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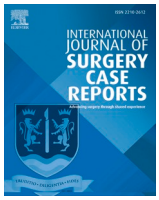

Case report

Laparoscopic repair of colonoscopy-induced adult Bochdalek hernia: Case report

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ABSTRACT

Introduction: Bochdalek hernias are congenital diaphragmatic malformations caused by a failure to close the pleuroperitoneal cavity in the posterolateral area. Bochdalek hernias are very rare in adult, with congenital diaphragmatic defects being even rarer.

Presentation of case: A 35-year-old man presented to our emergency room with epigastric pain after colonoscopy. The patient had no history of trauma. Plain chest X-ray revealed bowel gas patterns and haziness in the left lower lung field. Abdominal computed tomography revealed a left diaphragmatic defect in the posterolateral area, with herniation of the omentum and colon. The patient successfully underwent laparoscopic herniorrhaphy.

Discussion: The diaphragm comprises fibrous tissue and muscle. Therefore, direct damage by a colonoscope is almost impossible. Normal chest X-ray as a part of a health screening was performed 9 days prior to admission, and the size of the diaphragmatic defect could be covered by the spleen; therefore, the patient was considered hernia-free for over 30 years.

Conclusion: We report a rare case of delayed Bochdalek hernia that may have been induced by the difficult insertion of a colonoscopy. Although rare, this disorder should be recognized, examined and treated appropriately to avoid complications.

1. Introduction

In 1848, Bochdalek conceptualized a congenital hernia induced by the developmental failure of the posterolateral foramina to fuse properly [1]. Bochdalek hernia is a congenital anomaly normally diagnosed in neonatal and postnatal patients, and its clinical manifestation of symptoms and diagnosis are very rare in adults. Nevertheless, it is also noticed in asymptomatic adult patients seeking medical attention for other reasons. We herein report the case of a 35-year-old man whose symptomatic left sided Bochdalek hernia was induced after colonoscopy and treated laparoscopically. This case report has been reported in line with the SCARE criteria [2].

2. Presentation of case

A 35-year-old man presented to our emergency department with epigastric pain and mild dyspnea following his first colonoscopy for a health screening for her medical appointment at a local health care clinic. He had undergone open heart surgery (ventricular septal defect) 30 years ago but did not have any history of trauma. The endoscopist reported that colonoscopic progression was difficult in the splenic flexure. His blood pressure was 143/78 mmHg, heart rate was 102 beats/min, and body temperature was 36.6 °C. On physical examination, his abdomen was soft; however, focal tenderness was noticed in the epigastric area, and a remarkable decrease in breathing sounds in the left hemithorax was observed. Plain chest X-ray revealed bowel gas patterns and haziness in the left lower lung field, although the findings were normal 9 days prior (Fig. 1A and B). Contrast-enhanced abdominal computed tomography (CT) and multiplanar reconstruction showed diaphragmatic defects in the posterolateral area, along with a herniation of the omentum and colon into the left thoracic cavity (Fig. 2A). There were no reports of colonoscopy-induced diaphragmatic damage, which made us think that he was not patient, but previous chest X-ray demonstrated normal findings. Moreover, occurrence of acute symptoms and manifestation of hernia after colonoscopy, meaning that diaphragmatic damage could not be completely excluded. Colonoscopy-induced diaphragmatic injury was suspected.

