

**Case  
Report**

# Advantages of Video-assisted Thoracoscopic Surgery for Adult Congenital Hernia with Severe Adhesion: Report of Two Cases

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**Adults who have undergone surgical repair of congenital diaphragmatic hernia have a prolonged illness. They usually have severe adhesions around the intrathoracic hernial sac; therefore, the adhesion itself as well as misidentification of the hernial defect can make surgical repair difficult, even in open surgery. Here, we present the successful video-assisted thoracoscopic surgical repairs of Bochdalek and Morgagni hernias in patients with severe adhesions of the hernial sac (peritoneum) to the parietal pleura lying over the thoracic wall and diaphragm. An 18-year-old woman with a Bochdalek hernia and a 28-year-old woman with a Morgagni hernia underwent thoracoscopic division of severe adhesions, proper minithoracotomy, and precise repairs of diaphragmatic defects. Postoperative courses of both patients were uneventful with no signs of recurrence of the hernia. Thus, we recommend the thoracoscopic approach as the first choice over an open or laparoscopic approach in the management of adult patients with Bochdalek or Morgagni hernias and severe adhesion.**

**Key words:** video-assisted thoracoscopic surgery, morgagni, bochdalek, congenital diaphragmatic hernia, adhesion

## Introduction

Recently, the indication for video-assisted thoracoscopic surgery (VATS) was expanded to include adult congenital diaphragmatic hernias of Bochdalek<sup>1-3)</sup> and Morgagni.<sup>4-9)</sup> This approach offers greater advantages over open thoracotomy because it is less invasive and allows the surgeon to make more precise incisions during

the herniorrhaphy. We present two cases of successful VATS herniorrhaphy in patients with severe adhesion between the hernial sac and parietal pleura lying over the thoracic wall and diaphragm.

