



Post-esophagectomy diaphragmatic hernia—a case series

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Summary

Background Herniation of abdominal viscera through the esophageal hiatus is a rare complication following surgery for esophageal malignancies. This complication sometimes occurs suddenly and leads to a severe postoperative course.

Methods We present three cases of post-esophagectomy diaphragmatic hernia operated for cancer of the lower esophagus. All patients underwent initial upper gastrointestinal (GI) endoscopy and biopsies for diagnosis. Staging was done by contrast computed tomography (CT) of the chest/abdomen/pelvis. Patients underwent neoadjuvant chemotherapy followed by surgery.

Results No patients had previous hiatal hernias prior to surgery, and full crural sling dissections were carried out in all cases. The three cases vary in clinical presentation and show imaging findings of diaphragmatic hernias with variable visceral contents.

Conclusion While differences in pressure between the abdominal and thoracic cavities are important, the size of the hiatal defect is something that can be influenced surgically. As with all oncological surgery, safe resection margins are essential without adversely affecting anatomical structure and function. The commonest cause is excessive widening of the esophageal hiatus during surgery and, therefore, narrowing the hiatus to fit the conduit can prevent this complication.

Keywords Post esophagectomy complication · Diaphragmatic hernia · Ivor lewis · Esophageal carcinoma · Esophageal hiatus

Introduction

Esophageal carcinoma is the 13th most common cancer in adults and the sixth leading cause of cancer death in the world [1, 2]. Squamous-cell carcinoma is the predominant form of esophageal carcinoma worldwide.

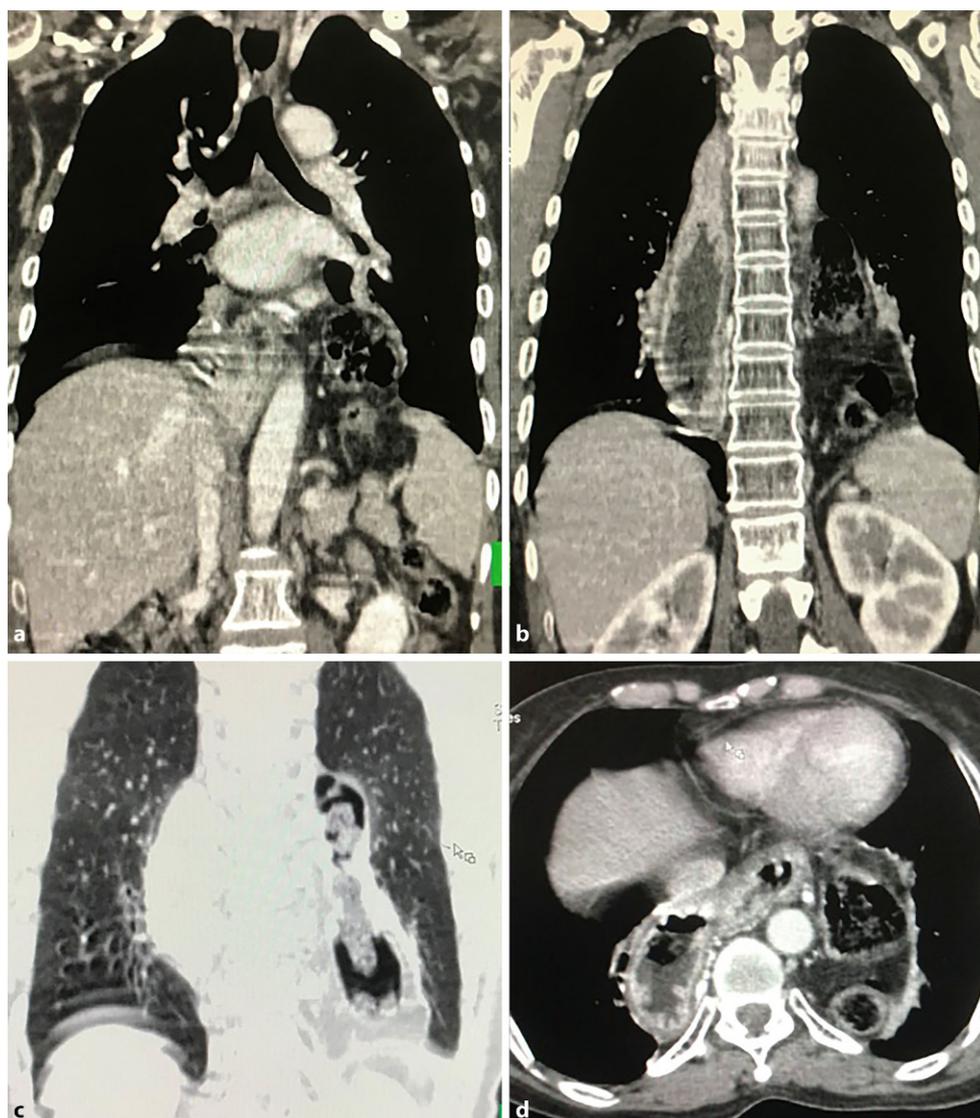
Esophageal cancer is about twice as common in men as in women [3]. As is the case for most forms of cancer, esophageal malignancy is more common in older patients [3]. More than 80% of cases occur in people over the age of 60 [3, 4]. Further, there are genetic factors increasing the likelihood of developing esophageal cancer.

