Case Report

Laparoscopic repair of giant diaphragmatic hernia after minimal invasive esophagectomy: a case report and review of the literature

Beatrice D'Orazio[1,2], Perrine Ledent[1], Eleonora Farinella[3]

[1]Digestive Surgery-CHU de Charleroi, Hôpital Civil Marie Curie, Lodelinsart, Belgium; [2]General Surgery Unit-Department of Surgical, Oncological and Stomatological Sciences, University of Palermo, Palermo, PA, Italy; [3]Chirurgie Digestive Centre Hospitalier Universitaire Saint-Pierre, Bruxelles, Belgium

Correspondence to: Dr. Eleonora Farinella. Chef de Service-Chirurgie Digestive Centre Hospitalier Universitaire Saint-Pierre, Site Porte de Hal- Rue Haute 322,1000 Bruxelles, Belgium. Email: eleonora.farinella@stpierre-bru.be.

Abstract: The incidence of esophageal cancer (EC) is rapidly increasing, as well as the overall survival of patients affected by it, given the improvement in its multimodal treatment. Minimally invasive esophagectomy (MIE) is the cornerstone to reach this goal, but the alteration of the anatomy that comes along with the surgery leads to an increased risk of diaphragmatic hernia (DH). This latter is a rare but highly morbid complication of MIE, which is expected to become more and more relevant. A 61-year-old man undergone to MIE for cancer, with uneventful immediate post-operative course, presented to our observation, 8 years after the procedure, with unspecific abdominal pain and vomiting. The CT scan showed a giant DH involving the small bowel and the transverse colon, which ascended in the thoracic cavity through a large defect of the left hemi diaphragm. A laparoscopic transabdominal repair, with direct suture of the diaphragm pillars, was performed. We did not record any immediate or long term post-operative complications, but a recurrence at 2 years CT scan follow-up. We treated the recurrent DH with an open repair employing a dual mesh placed on the left hemi diaphragm. No post-operative complications or further recurrences have been recorded. DH may be a life threatening early or long term post-esophagectomy complication. Nowadays, still little is known on its risk factors, and it has a nuanced clinical presentation, which frequently brings to a delayed diagnosis. Moreover, to the best of our knowledge a general consensus is lacking on the most appropriate attitude or technique to adopt in front of this uncommon disease. Our personal experience shows the efficacity and safety of a surgical approach, with direct suture, in a symptomatic post-MIE.

Keywords: Esophagectomy; minimally invasive surgery; diaphragmatic hernia (DH); transabdominal repair

Received: 15 November 2020; Accepted: 18 May 2021; Published: 25 January 2022.
doi: 10.21037/ls-20-134
View this article at: https://dx.doi.org/10.21037/ls-20-134

Introduction

The incidence of esophageal cancer (EC) is growing worldwide, in 2015, 1,700 new cases were reported in the United states, among which the 32% already had a locally advanced disease at the time of the diagnosis (1,2). The bedrock to guarantee a long-term survival to patients with EC, along with multimodal therapy, is, definitely, represented by the complete surgical resection (3-5).

Various surgical techniques are available aiming to this purpose, such as Ivor Lewis esophagectomy, transhiatal esophagectomy, 3-field esophagectomy and minimally invasive esophagectomy (MIE) (6). All of them include the resection of the esophagus with the advancement of the gastric tube or a colon interposition in the thoracic cavity through the diaphragmatic hiatus, this leads to an alteration of the normal anatomy exposing to a remarkable higher risk of diaphragmatic hernia (DH) (7).

DH is defined as an abnormal movement of abdominal organs into the thoracic cavity, which may bring to life threatening complications, raising the morbidity and mortality post-esophagectomy rate (8). It can occur more

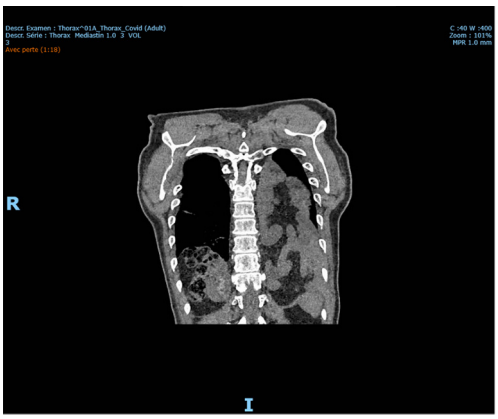

Figure 1 CT scan: DH with small bowel and transverse colon ascended through a defect in the left hemi-diaphragm post-MIE. DH, diaphragmatic hernia; MIE, minimally invasive esophagectomy.

