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## Successful laparoscopic repair of an incarcerated Bochdalek hernia associated with increased intra-abdominal pressure during use of blow gun: A case report

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## ABSTRACT

**BACKGROUND:** Bochdalek hernia is a congenital diaphragmatic hernia, and adult cases are rare, with a reported frequency of 0.17%–6% among all diaphragmatic hernias.

**PRESENTATION OF CASE:** A 78-year-old man was referred to our hospital with a sudden onset of whole abdominal pain after playing with a blow gun. Chest radiography and computed tomography revealed diaphragmatic hernia with the small intestine. We therefore diagnosed him with an incarcerated Bochdalek hernia associated with increased intra-abdominal pressure during use of blow gun. Laparoscopic repair was performed. The omentum, transverse colon, and small intestine were located in the left thoracic cavity, without ischemic change. After placing the herniated organs into the abdominal cavity, we performed a primary closure of the diaphragmatic defect with interrupted non-absorbable sutures.

**DISCUSSION:** It is generally recommended that all adult Bochdalek hernia patients undergo surgical repair to prevent life-threatening complications due to incarceration. Recently, laparoscopic techniques for repair the hernia have gained popularity, especially in elective cases. In our case, we could successfully perform emergency laparoscopic repair, as it is associated with a shorter inpatient hospitalization period.

**CONCLUSION:** An incarcerated Bochdalek hernias associated with increased intra-abdominal pressure is an uncommon clinical finding in an adult, and laparoscopic repair of an incarcerated Bochdalek hernia is safe, feasible, and an excellent option as it is minimally invasive.

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### 1. Introduction

Bochdalek hernia is a congenital diaphragmatic hernia caused by the failure of the posterolateral diaphragmatic foramina that usually presents in the neonatal period. Therefore, adult cases are rare, with a reported frequency of 0.17%–6% among all diaphragmatic hernias [1,2].

Putative causes for Bochdalek hernia in adults include congenital herniation, blunt or penetrating trauma, physical exertion, pregnancy, labor and delivery, sneezing or coughing, and even ingestion of a large meal [3].

We herein report a case of an incarcerated Bochdalek hernia associated with increased intra-abdominal pressure during use of blow gun, which was successfully treated with a laparoscopic approach.

### 2. Case presentation

A 78-year-old man was referred to our hospital with a sudden onset of whole-abdominal pain after playing with a blow gun for 2 h. The patient had no history of any previous abdominal or thoracic trauma. The white cell count was  $14.4 \times 10^3/\mu\text{L}$ . A blood gas analysis revealed hypocapnia (PaO<sub>2</sub> 85.4 mm Hg; PaCO<sub>2</sub> 27.2 mm Hg). Chest radiography revealed elevation of the left diaphragm with intestinal gases. Computed tomography (CT) of the chest revealed diaphragmatic hernia with the small intestine (Fig. 1). We therefore diagnosed him with an incarcerated Bochdalek hernia associated with increased intra-abdominal pressure during use of blow gun.

A laparoscopic repair was performed. After the induction of general anesthesia, the patient was placed in a supine position. The surgeon stood on the right side of the patient and the first assistant on the left side; the laparoscopist stood between the abducted legs of the patient. A camera port was inserted into an inferior umbilical incision. Next, a pneumoperitoneum of 12 mm Hg was created, and 4 additional ports (1 port with a diameter of 12 mm and 3 with a

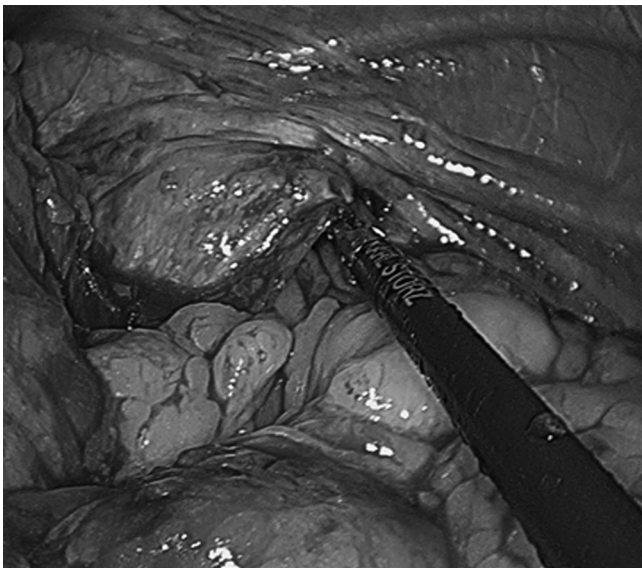
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**Fig. 1.** Preoperative enhanced chest and abdominal computed tomography (CT) scans.

