of left lower lobe collapse. Subsequent High-Resolution Computed Tomography (HRCT) (Figure 2) confirmed a defect in the left posterior aspect of the diaphragm with herniation of mesentery and bowel loops into the thorax, consistent with

a Bochdalek hernia. The HRCT also noted the collapse of the left lower lobe of the lung. Routine blood investigations and the Electrocardiogram (ECG) were found to be normal. To prepare for surgery and optimize pulmonary function, the respiratory medicine team advised treatment including nebulization with duolin and budecort.

Anaesthetic Management

Given the complexity and the proximity of the surgical site to the heart, the procedure was categorized as high risk, and the necessary fasting (NBM) hours were confirmed. Standard monitoring devices were connected in the operating room (OR), including ECG, SpO_2, and $EtCO_2$. Due to the potential for large fluid shifts and hemodynamic instability during major surgery lasting six hours, invasive monitoring was instituted: an arterial line was placed, and a Triple Lumen Central Venous Catheter (CVC) was inserted into the right internal jugular vein to monitor Central Venous Pressure (CVP). The CVP measurement was 14 cm.

Aspiration prophylaxis was ensured by administering a prophylactic antibiotic, and premedication included Injection Glycopyrolate 0.2 mg. After 5 minutes of preoxygenation, a modified Rapid Sequence Induction (RSI) was performed using Inj. Loxicard 3cc, Injection Fentanyl 100 mcg, Injection Midazolam 1mg, Injection Propofol 100 mg, and Inj. Cisatracurium 12 mg.

The patient was successfully intubated with a Double Lumen Tube (DLT) 35Fr (cuffed), secured at 26.5 cm after confirming equal bilateral air entry. Anaesthesia was maintained using controlled ventilation with a mixture of O_2 FiO_2 50% with air and sevoflurane, supplemented by an infusion of Inj. Cisatracurium 3 mg/hour.

The surgery lasted for 6 hours. Throughout the case, the patient remained hemodynamically stable with all vital parameters consistent. Total blood loss was estimated at 550 mL, and urine output was 700 mL. The surgical procedure involved repositioning the intestine.

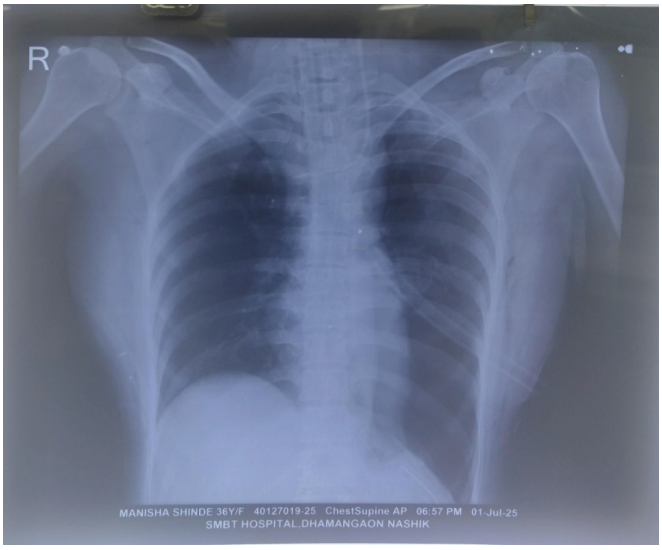

Figure 3: Post operative Chest X ray day 1 with intercoastal drainage tube in situ.

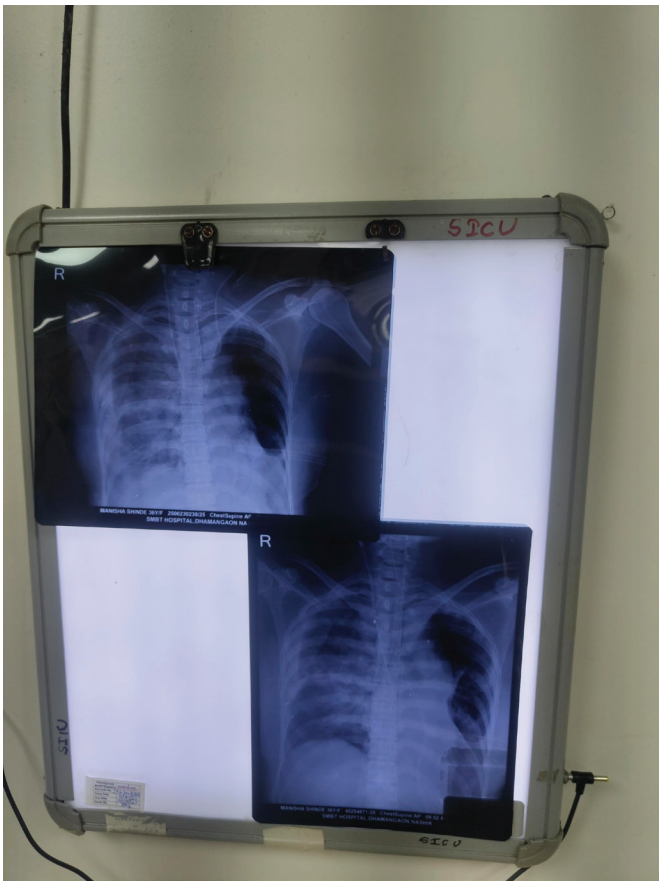

Figure 4 : Post-operative day 3 chest X-ray showing pneumothorax on left side.