The patient underwent laparoscopic exploration. He was placed in

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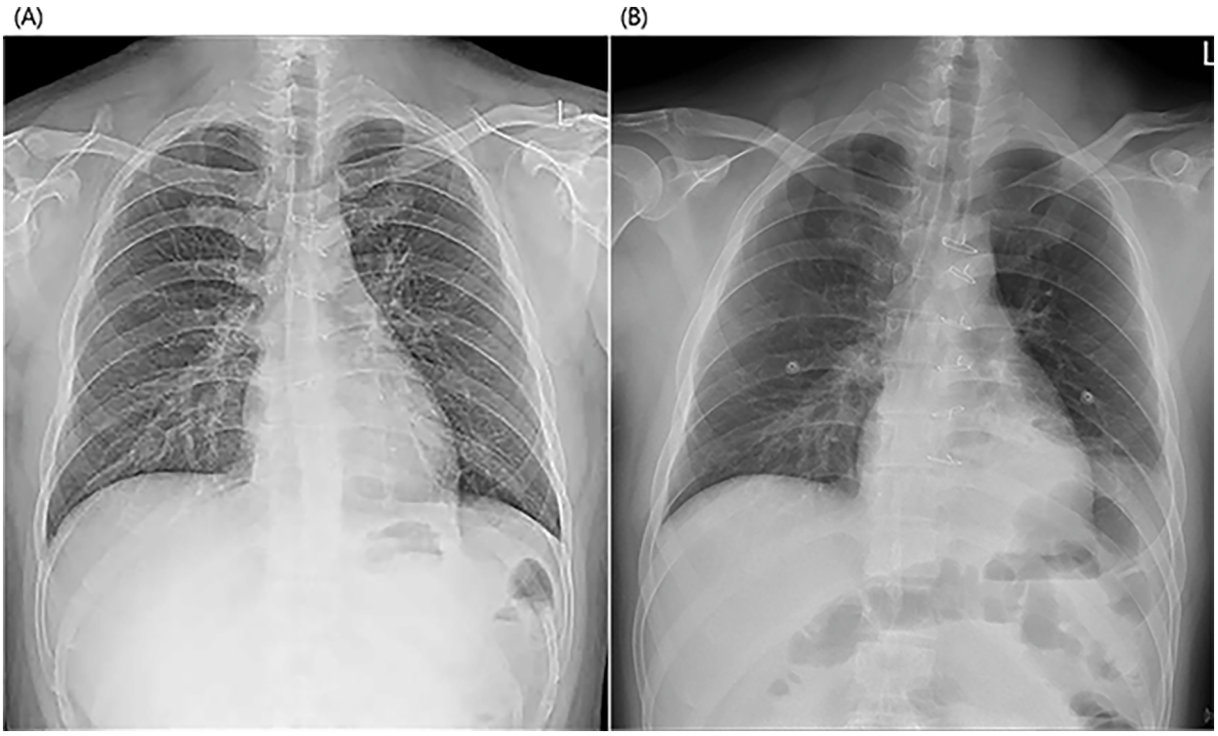

Fig. 1. Plain chest X-ray showing normal findings 9 days before admission (A) and bowel gas patterns on the left lower lung field on admission (B).

Fig. 2. Preoperative contrast-enhanced abdominal computed tomography (coronal reconstruction) (A); postoperative diaphragmatic defect in the posterolateral area with herniation of the omentum and colon into the left thoracic cavity (B).

the supine position under general anesthesia using a single-lumen endotracheal tube. Trocars were placed in the supraumbilical region (10 mm, 30° camera), in the midline at 4 cm from the xiphoid process (10 mm), in the subcostal plane at the midclavicular line (5 mm), and in the left axillar anterior line at 7 cm from subcostal trocar (5 mm). Intraoperatively, the transverse colon and omentum were found to be herniated into the thoracic cavity through the diaphragmatic defect. After reducing the abdominal organs, a 5 × 2 cm diaphragmatic defect was located without a hernia sac on the posterolateral side of the left diaphragm. The margins of the diaphragmatic defect were lined by a smooth peritoneum without any acute torn lesion (Fig. 3A). We recognized that this defect was not an acute injury but a previous congenital diaphragmatic defect. Hence, primary closure of the defect was performed using interrupted sutures with a non-absorbable poly-filament (Fig. 3B). Postoperatively, the patient was diagnosed with a left-sided Bochdalek hernia. The patient had an uneventful recovery and was

