Case Reports in Gastroenterology

Case Rep Gastroenterol 2018;12:271–276

DOI: 10.1159/000489294
Published online: June 15, 2018

Single Case

Usefulness of Plain Computed Tomography with Swallowing of Gastrografin™ for the Diagnosis of a Late-Onset Iatrogenic Diaphragmatic Hernia following Biopsy of a Diaphragmatic Tumor: Report of a Case

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Keywords
Iatrogenic diaphragmatic hernia · Late onset · Epigastralgia · Computed tomography · Swallowing of Gastrografin™

Abstract
Although diaphragmatic hernia (DH) may be congenital, posttraumatic, or iatrogenic, DHs after diaphragmatic surgery are rarely reported in the literature. This report describes the rare case of a 14-year-old girl complicated by iatrogenic DH following the biopsy of granulomatous lesions of the left diaphragm, when a mediastinal mixed germ cell tumor was extirpated. Plain computed tomography (CT) with swallowing of Gastrografin™ was useful for the diagnosis of this disorder. The patient presented to our hospital with frequent epigastric pain and vomiting 11 months after the original surgery. Chest X-ray, a gastrointestinal contrast study, and plain CT with swallowing of Gastrografin™ revealed the left DH with gastric content. At laparotomy,

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the diaphragmatic defect, 3 × 3 cm in diameter, was repaired using nonabsorbable sutures after hernia reduction. The patient showed a rapid recovery with complete resolution of symptoms. We should consider the presence of iatrogenic DH in patients who develop epigastralgia after procedures involving the diaphragm, even at 11 months after the original surgery. Furthermore, plain CT with swallowing of Gastrografin™ is useful for the diagnosis of this disorder.

Background

A diaphragmatic hernia (DH) is a herniation of the upper abdominal viscera within the pleural cavity through a defect in the diaphragm. DHs are divided into either congenital or acquired forms. Congenital DHs are divided into 3 types: Bochdalek hernia, Morgagni hernia, and esophageal hiatal hernia. Most acquired cases result from trauma, especially blunt or penetrating thoracoabdominal injury. The rest of the acquired DHs are caused by an iatrogenic etiology, such as surgery, and these cases are rarely reported in the literature [1].

Since a DH can result in delayed diagnosis [2] and can be fatal in some cases, it is important for surgeons to be aware of this condition. We herein report the rare case of an iatrogenic DH, following the biopsy of granulomatous lesions of the left diaphragm, when a mediastinal mixed germ cell tumor was extirpated in a 14-year-old girl. In the present case, plain computed tomography (CT) with swallowing of Gastrografin™ was useful for the diagnosis of this disorder.

Case Presentation

A 14-year-old girl had undergone mediastinal tumorectomy together with left upper lobectomy, partial resection, and simple suture of the left diaphragm, conducted through a median sternotomy and intercostal thoracotomy for a mediastinal mixed germ cell tumor and granulomatous lesions of the left diaphragm. Eleven months after the first surgery, during adjuvant chemotherapy, the patient presented with frequent epigastric pain and vomiting. The abdominal pain occurred frequently about 30 min after taking meals, especially when the patient had eaten a large amount of food. Blood examination was performed. On examination, the vital signs were stable and her abdomen was soft without rebound or tenderness. White blood cell count was 3,200/μL, hemoglobin was 12.0 × 10^4/μL, platelets were 18.5 × 10^4/μL, and C-reactive protein was 0.03 mg/dL, i.e., within the normal range, and the patient had no liver or renal damage. The symptom did not improve for 7 months but showed no deterioration, while the patient was medicated with H2-blockers. During these 7 months of medication, the patient had no episode of chest-related symptoms or strangulation of the intestines. As a chest X-ray incidentally showed a left DH with gastric content (Fig. 1a), a study was conducted to confirm the left DH with a thoracic upside-down stomach (Fig. 1b), and plain CT was subsequently performed after swallowing of Gastrografin™, and it anatomically revealed the left DH with fissuring of the diaphragm (Fig. 2). Therefore, the patient underwent laparotomy at 17 months after the operation. Regarding the operative findings, a part of the stomach, i.e., the fundus and upper part of the body, impacted the defect of the left diaphragm. There was no hernia sac, and the size of the diaphragmatic defect was 3 × 3 cm in diameter (Fig. 3); the rim of the DH formed an adhesion between the greater omentum. We could not find any residual