Most esophageal cancer cases can be linked to lifestyle and environmental factors [3]. Smoking and excessive alcohol consumption are direct lifestyle factors relating to the development of esophageal cancer [3]. Low socioeconomic status as well as poor oral hygiene and nutritional deficiencies are associated with an increased risk of squamous cell cancers [1, 3]. Recurrent gastro-esophageal reflux and the development of Barrett's esophagus as well as obesity increase the risk of developing adenocarcinoma [1].

Esophageal cancer is aggressive with a poor prognosis. The optimal treatment for resectable esophageal cancer is curative surgery, including transhiatal or transthoracic esophagectomy, accompanied by reconstruction of the digestive conduit [5, 6]. Cases of diaphragmatic herniation (DH) after esophagectomy for esophageal cancer have been previously reported. Diaphragmatic herniation is recognized as a low-risk postoperative complication causing abdominal contents in the large and small intestine to extend into

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Fig. 1 **a, b** Coronal contrast-enhanced computed tomography (CECT) images revealing the gastric pull-through with left diaphragmatic hernia containing small bowel loops and celiac axis. **c** Lung window coronal CT images revealing air within the bowel loops. **d** Axial CECT revealing gastric pull-through with left diaphragmatic hernia containing small bowel loops and celiac axis



the thoracic cavity via the esophageal hiatus. The type of surgical technique applied seems to have an effect on postoperative herniation rates with minimally invasive esophagectomy reported to have higher rates of postoperative herniation when compared with traditional, open esophagectomies [7].

Case reports

We present three cases of giant DH after esophagectomy for cancer of the lower esophagus, all of which presented over a 1-month period in August 2018. All patients underwent initial upper gastrointestinal (GI) endoscopy with biopsies for diagnosis and subsequent computed tomography scan (CT) of the chest/abdomen/pelvis for staging. All patients underwent neoadjuvant chemotherapy with two cycles of 5-FU and cisplatin followed by open Ivor–Lewis esophagectomy (ILO). No patients had previous hiatal hernias

prior to surgery, and full crural sling dissections were carried out in all cases.

Case 1

The first patient was a 65-year-old woman with a long history of gastroesophageal reflux disease. She presented to gastroenterology for investigation of anemia. Visualization of the upper GI tract showed an ulcerated lesion in the lower esophagus at 35 cm. Biopsies confirmed a moderately differentiated adenocarcinoma. Staging was T3N1M0. Following two cycles of neoadjuvant chemotherapy, she underwent open ILO 5 months after her initial diagnosis. Pathological staging was pT3 pN0 with negative resection margins. The patient showed relatively good recovery with temporary hoarseness. The findings at regular follow-ups performed every 2 months were normal until left upper quadrant abdominal pain developed 4 months after surgery. The patient underwent ab-