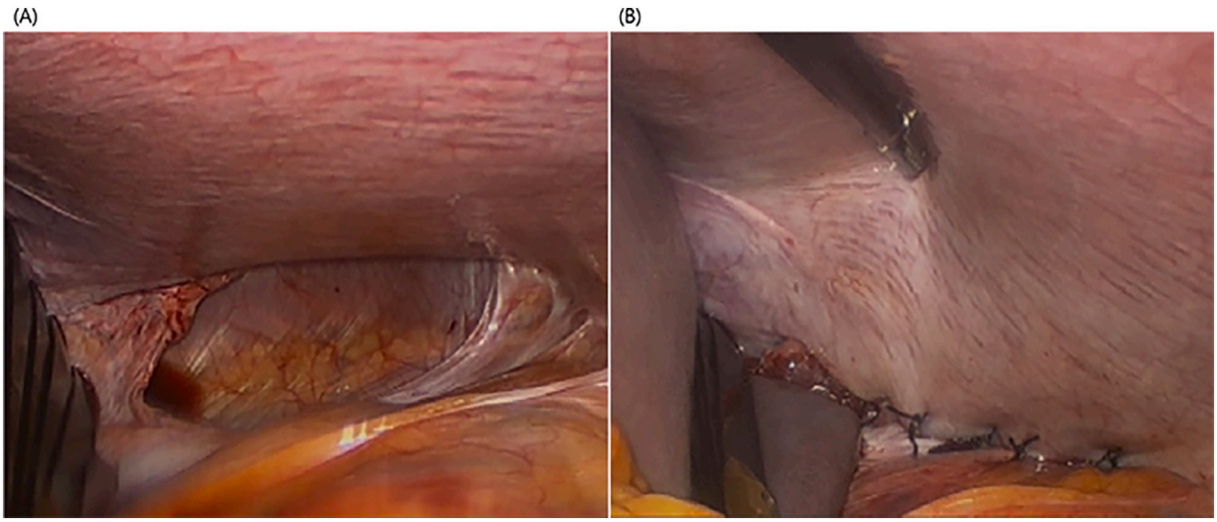

Fig. 3. Operative findings: a 5 × 2 cm diaphragmatic defect located without a hernia sac on the posterolateral side of left diaphragm (A); primary closure of the defect was performed by an interrupted suture with a non-absorbable poly-filament (B).

discharged on seventh days postoperatively. At the postoperative follow-up at 15 months, physical and radiological examinations showed no signs of recurrence.

3. Discussion

Bochdalek hernias, first described by Bochdalek in 1848, are characterized by a congenital defect in the posterolateral region of the diaphragm without a hernia sac resulting from the developmental failure of the pleuroperitoneal canal [1]. Bochdalek hernias are a congenital anomalies that occur in approximately 1 in 2200–12,500 live births, and most Bochdalek hernias (80 %–90 %) occur on the left side [3]. Most Bochdalek hernias are diagnosed in infancy with acute respiratory failure, and these hernias are associated with other congenital anomalies in 25 %–57 % of cases [4]. A congenital diaphragmatic hernia is extremely rare in adults [5]. In line with the abovementioned our patient had a left-sided hernia and had previously undergone open-heart surgery to close ventricular septal defect.

Symptomatic Bochadalek hernias are common in neonatal age groups, but are rarely reported in adults. A patient's symptoms are determined by the presence, severity, and acuteness of herniation. Adult Bochdalek hernias are more commonly associated with gastrointestinal symptoms than with pulmonary symptoms. However, some cases may be asymptomatic and detected unexpectedly [4,5]. A lack of symptoms might present with a small amount of herniation, possibly owing to a small defect. Our patient had no lifetime symptoms until the colonoscopic examination. Normal chest X-ray, as a part of a health screening was performed 9 days prior to admission, and the size of the diaphragmatic defect could be covered by the spleen; therefore, the patient was considered hernia-free for over 30 years.

The diaphragm comprises fibrous tissue and muscle, and converges centrally to the central tendon. Therefore, direct damage by a colonoscope is almost impossible, and colonic perforation by colonoscopy will precede diaphragmatic injury. In all reports of diaphragmatic hernia after colonoscopy, the patients had diaphragmatic damage due to previous trauma or abdominal surgery [6–8]. That is, there were defects in the diaphragm before colonoscopy was performed.

As for the mechanism of scope progression in the splenic flexure region during colonoscopy, the direction of the vector applied to the cephalad is changed to the right, which is the transverse direction of the part of the colon that is fixed with the diaphragm by the splenic ligament. The scope is subsequently moved forward. Thereafter, a large amount of force is applied to the diaphragm (Fig. 4). However, in our patient, the fixation of this part was very weak owing to a defect in the diaphragm; therefore, it would have been difficult to withhold the force applied during colonoscopy. In addition, when the splenic flexure colon was pushed to the diaphragm, the diaphragmatic defect that was barely covered by the spleen was exposed, and the abdominal organs would have been herniated.

The management of Bochdalek hernias is typically performed via the thoracic or abdominal route. The choice of the procedure depends on the surgeon's experience. In our patient, the operation was performed laparoscopically because there could be damage to the colon due to colonoscopy. Small diaphragmatic defects are usually treated by primary repair using non-absorbable sutures. As for large defects, prosthetic meshes or tissue-engineered grafts are used to avoid excessive tension following repair. With the development of surgical techniques, surgery for congenital diaphragmatic hernia is now performed using minimally invasive techniques, such as laparoscopy or thoracoscopy [9]. Such techniques may induce a reduced morbidity and hospital stays and also offer the advantages of a faster return to a normal diet and normal activity, and better cosmesis [10].

4. Conclusion

We report a rare case of delayed Bochdalek hernia that may have been induced by the difficult insertion of a colonoscopy. Although rare, this disorder should be recognized, examined and treated appropriately to avoid complications.

Source of funding

Any study sponsors had no involvement.