sutured threads used in the first operation around the defect. The omental adhesion was released, and the impacted stomach was pulled back into the abdominal cavity. The diaphragmatic defect was repaired using nonabsorbable sutures. No drain tubes were placed. The patient showed a rapid recovery, with complete resolution of symptoms without any complications, except for a small amount of left pleural effusion, which disappeared spontaneously. The patient remained well at 3 months.

Discussion

Iatrogenic DH is caused by undetected injury to the diaphragm during a surgical process, and this defect is likely to increase in size due to the pressure gradient between the abdominal and thoracic cavities. It is rarely discussed in the literature [1], although this disorder might be due to the underreporting of complications. Estimating from rare reports of the morbidity rate, DH was found in 4% of patients after esophagostomy in adults [3]. The rate of iatrogenic DHs differs according to the type of surgery; in fact, only 1 out of 1,535 cases after laparoscopic cholecystectomy suffered iatrogenic DH in adults [4].

In the present case, gastrointestinal symptoms, such as epigastric pain and vomiting, occurred at a later period of 11 months following biopsy of the diaphragmatic tumor. These are the major symptoms of DH, and cardiorespiratory symptoms, such as chest pain, shortness of breath, palpitations, and heartburn, are the others. The herniation of abdominal viscera into the thoracic cavity or pericardium causes these symptoms.

Although iatrogenic DH can be fatal in some cases [5], the diagnosis of DH is sometimes delayed, such as in the present case. One reason for this late diagnosis might be the delayed presentation of DHs, which makes it difficult to associate the symptoms with complications of the first surgery. In the present case, the side effects of chemotherapy for mediastinal mixed germ cell tumor were considered to be a cause of the epigastric pain, and this might be another reason for the delayed diagnosis of DH in the present case, as well as the reason described above.

The present case was diagnosed with gastrointestinal contrast series and plain CT with swallowing of Gastrografin™. To diagnose thoracic herniation of abdominal viscera, such as the stomach, small intestine, and colon, upper gastrointestinal Gastrografin™ swallowing might be used. In the present case, plain CT was subsequently performed after swallowing of Gastrografin™, which showed the discontinuity of the diaphragmatic defect. In addition, a part of the stomach herniated through the diaphragmatic defect into the left thorax, and the rest of the stomach was visible under the diaphragm with Gastrografin™. There was no need to perform any further evaluation because upper gastrointestinal Gastrografin™ series and plain CT with swallowing of Gastrografin™ could be used to correctly diagnose the DH and showed the correct anatomical relations of DH. There is 1 case report of a traumatic diaphragmatic rupture diagnosed by plain CT with an oral contrast agent [6]; however, there is no report of iatrogenic DH diagnosed by plain CT with an oral contrast agent.

In general, the treatment of iatrogenic DH involves surgical repair through a transthoracic [7] or transabdominal [8, 9] approach. Iatrogenic DH with a large defect or muscle weakness should be repaired with synthetic grafts in adult patients [10]. The present patient underwent laparotomy. Based on the operative findings, the defect of the left diaphragm was small enough to be repaired by nonabsorbable sutures alone, and the patient showed rapid recovery after surgery. She remained asymptomatic without DH recurrence at 3 months.

Conclusions

We encountered iatrogenic DH in a 14-year-old girl 11 months after diaphragm biopsy. Late onset following the original surgery and a history of chemotherapy for the original disease led to a delay in the correct diagnosis. In particular, plain CT with swallowing of Gastrografin™ played an important role in the correct diagnosis of DH. In summary, iatrogenic DH should be considered in children who develop symptoms of epigastralgia after procedures involving the diaphragm, even at 11 months after the original surgery. When DH is suspected, plain CT scanning with the administration of an oral contrast agent might be useful for recognizing the correct anatomical relations of DH.