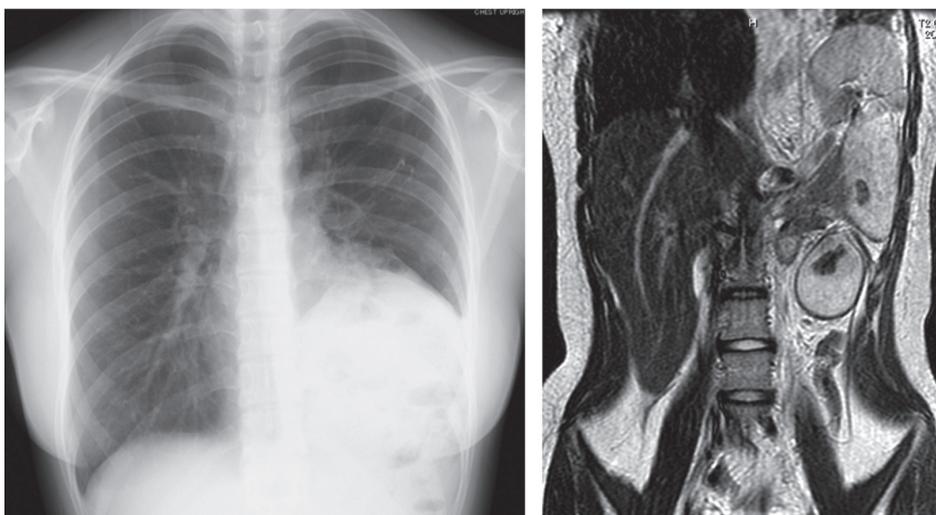
## Case Reports

### Case 1

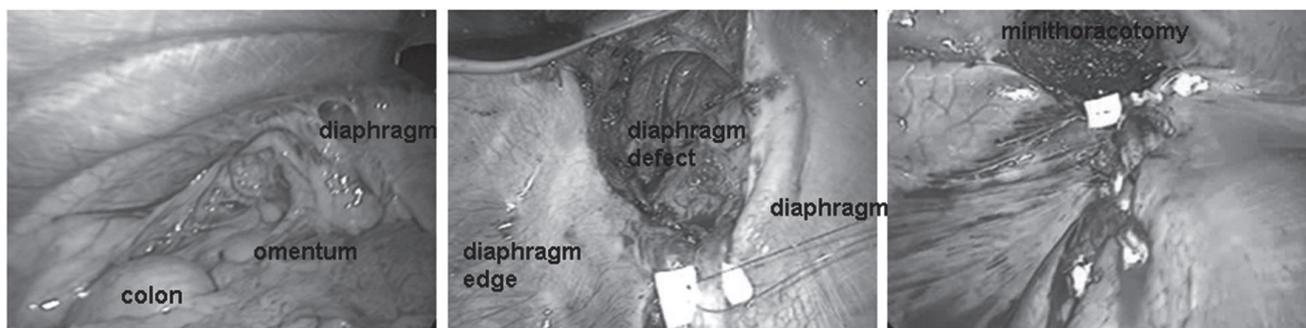
An 18-year-old asymptomatic woman, who had an abnormal shadow on the left hemithorax on chest radiography, was diagnosed as Bochdalek hernia during senior high school medical check-up (**Fig. 1a**). She was admitted to Sapporo Medical University Hospital for surgical treatment. The preoperative computed tomography (CT) showed segments of the colon and small intestine with air-fluid levels in the left thoracic cavity. The diaphragmatic defect could be identified clearly in the preoperative magnetic resonance imaging (MRI) (**Fig. 1b**).

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**Fig. 1** Case 1: Preoperative chest radiography (a). Preoperative magnetic resonance imaging (MRI). Bochdalek hernia defect on MRI (b).



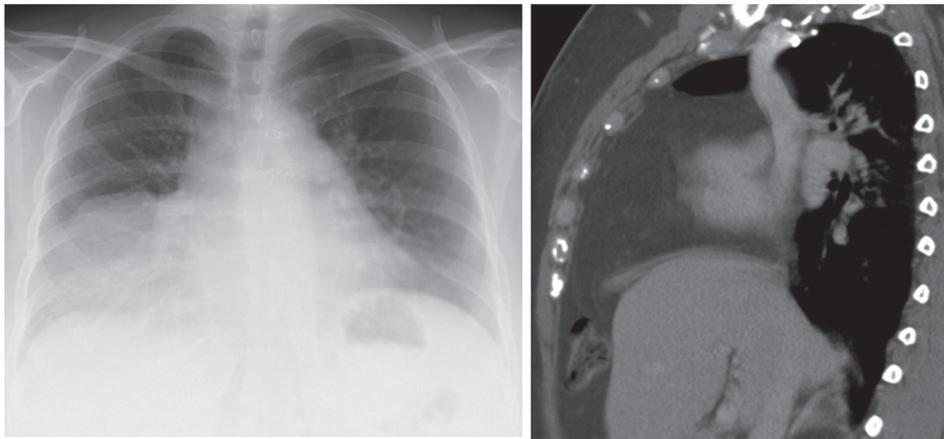
**Fig. 2** Case 1: The herniated omentum was adherent to the chest wall and diaphragm (a). A 5 × 3 cm diaphragm defect was detected only after division of the adhesion. The defect was closed by re approximating the diaphragm edges and fixing to the right thoracic wall using 3-0 polypropylene horizontal mattress sutures with pledgets, and the sutures were tied above the intercostal muscle (b, c).

The operation was performed under general anesthesia using double-lumen tube with epidural tubing. The patient was placed in the right decubitus position, then two 12 mm ports were made through the 4th and 7th intercostal spaces (ICS) on the anterior axillary line, and a 30-degree thoracoscope was inserted. Thoracoscopy demonstrated the hernial sac, containing the omentum, small intestine and colon, in the left thoracic cavity, and the peritoneum over the herniated omentum was adherent to the pleura over the left thoracic wall and diaphragm (**Fig. 2a**). The 5 × 3 cm diaphragmatic defect could be identified in the posterior region of the left diaphragm after the thoroscopic adhesiotomy. The thoracoscopy showed that parts of the small intestine, colon, and omentum herniated into the left thoracic cavity through the defect. Then, a 35mm minithoracotomy was