Postoperative Course

At the conclusion of the surgery, the DLT was exchanged for a single lumen No. 7 Endotracheal tube under direct vision. The patient was immediately transferred to the Surgical Intensive Care Unit (SICU) while still intubated and was mechanically ventilated for 24 hours to assist lung expansion. Post-operative chest X-ray on Day 1 (Figure 3) confirmed reduction of the hernia and showed complete good lung expansion with an intercostal drainage tube in situ. The patient was finally extubated on postoperative day three. A subsequent chest X-ray on Postoperative Day 3 (Figure 4) revealed the development of a pneumothorax on the left side. The intercostal tube was adjusted after seeing the pneumothorax, which was resolved subsequently on further post-operative course.

Discussion

The case presented involves the anaesthetic management of a late-presenting congenital diaphragmatic hernia (LPCDH),

specifically a Bochdalek hernia, in a 36-year-old adult. CDH is generally considered rare, occurring in approximately 1 in 3000 live births.[1,3] While typically diagnosed in neonates as an emergency condition, the late presentation in adulthood is uncommon, accounting for only 5% to 30% of cases.[1-4]

The patient's symptoms—abdominal pain and breathlessness (NYHA Grade II)—are consistent with the vague cardiorespiratory and gastrointestinal symptoms that often characterize LPCDH, which can make diagnosis challenging.[3] With the protrusion of the gastric contents into the thorax the respiratory function is compromised, making the airway management very important.[8] A history of previous surgeries, such as the two LSCS procedures, may have contributed to increased intra-abdominal pressure over time, potentially leading to symptomatic herniation.[6]- The case highlights the necessity of maintaining a differential diagnosis of diaphragmatic hernia in patients presenting with such symptoms.[3,4]

Diagnosis was confirmed through a combination of Chest X-ray, which showed left lower lobe collapse, and HRCT, which accurately identified the posterior diaphragmatic defect and the herniated mesentery and bowel loops. CT scans are widely recognized as the gold standard for confirming the diagnosis of diaphragmatic hernias in adults. The patient's left-sided posterolateral defect aligns with the typical presentation of the Bochdalek hernia, the most common CDH type.[1,3,4]

Anaesthetic management of adult CDH is considered challenging at every stage, requiring meticulous planning and preparation.[3-5]

1. *Aspiration Risk and Induction:* The presence of herniated bowel loops classifies the patient as having a potential for gastrointestinal obstruction or incarceration, requiring the standard approach for a "full stomach".[3-5] Rapid Sequence Induction (RSI) with cricoid pressure is the standard for securing the airway quickly in such high-risk patients, which was implemented here. Pre-operative optimization, including nebulization, was correctly performed to improve pulmonary reserve.[3,4]
2. *Monitoring:* The decision to use invasive monitoring, including an arterial line and a triple-lumen CVC, was vital given the major nature and six-hour duration of the surgery. CVP monitoring is crucial for assessing fluid status and managing potential hemodynamic instability caused by the sudden reduction of visceral contents and subsequent changes in venous return and cardiac output.[3,4,9]
3. *Lung Isolation:* The use of a Double Lumen Tube (DLT) for lung isolation is a key technique in CDH repair, especially when approaching the defect.[4,5] The DLT allowed for preventing positive pressure ventilation into the compromised left hemithorax, thereby avoiding the combined mass effect of inflated lung tissue and herniated viscera.[4,5] Effective lung isolation is necessary to prevent severe airway compromise or impairment to ventilation.[7-9]
4. *Ventilation and Agents:* The maintenance strategy utilizing Sevoflurane and an O_2/Air mixture adheres to the fundamental principle of avoiding Nitrous Oxide (N_2O).[2,4,5] N_2O must be avoided because it can diffuse into the herniated bowel loops, increasing their volume and exacerbating compression on the already hypoplastic or compressed lung tissue.[3,5] Although not explicitly stated, successful anaesthetic management typically involves maintaining a low airway pressure and low tidal volume strategy to protect the lung.[4,5]

Postoperative Outcomes

While the patient was hemodynamically stable intraoperatively, the conversion of the DLT to a Single Lumen Tube and continued mechanical ventilation in the SICU for 24 hours were essential to assist with optimal left lung expansion.[3] The patient's eventual extubation on postoperative day three was followed almost immediately by the radiological confirmation of a left-sided pneumothorax.[3]

The occurrence of pneumothorax post-repair is a known risk associated with diaphragmatic hernia repair.[5] This complication can be related to the nature of the Bochdalek defect, which typically lacks a true hernial sac in most cases, allowing for direct communication between the pleural and peritoneal spaces.[1] Furthermore, if minimally invasive techniques are used (though not specified here, laparoscopic repair is common), there is a recognized risk of pneumothorax due to insufflation pressure.[1,3,5] Close postoperative monitoring, including serial radiological examinations, is mandatory to detect and manage complications like pneumothorax or persistent atelectasis.[2]

In conclusion, this case illustrates the complex, multidisciplinary approach necessary for managing LPCDH, emphasizing the critical role of pre-emptive anaesthetic techniques—particularly lung isolation, meticulous monitoring, and stringent avoidance of N_2O—to ensure positive outcomes in this high-stakes surgical population.

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