Statement of Ethics

Consent for publication has been obtained from the patient.

Disclosure Statement

The authors declare no conflicts of interest.

References

1 Bettolli M, Jackson CC, Sweeney B, Rubin S. Iatrogenic anterior diaphragmatic hernia in childhood. Eur J Pediatr Surg. 2008 Aug;18(4):275–6.
2 Shah R, Sabanathan S, Mearns AJ, Choudhury AK. Traumatic rupture of diaphragm. Ann Thorac Surg. 1995 Nov;60(5):1444–9.
3 van Sandick JW, Knegjens JL, van Lanschot JJ, Obertop H. Diaphragmatic herniation following oesophagectomy. Br J Surg. 1999 Jan;86(1):109–12.
4 Armstrong PA, Miller SF, Brown GR. Diaphragmatic hernia seen as a late complication of laparoscopic cholecystectomy. Surg Endosc. 1999 Aug;13(8):817–8.
5 Ramos CT, Koplewitz BZ, Babyn PS, Manson PS, Ein SH. What have we learned about traumatic diaphragmatic hernias in children? J Pediatr Surg. 2000 Apr;35(4):601–4.
6 Koroglu M, Ernst RD, Oto A, Mileski WJ. Traumatic diaphragmatic rupture: can oral contrast increase CT detectability? Emerg Radiol. 2004 Jul;10(6):334–6.
7 de Meijer VE, Vles WJ, Kats E, den Hoed PT. Iatrogenic diaphragmatic hernia complicating nephrectomy: top-down or bottom-up? Hernia. 2008 Dec;12(6):655–8.
8 Chin RY, Glew MJ, Brady P. Iatrogenic intrapericardial diaphragmatic hernia. ANZ J Surg. 2002 Sep;72(9):681–3.
9 Boyce S, Burgul R, Pepin F, Shearer C. Late presentation of a diaphragmatic hernia following laparoscopic gastric banding. Obes Surg. 2008 Nov;18(11):1502–4.
10 Muysoms FE, Cathenis KK, Hamerlijnck RP, Claeys DA. Laparoscopic repair of iatrogenic diaphragmatic hernias after sternectomy and pedicled omentoplasty. Hernia. 2009 Dec;13(6):617–23.

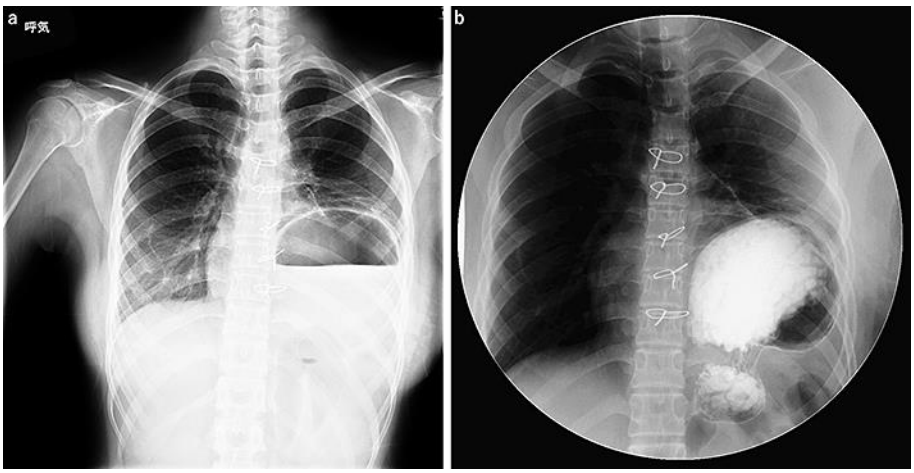

Fig. 1. Plain abdominal X-ray and abdominal X-ray with Gastrografin™. **a** Plain abdominal X-ray showed gastric gas above the left diaphragm. **b** Abdominal X-ray with swallowing of Gastrografin™. Gastrointestinal series employing Gastrografin™ swallowing for the stomach showed the upper stomach strangulated into the left diaphragm.