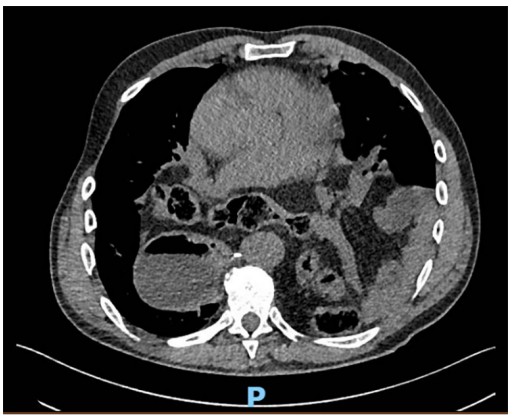

Figure 2 CT scan: recurrent DH with stomach and transverse colon ascended through a defect in the left hemi-diaphragm post-DH laparoscopic repair post-MIE. DH, diaphragmatic hernia; MIE, minimally invasive esophagectomy.

frequently after MIE, as an immediate post-operative event or a late post-operative complications, with cases reported from 2 days after surgery up to 7 years after the procedure, with a mean time presentation of 2 years (9,10). The incidence of this rare but morbid complications has been recently reported ranging from 0.7% to 26% (10,11), but this is likely underestimated, given the short time follow-up and the high rate of disease recurrence in this patient (7), and at the same time it will shortly become more and more relevant with the enhanced overall survival of EC, given the outstanding improvement of its multimodal treatment (12).

Nevertheless, little is known on risk factor and gold standard therapy of DH, so that, we present a case of giant DH post-MIE, with the aim of enriching our knowledge on this specific field.

We present the following article in accordance with the CARE reporting checklist (available at https://ls.amegroups.com/article/view/ls-20-134/rc).

Case presentation

A 61-year-old man underwent MIE for locally advanced EC post neoadjuvant RT-CT. The immediate postoperative course was characterized by the absence of major complication and he was discharged after 14 days of hospitalization.

At 8-month follow-up, the patients presented to our observation with unspecific abdominal pain and vomiting. A CT scan was performed, which highlighted a DH with ascension of the small bowel and the transverse colon behind the gastric tube (*Figure 1*).

So that, the patient was hospitalized to our surgical unit immediately after the diagnosis and he underwent to a laparoscopy repair of his giant DH. At surgical exploration we found a large defect of the left hemi diaphragm with the small bowel and transverse colon, which ascended into the thoracic cavity. After the laparoscopic transabdominal reduction of the hernial content, a direct suture of the diaphragmatic pillars was performed. The hernia orifice was closed by approximation of the left diaphragm pillar according to the Beaulieu technique.

The postoperative course was uneventful, and the patient was discharged 6 days after surgery.

At 2 years follow-up the patients come back to our observation presenting gastrointestinal symptoms such as non-specific abdominal pain, vomiting and respiratory difficulties, at CT scan control, we found a recurrence of DH with ascending stomach and transverse colon (*Figure 2*). After expressing his consent the patient underwent an open repair of its DH, with the employ of a dual mesh prothesis placed on the left hemi diaphragm, 1.5 cm distant from the esophagus along with the performance of an exhaust incision of the left hemidiaphragm. The post-operative course was again uneventful, the patients was discharged after 7 days from the surgery.

At 5 years CT scan follow-up we did not record any recurrence.

All procedures performed were in accordance with the

ethical standards of the Helsinki Declaration as revised in 2013. 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 editorial office of this journal.

Discussion

DH is a rare but morbid complication of esophageal surgery, since 2007only 36 cases have been reported in the literature, they mainly deal with the herniation of small bowel, transverse colon and spleen in the left hemithorax (13). As a matter of fact, in our case, we observed the small bowel and transverse colon ascending into the left hemithorax.

Oor *et al.* (14), highlighted in their metanalysis a higher incidence of DH following MIE (4.5%) as compared with open procedures (1%). When it occurs as an early post-operative event, it is most likely due to the lack of peritoneal adhesion, mostly during MIE (15,16), while if it occurs later in the post-operative course, other factors might be involved, such as a progressive hiatal dilatation, an increased abdominal pressure and the negative intrathoracic one (17,18).

Moreover, we have very limited information about the possible predictive factors for DH, some of the factors predisposing post-esophagectomy patients to DH could be female sex, Body mass index (BMI) <25 kg/m^2 and extended hiatal opening (19,20).

DH is characterized by a very wide spectrum of clinical presentation, most of the patients are asymptomatic, others present totally unspecific symptoms, and a minority of them show gastrointestinal or respiratory manifestation depending of the content of the DH, this usually leads to a delated diagnosis with a significant growth of DH related complications, such as ischemia or perforation (21). Furthermore, CT scan should be considered as the gold standard technique for diagnosing this disease (12). The patient presented to our observation 3 years after MIE, got a non-specific abdominal pain with vomiting and was diagnosed with DH after undergoing a CT scan of the abdomen and the thorax.