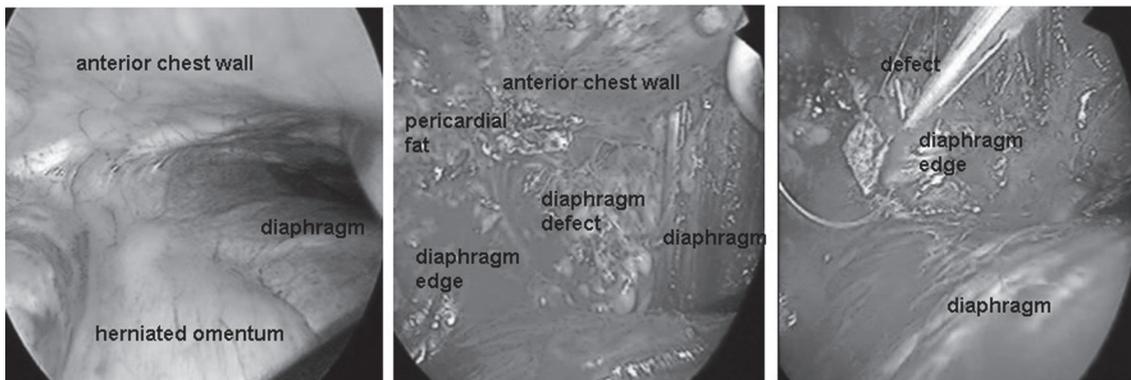
made just above the defect through the posterior 9th ICS. The contents of the hernial sac were repositioned into the peritoneal cavity. The diaphragmatic defect was closed by re approximating the edges, and fixing to the left thoracic wall using 3-0 polypropylene horizontal mattress sutures with pledgets, and the sutures were tied above the intercostal muscle (**Fig. 2b** and **2c**). The postoperative course was uneventful. The chest tube was removed on postoperative day 1, and she was discharged home 5 days later. She remains well without any signs of recurrence of hernia 1 year after surgery.

### Case 2

A 28-year-old woman, who had an abnormal shadow on the right hemithorax on chest radiography, was suspected to have a pericardial lipoma (**Fig. 3a**) since she



**Fig. 3** Case 2: Preoperative chest radiography (a). Preoperative computed tomography (CT). The defect in the diaphragm was clearly identified on the right supero-anterior area of the liver on CT (b).



**Fig. 4** Case 2: Fat mass adherent to the right anterior mediastinum and diaphragm (a). A 7 × 4 cm oval-shaped diaphragmatic defect at the left lateral side from the median line (b). The defect was closed by fixing edges of the diaphragm defect to the anterior chest wall, and sutures were tied above the right medial rectus muscle (c).

was eighteen. However, she has undergone no treatment since that time. She began to experience exertional dyspnea at the age of 26, and the intrathoracic mass gradually increased in volume. Subsequently, she was admitted to the same hospital for excision of the intrathoracic lipoma. The preoperative CT clearly showed the right anteromedial diaphragmatic defect and only segments of the omentum herniated into the right thoracic cavity at the anteromedial area (**Fig. 3b**). In addition, the fat density mass was shown to extend from just above the upper surface of the liver to the subcarinal level (**Fig. 3b**). Finally, she was diagnosed with Morgagni diaphragmatic hernia. The operation was performed under general anesthesia using double-lumen tube with epidural tubing. The patient was positioned supine with about 15-degree head-

up and 15-degree left side rotation. Three 12-mm ports were made in the 6th and 8th ICS on the anterior axillary line, and 7th ICS on the posterior axillary line. Then a 30-degree thoracoscope was inserted. The thoracoscopy showed the fat mass adherent to the right anterior mediastinum and diaphragm (**Fig. 4a**). The 7 × 4 cm oval-shaped diaphragmatic defect could be identified after thoracoscopic division of the adhesion between the pericardial fat pad in the substernal cardiophrenic angle and the fat mass. Omentum was seen protruding into the thorax and adherent to the right diaphragm and right mediastinum. After the mediastinal edge of the defect could be identified, a 70-mm right submammary minithoracotomy through 7th ICS was made just above the defect. The volume of the herniated omentum was too much to

be repositioned into the peritoneal cavity. In addition, there was no space in the peritoneal cavity because of obesity (body weight of 94 kg and height of 150 cm, BMI = 42 kg/m<sup>2</sup>). Hence, the herniated omentum fat was mostly resected and taken out of the thoracic cavity (**Fig. 4b**). The defect of the diaphragm was closed by fixing the edges to the anterior chest wall with several interrupted 3-0 polypropylene horizontal mattress sutures buttressed with pledgets, and the sutures were tied above the right medial rectus muscle (**Fig. 4c**). The postoperative course was unremarkable. The chest tube was removed on postoperative day 2, and she was discharged home 3 days later. She remains well without any signs of recurrence of the hernia 6 months after surgery.