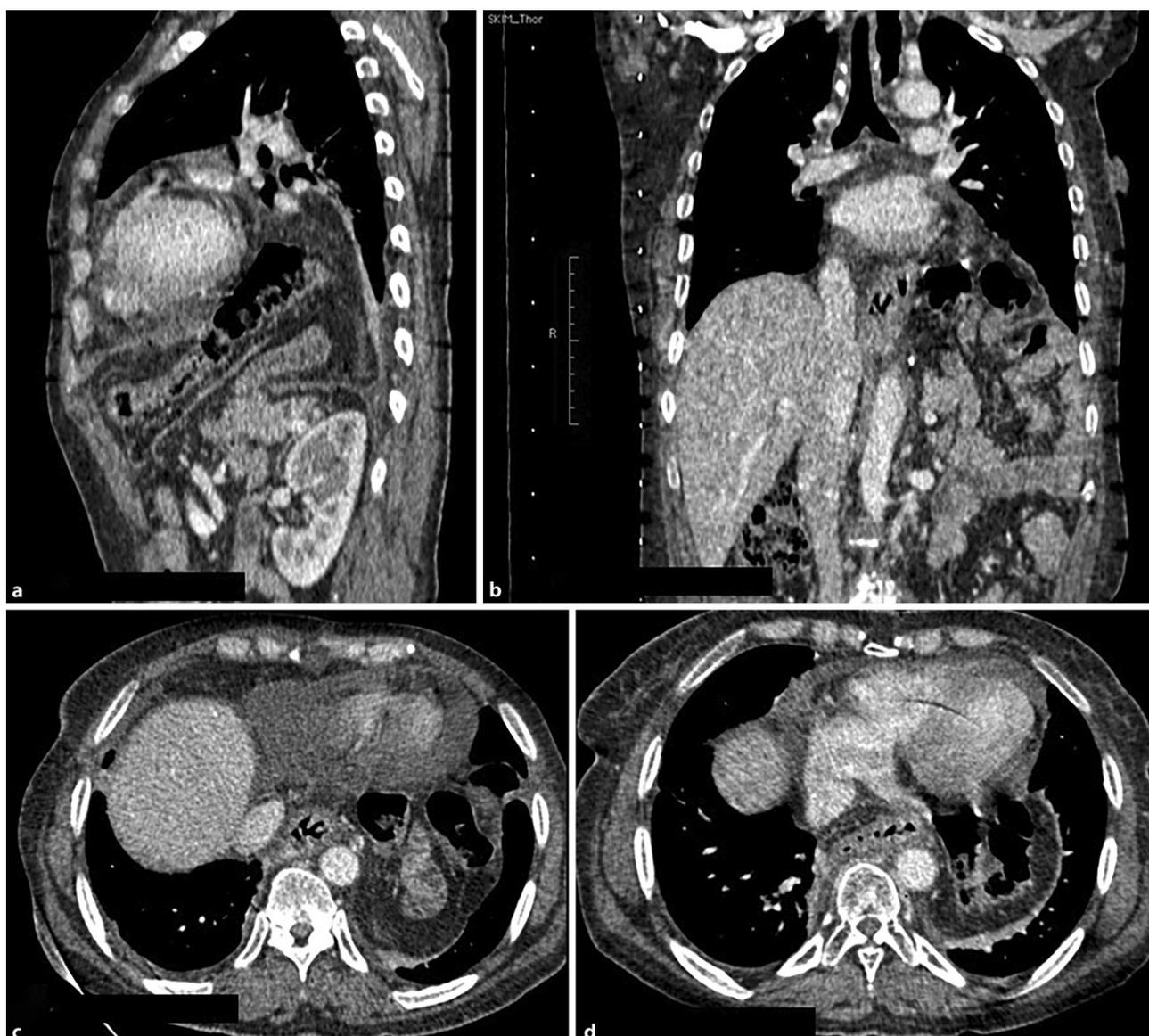


Fig. 2 Sagittal (a), coronal (b), and sequential axial (c, d) contrast-enhanced computed tomography images showing the diaphragmatic hernia with herniation of both the small and large bowel loops into the left hemithorax

dominal CT and chest X-ray imaging. The chest X-ray showed no significant problems, but the CT revealed a prominent diaphragmatic hernia with herniation of the small bowel loops and celiac axis (Fig. 1). The patient was admitted for corrective repair in the following week.