To the best of our knowledge, nowadays a standardized treatment protocol of DH is lacking (22). Some authors advocate a surgical repair even for asymptomatic patients (21,23), while others such as Erkmen *et al.* (24) suggest a surgical treatment of post-esophagectomy DH only for symptomatic patients, with an active observation of asymptomatic ones with CT scan every 6 months. In general, we can state that as surgery risks for patients underwent to esophagectomy are higher than in the general population only symptomatic DH should undergo a surgical repair (25), even if Brenkman *et al.* (22), demonstrated in their series that a conservative management was successful even in the 90% of their symptomatic patients, and stated that whether to perform surgery depends on the severity of symptoms, prognosis and patient fitness.

A general consensus is lacking even concerning the most appropriate surgical technique to repair the DH, primarily repairing the diaphragm defect with a direct suture of the pillars is effective in most cases, as in our, avoiding the risk of visceral erosion linked to the use of a mesh (8); whereas some surgeons such as Narayanan *et al.* (26), prefer the employ of a biologic mesh advocating effective results, or even Müller-Stich *et al.* (27) favour the use of a mesh in the absence of ischemia or perforation signs, with a significant diminution of recurrences.

Nevertheless, studies showing the superiority of one or the other approach are few, but Watson *et al.* (28) demonstrated in their work that there were no significant differences between the 2 techniques in terms of clinical outcome nor recurrence rate. In our experience of recurrence, we adopt an open surgical approach, in order to promote the adhesion formation and reduce further recurrences, along with the positioning of a dual mesh prothesis on the defect placed in the left hemidiaphragm and we did not record any further recurrences or post-operative complication.

However, given the increasing incidence of DH with MIE, the best conduct should ideally aim to prevent this post-operative complication. Several approach to reduce the risk of DH during MIE have been proposed, among those we number limiting the hiatal size by living the crura intact, closing anteriorly the hiatus, securing the stomach to the hiatus, suturing the conduit to the crura, preserving the peritoneal lining and relaxing incision in the left hemi-diaphragm (7). From our point of view, given our experience even if little, a good strategy aiming to prevent DH post-MIE occurrence, could be a minimal opening of the hiatus, with a laparoscopic transabdominal approach and if further mobilization of the esophagus is necessary a right lateral approach, with the incision of the right hemidiaphragm, should be preferred.

Conclusions

The above mentioned case demonstrates as the transabdominal laparoscopic approach, with direct suture of the diaphragmatic

defect, seems to be safe and effective for repair of giant DH after MIE.

Moreover, as the DH could lead to high morbidity and mortality rate after MIE and it is supposed to be seen more and more frequently, given the rise in survival expectancy of patients affected by EC, we should pay more attention to this post-operative complication and to the possible prevention techniques.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the Guest Editor (Nadia Russolillo) for the series "Amplifying the voices of women surgeon scientists" published in *Laparoscopic Surgery*. The article has undergone external peer review.

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://ls.amegroups.com/article/view/ls-20-134/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://ls.amegroups.com/article/view/ls-20-134/coif). The series "Amplifying the voices of women surgeon scientists" was commissioned by the editorial office without any funding or sponsorship. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the Helsinki Declaration as revised in 2013. 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 editorial office of this journal.

References

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2015. CA Cancer J Clin 2015;65:5-29.
2. Rice TW, Rusch VW, Ishwaran H, et al. Cancer of the esophagus and esophagogastric junction: data-driven staging for the seventh edition of the American Joint Committee on Cancer/International Union Against Cancer Cancer Staging Manuals. Cancer 2010;116:3763-73.
3. Paulson EC, Ra J, Armstrong K, et al. Underuse of esophagectomy as treatment for resectable esophageal cancer. Arch Surg 2008;143:1198-203; discussion 1203.
4. Abrams JA, Buono DL, Strauss J, et al. Esophagectomy compared with chemoradiation for early stage esophageal cancer in the elderly. Cancer 2009;115:4924-33.
5. Taylor MD, LaPar DJ, Davis JP, et al. Induction chemoradiotherapy and surgery for esophageal cancer: survival benefit with downstaging. Ann Thorac Surg 2013;96:225-30: discussion 230-1.
6. Swisher SG, Hunt KK, Holmes EC, et al. Changes in the surgical management of esophageal cancer from 1970 to 1993. Am J Surg 1995;169:609-14.
7. Benjamin G, Ashfaq A, Chang YH, et al. Diaphragmatic hernia post-minimally invasive esophagectomy: a discussion and review of literature. Hernia 2015;19:635-43.
8. M Hennessy M, Ivanovski I, Spartalis E, et al. Diaphragmatic hernia following esophagectomy for esophageal cancer: A systematic review. J BUON 2019;24:1793-800.
9. van Sandick JW, Knegjens JL, van Lanschot JJ, et al. Diaphragmatic herniation following oesophagectomy. Br J Surg 1999;86:109-12.
10. Willer BL, Worrell SG, Fitzgibbons RJ Jr, et al. Incidence of diaphragmatic hernias following minimally invasive versus open transthoracic Ivor Lewis McKeown esophagectomy. Hernia 2012;16:185-90.
11. Price TN, Allen MS, Nichols FC 3rd, et al. Hiatal hernia after esophagectomy: analysis of 2,182 esophagectomies from a single institution. Ann Thorac Surg 2011;92:2041-5.
12. Shapiro J, van Lanschot JJB, Hulshof MCCM, et al. Neoadjuvant chemoradiotherapy plus surgery versus