Ethical approval

As these was a report of an interesting case and was not a trail or an observational research there was no need for an ethical approval.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

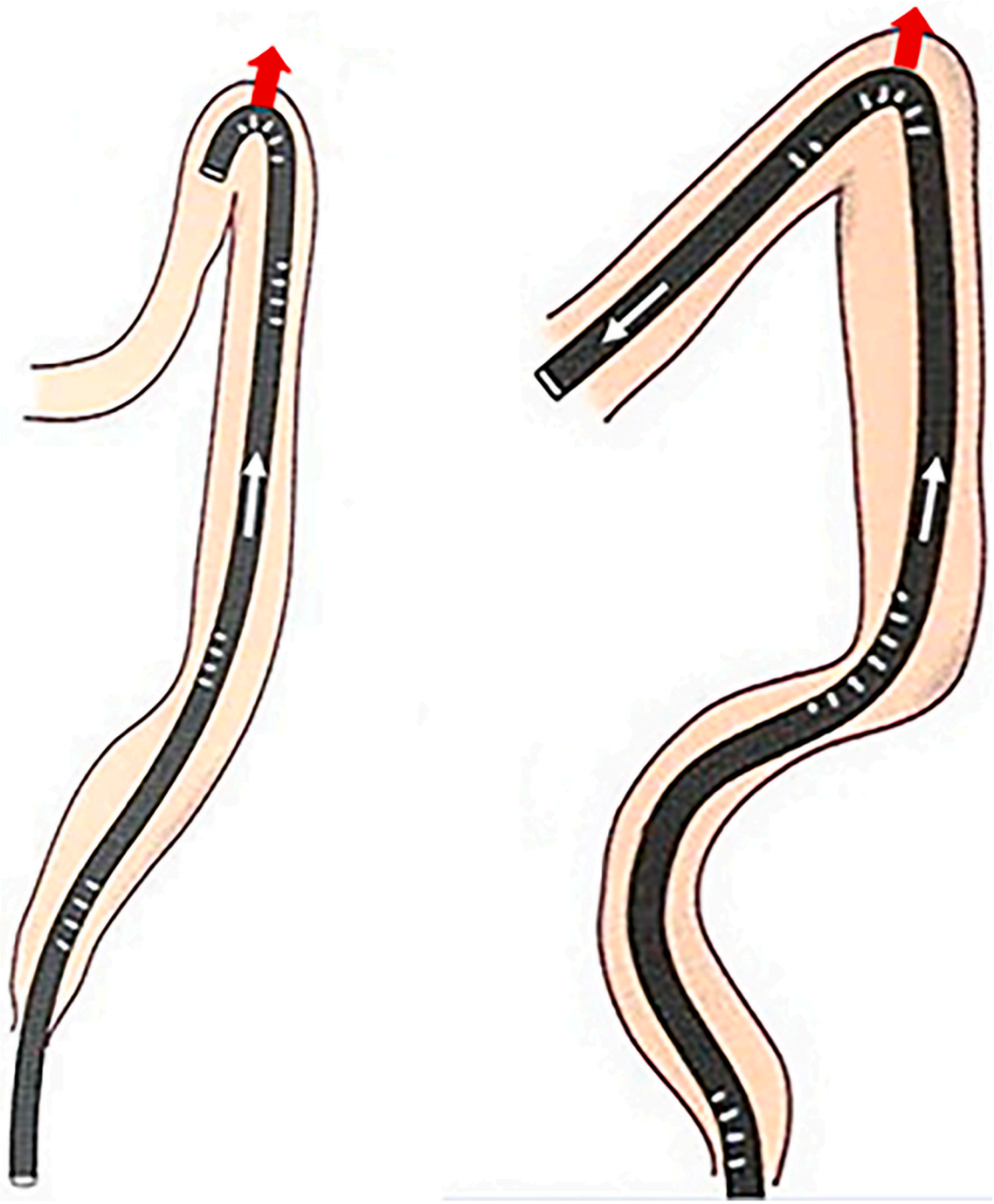

Fig. 4. As for the mechanism of scope progression in the splenic flexure region during colonoscopy, the direction of the vector applied to cephalad is changed to the right, which is the transverse direction of the part of the colon that is fixed with the diaphragm by the splenic ligament.

Registration of research studies

Not Applicable.

Guarantor

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CRediT authorship contribution statement

Sung Hoon Cho contributed to writing the paper and data collection.
Kyoung Hoon Lim contributed to conceptualization, supervision and reviewing the paper.

Declaration of competing interest

The authors declare that they have no competing interests.

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