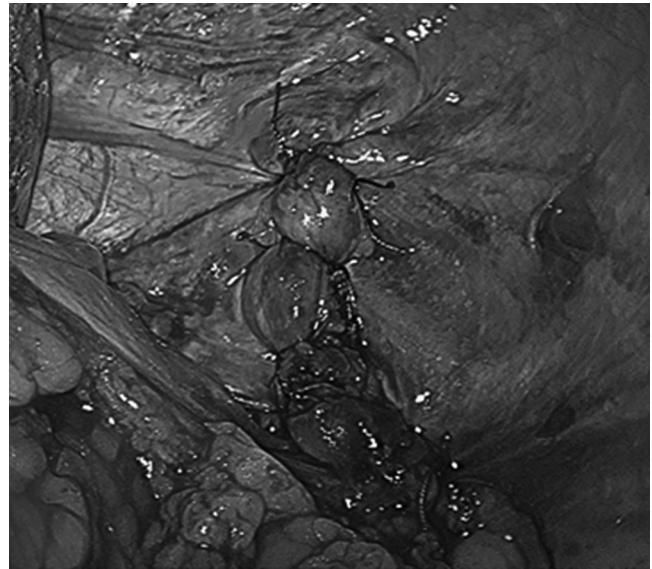
The chest CT shows a diaphragmatic hernia. The small intestines have herniated into the left thoracic space through a left posterior diaphragmatic defect.



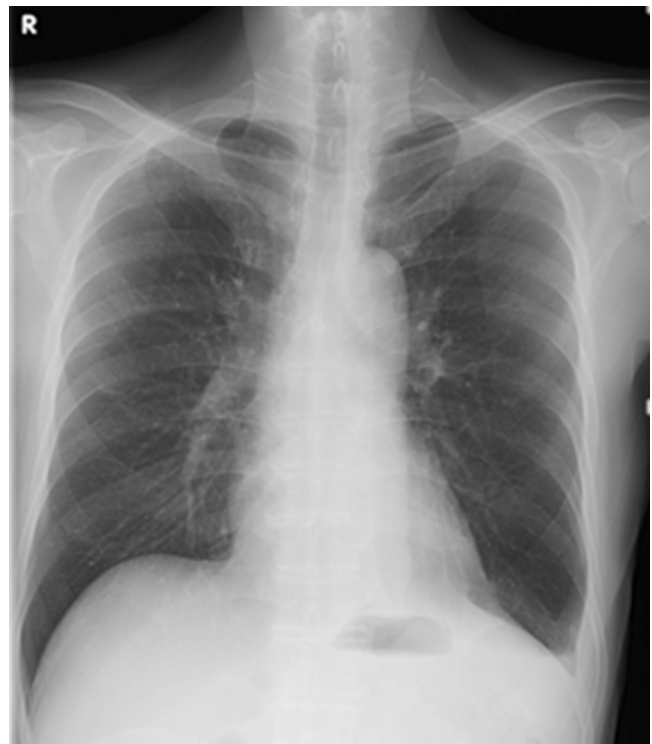
**Fig. 2.** Laparoscopic view of left posterior diaphragm. The omentum, transverse colon, and small intestine have herniated through a left posterior diaphragmatic defect.

diameter of 5 mm) were inserted into the left upper, right lower, left lower, and right upper quadrants, under laparoscopic imaging.