Case 2

Our next case was a 57-year-old female patient with chronic dysphagia. Endoscopy showed thickening of the lower thoracic esophagus at about 30 cm. Biopsy revealed squamous cell carcinoma stage T2N0M0. She underwent transhiatal esophagectomy with esophago-gastric anastomoses. The postoperative period was uneventful and she was discharged on the 12th postoperative day. Pathological staging was

T2N0M0. After surgery, she received three cycles of chemotherapy. Her follow-up CT scan at 6 months was unremarkable. However, the follow-up scan at 13 months showed a large diaphragmatic defect with herniation of the small and large bowel loops into the left hemithorax (Fig. 2). The patient was operated on for the hernia and is currently being followed up.

Case 3

The third patient was a 75-year-old woman with a history of dysphagia. Endoscopy revealed an ulceroproliferative lesion in the lower esophagus at 35 cm; biopsy also showed a differentiated adenocarcinoma with a staging of T3N1M0. The patient underwent two cycles of neoadjuvant chemotherapy followed by open ILO after 4 months. The patient showed good

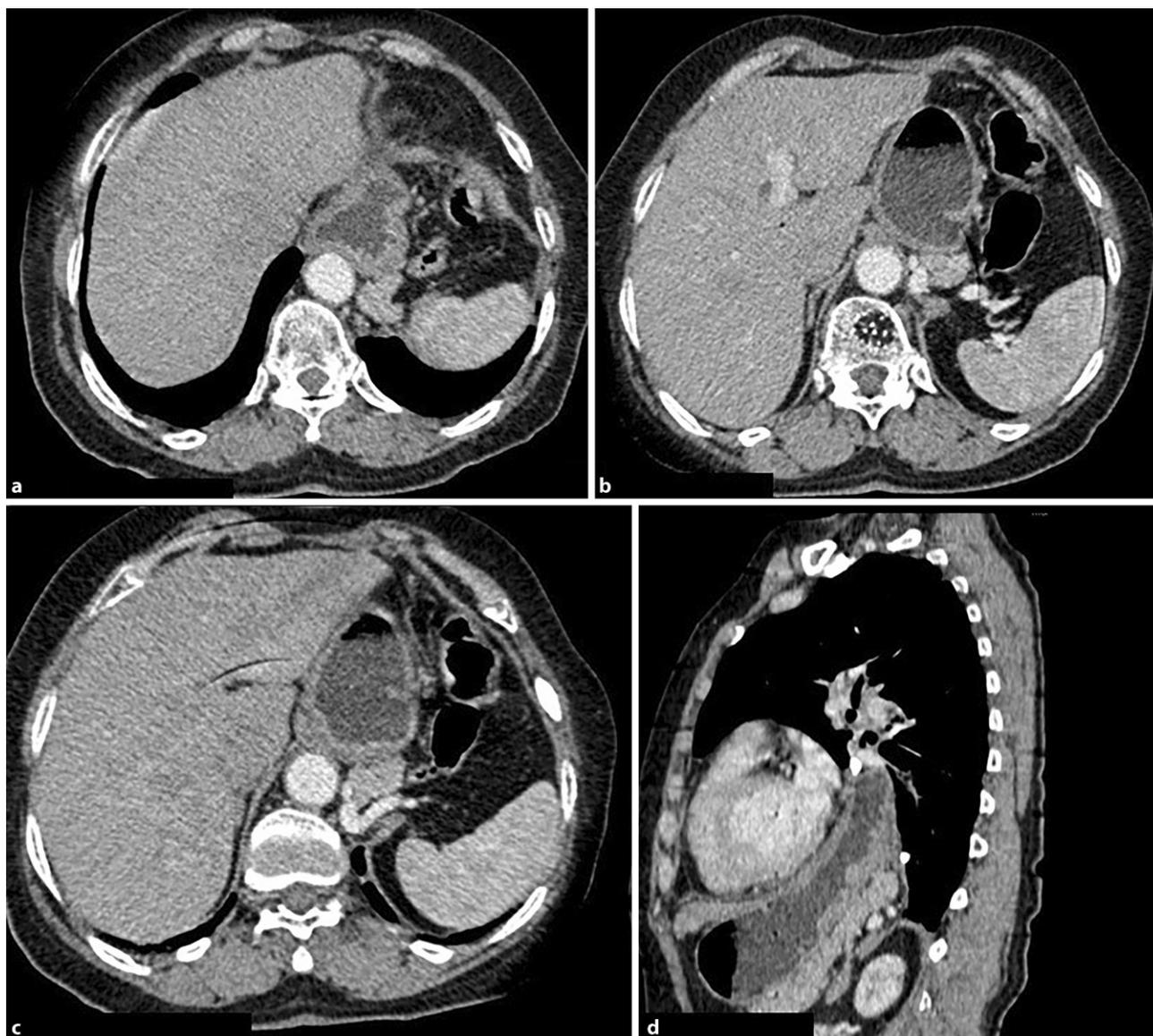


Fig. 3 **a–c** Sequential axial contrast-enhanced computed tomography (CECT) images revealing herniation of the pancreas, part of the stomach, and superior mesenteric vessels through the defect. **d** Coronal CECT image depicting the diaphragmatic hernia

recovery and was on follow-up. An abdominal CT after 1 year for disease status revealed a large diaphragmatic hernia with protrusion of the stomach, pancreatic tail, and the superior mesenteric vessels (Fig. 3). Surprisingly the patient was asymptomatic. Corrective surgery was offered; however, the patient declined and is currently being followed up.

Discussion

The reported incidence of diaphragmatic hernia following esophageal cancer surgery is 0.3–4%, although the incidence of asymptomatic hernias may be higher [8, 9]. It can occur following transhiatal or transthoracic esophagectomy [9, 10]. These iatrogenic hernias may present in the immediate (within 1 week), early (up to 2 years), or late postoperative period (up to