## Discussion

We believe that the most important issue for precise and proper repair of diaphragmatic defect is the identification of the defect site and size preoperatively and intraoperatively. However, preoperative CT or MRI in the usual horizontal plane occasionally can not reveal the definitive diagnosis of congenital diaphragmatic hernia or where the precise diaphragmatic defect is. In this situation, reformed coronal or sagittal sections on CT or MR images are useful in order to detect the precise diaphragmatic defect site and size. This preoperative information helps surgeons arrive at valuable decision for operative strategies. In addition, the operative findings benefit operative strategies. Congenital diaphragmatic hernias in adult were repaired by several methods and approaches, such as thoracoscopic,<sup>1-6</sup> laparoscopic,<sup>7, 8</sup> both thoracoscopic and laparoscopic approaches,<sup>9</sup> and open transthoracic<sup>10, 11</sup> or transperitoneal<sup>12</sup> approach. However, most adult patients, who underwent surgical repair of congenital diaphragmatic hernia, have had a long illness courses. Furthermore, volume of herniated viscera is relatively large even if diaphragmatic defect is small. Therefore, there are a lot of possibilities that they have severe adhesion of herniated viscera around tissues and that diaphragm defect could not be identified easily intraoperatively.

In brief, a thoracoscopic approach could offer more advantages over open thoracotomy or a laparoscopic approach in adults because the cases are different from those that occur during neonate or infancy.<sup>6, 13</sup> Transperitoneal laparotomy and laparoscopic approaches are commonly used to repair diaphragmatic hernia in infants or children because they rarely have severe adhesion in the

thoracic cavity, and difficult adhesiotomy in the thoracic cavity is unnecessary.<sup>7, 13</sup> In adult congenital diaphragmatic hernia, the thoracoscopic view is considered to be the first priority because it allows better control during dissection of thoracic adhesion within minimum invasion. In addition, operative management of single-lung ventilation with a double-lumen endotracheal tube in the adult is much easier than in the neonate minimum size. Open thoracotomy or peritoneal approach should be considered additional procedures in order to repair the hernia accurately if needed. It is reported that an additional trans-xiphoid approach after a thoracoscopic view can be used to dissect adhesions or to repair the defect<sup>12, 14</sup> for a reoperation or in cases of severe adhesion. Therefore, thoracoscopic views and surgical procedures are beneficial in the repair of congenital diaphragmatic hernias in patients with severe adhesion.

In order to repair diaphragmatic defect accurately, we used the extrathoracic ligation method; wherein the edge of the defect was fixed to the thoracic wall using mattress sutures with pledgets and the sutures were then tied on the intercostal muscle or rectus muscle. The congenital diaphragmatic defects sometimes do not have sufficient margin for reapproximation directly. Several surgeons reported using artificial material for closing large defect.<sup>6-8, 10, 11</sup> Where the minithoracotomy is made to close the defect is the most critical decision. The extrathoracic ligations have to be made on the intact intercostal muscle or rectus muscle, which is close to the incision site. Therefore, proper site for the minithoracotomy or, even open thoracotomy, should be selected when extrathoracic ligation is required. However, when there is severe adhesion of the herniated viscera to the thoracic wall or diaphragm, the diaphragmatic defect could be identified only after adhesiolysis. Otherwise, operative incisions might be larger than the minimum size or extrathoracic ligations to close the defect might be impossible. If transperitoneal laparotomy or a laparoscopic approach were used, this extrathoracic ligation method is might not be chosen, and alternative methods (e.g. using artificial material for closing defect) would be used. Therefore, thoracoscopic approach has the advantage of giving the surgeon more choices in the selection of an extrathoracic ligation method. In addition, the approach allows the surgeon to make a proper incision and precise repair of the defect. Both patients had severe adhesions of hernial sac to the parietal pleura lying over the thoracic wall and diaphragm. In addition, both two of diaphragmatic defects could be identified only after the

thoracoscopic adhesiotomy. Therefore, thoracoscopic views and adhesiotomy by this approach made both operations easier and simpler to perform. Then, minimum thoracotomies and precise repairs of defects is possible. Therefore, this approach has advantages over open thoracotomy or a laparoscopic approach because it is less invasive and enables the surgeon to make precise incisions. Thus, we recommend the thoracoscopic approach as the first choice in the repair of Bochdalek and Morgagni hernias, in adults with severe adhesion.

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