First, a thorough examination of the peritoneal cavity was performed with care taken to exclude other intra-abdominal diseases. The omentum, transverse colon, and small intestine were located in the left thoracic cavity without ischemic change (Fig. 2). After placing the herniated organs into the abdominal cavity, we performed a



**Fig. 3.** Laparoscopic view of left posterior diaphragm. After placing the herniated organs into the abdominal cavity, we performed a primary closure of the diaphragmatic defect with interrupted non-absorbable sutures.



**Fig. 4.** Chest radiogram at 14 days after discharge. There was no recurrence of diaphragmatic hernia.

primary closure of the diaphragmatic defect with interrupted non-absorbable sutures (Fig. 3). The procedure duration was 153 min and there was no significant blood loss. The postoperative course was uneventful and the patient was discharged 7 days after the procedure. Chest radiography at two weeks after discharge revealed no recurrence of diaphragmatic hernia (Fig. 4).

### 3. Discussion

Congenital diaphragmatic hernias resulting from a developmental failure of posterolateral diaphragmatic foramina to fuse properly were first described by Bochdalek in 1848 [3]. If the herniation is present at birth, it is termed “congenital.” If the herniation forms later, perhaps because of extension of intra-abdominal or perirenal fat into the thorax, it is termed “acquired.” In the neonate, Bochdalek hernia is one of the leading causes of respiratory distress and remains one of the most common congenital anomalies of the thorax [1].

The diagnosis of a Bochdalek hernia in adult is problematic because of the rarity of this disease and the variety of the presenting symptoms, such as cough, chronic dyspnea, chest pain, recurrent abdominal pain, postprandial fullness, and vomiting [4]. Although the presence of bowel sounds within the chest and the absence of breath sounds are typical findings associated with a Bochdalek hernia, a misdiagnosis rate of 38% has been reported, and misdiagnosis of Bochdalek hernia may lead to inappropriate interventions or sudden death [5,6]. Bochdalek hernia is difficult to diagnose in asymptomatic cases. Posteroanterior and lateral chest radiography is a useful tool for detecting Bochdalek hernia. Many cases of Bochdalek hernia are identified by gas-filled bowel loops or a soft tissue mass above the dome of the diaphragm. However, a case treated as a pulmonary infection approximately for 1 year because of chest radiography findings revealing consolidated areas in the left basal lung segments has been reported [4]. CT scans are the only way to directly visualize the focal defect in the diaphragm, and the presence of a soft tissue contour in the chest CT, in addition to opaque, filled, dilated bowel segments above the diaphragm, establishes a definitive diagnosis [7].

It is thought that an increased intra-abdominal pressure can be associated with the risk of herniation and strangulation of Bochdalek hernia in adults [8]. In this case, he played the blow gun before the onset of abdominal pain. Thus, we believe that he had an incarcerated Bochdalek hernia associated with increased intra-abdominal pressure developed during use of blow gun. We could not determine whether the hernia was acquired or congenital because of the lack of chest radiograms or CT images obtained before presentation and on follow-up.

It is generally recommended that all adult Bochdalek hernia patients undergo surgical repair to prevent life-threatening complications due to incarceration [6]. Recently, laparoscopic techniques for repair the hernia have gained popularity, especially in elective cases [9]. In our case, we could successfully perform emergency laparoscopic repair, as it is associated with a shorter inpatient hospitalization period.

In conclusion, an incarcerated Bochdalek hernia associated with increased intra-abdominal pressure is an uncommon clinical finding in an adult, and laparoscopic repair of an incarcerated Bochdalek hernia is safe and feasible; it is an excellent option as it is minimally invasive.

#### Conflict of interest

All authors have no conflict of interest.

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#### Ethical approval

Ethical approval not required.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

#### Author contribution

All authors in this manuscript contributed to the interpretation of data, and drafting and writing of this manuscript. M.H., H.T., K.N., N.I., K.Y., K.K., H.H. Y.K., S.H., and S.A. were engaged in patient's care in his hospital course including surgery under the supervision of H.T., K.H. and J.Y. All authors have read and approved this manuscript for publication.

#### Guarantor

Dr. Tsujimoto, who is the Chief of Department of Uppergastrointestinal Surgery, National Defense Medical College, is the Guarantor.

#### Authorship declaration

All authors certify that they have no commercial associations that might pose a conflict of interest in connection with submitted article.

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