surgery alone for oesophageal or junctional cancer (CROSS): long-term results of a randomised controlled trial. Lancet Oncol 2015;16:1090-8.
13. Vallböhmer D, Hölscher AH, Herbold T, et al. Diaphragmatic hernia after conventional or laparoscopic-assisted transthoracic esophagectomy. Ann Thorac Surg 2007;84:1847-52.
14. Oor JE, Wiezer MJ, Hazebroek EJ. Hiatal Hernia After Open versus Minimally Invasive Esophagectomy: A Systematic Review and Meta-analysis. Ann Surg Oncol 2016;23:2690-8.
15. Barbier PA, Luder PJ, Schüpfer G, et al. Quality of life and patterns of recurrence following transhiatal esophagectomy for cancer: results of a prospective follow-up in 50 patients. World J Surg 1988;12:270-6.
16. Choi YU, North JH Jr. Diaphragmatic hernia after Ivor-Lewis esophagectomy manifested as lower gastrointestinal bleeding. Am Surg 2001;67:30-2.
17. Luketich JD, Alvelo-Rivera M, Buenaventura PO, et al. Minimally invasive esophagectomy: outcomes in 222 patients. Ann Surg 2003;238:486-94; discussion 494-5.
18. Hölscher AH, Schneider PM, Gutschow C, et al. Laparoscopic ischemic conditioning of the stomach for esophageal replacement. Ann Surg 2007;245:241-6.
19. Laxa BU, Harold KL, Jaroszewski DE. Minimally Invasive Esophagectomy: Esophagogastric Anastomosis Using the Transoral Orvil for the End-to-Side Ivor-Lewis Technique. Innovations (Phila) 2009;4:319-25.
20. Kim T, Grobmyer SR, Smith R, et al. Esophageal cancer--the five year survivors. J Surg Oncol 2011;103:179-83.
21. Ganeshan DM, Bhosale P, Munden RF, et al. Diaphragmatic hernia after esophagectomy for esophageal malignancy. J Thorac Imaging 2013;28:308-14.
22. Brenkman HJ, Parry K, Noble F, et al. Hiatal Hernia After Esophagectomy for Cancer. Ann Thorac Surg 2017;103:1055-62.
23. DeMeester SR. Invited Commentary. Ann Thorac Surg 2015;100:269-70.
24. Erkmen CP, Raman V, Ghushe ND, et al. Laparoscopic repair of hiatal hernia after esophagectomy. J Gastrointest Surg 2013;17:1370-4.
25. Marchesi F, Dalmonte G, Morini A, et al. Laparoscopic repair of a giant hiatal hernia after minimally invasive oesophagectomy. Ann R Coll Surg Engl 2020;102:e130-2.
26. Narayanan S, Sanders RL, Herlitz G, et al. Treatment of Diaphragmatic Hernia Occurring After Transhiatal Esophagectomy. Ann Surg Oncol 2015;22:3681-6.
27. Müller-Stich BP, Kenngott HG, Gondan M, et al. Use of Mesh in Laparoscopic Paraesophageal Hernia Repair: A Meta-Analysis and Risk-Benefit Analysis. PLoS One 2015;10:e0139547.
28. Watson DI, Thompson SK, Devitt PG, et al. Laparoscopic repair of very large hiatus hernia with sutures versus absorbable mesh versus nonabsorbable mesh: a randomized controlled trial. Ann Surg 2015;261:282-9.

doi: 10.21037/ls-20-134
Cite this article as: D'Orazio B, Ledent P, Farinella E. Laparoscopic repair of giant diaphragmatic hernia after minimal invasive esophagectomy: a case report and review of the literature. Laparosc Surg 2022;6:9.