7 years; [9–11]). Patients may be asymptomatic or may present with features of respiratory distress, intestinal obstruction with or without strangulation of the bowel, fever, chest pain, cough, or lower gastrointestinal bleeding [9, 12, 13].

The most important factor predisposing to postoperative herniation is excessive manipulation of the hiatus during surgery or extensive disruption of the hiatus (either by resection of a portion of diaphragm for oncological clearance or extended incision of the surrounding hiatal tissue for placement of the conduit; [9, 14]). Diaphragmatic hernia following laparoscopic gastroplasty for esophagectomy has been attributed to the paucity of intra-abdominal adhesions following minimally invasive procedures [15]. Splenectomy or wide excision of the pleura may also

have a role to play in the development of diaphragmatic hernia.

Postoperative diaphragmatic hernia is a preventable complication. Methods described to prevent this include avoiding excessive widening of the diaphragm or using an anterior rather than lateral incision in the diaphragm to widen the hiatus, routine narrowing of the hiatus, and calibrating the hiatus to fit the conduit [10, 13–16].

Conclusion

Diaphragmatic hernia is a rare but preventable complication following surgery for esophageal malignancy; its successful management requires a high index of suspicion. Radical surgery might be performed at the expense of increased postoperative morbidity. However, such radical resections might not always be needed and the extent of surgery could be tailored to the patient. This means we need to decide which patients are suited for a less extensive resection and which patients need more radical surgery. Since the risk of recurrence biases the surgeon for extensive resections, perhaps earlier cross-sectional imaging should be advised for such patients for early detection and management of these hernias.

Conflict of interest S. Amreen, Z. Qayoom, N. Nazir, F. Shaheen, and T. Gojwari declare that they have no competing interests.

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