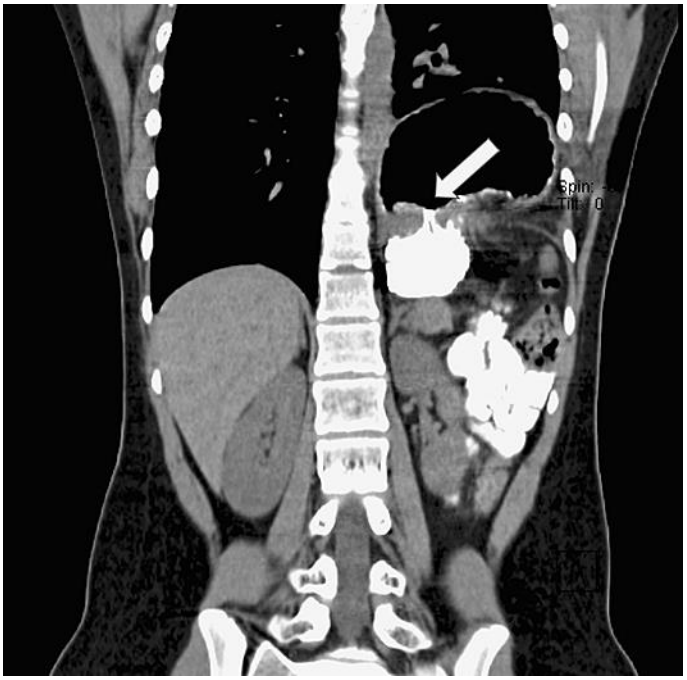

Fig. 2. Coronal plain computed tomography (CT) with swallowing of Gastrografin™. Coronal plain CT section with swallowing of Gastrografin™ showed the upper stomach strangulated into the left diaphragmatic hernia (arrow).

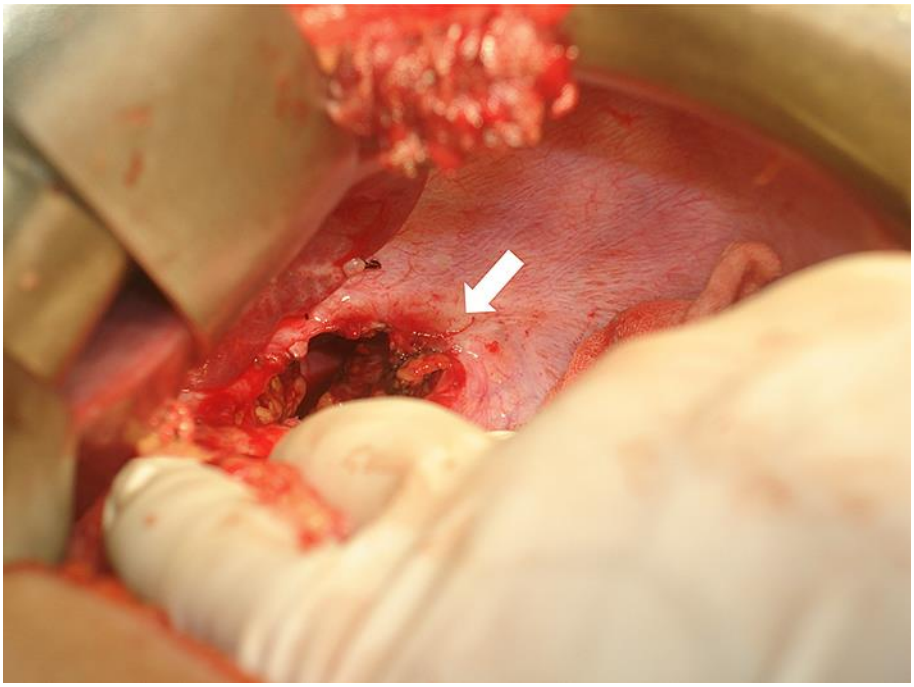

Fig. 3. Operative findings of diaphragmatic hernia. Operative findings revealing a 3 × 3 cm defect (arrow) in the left diaphragm.