Hybrid (Laparoscopy—Thoracotomy) Esophagectomy

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Abstract

The hybrid esophagectomy combines a laparoscopic approach for preparation of the gastric conduit and lymphadenectomy, followed by a right muscle sparing thoracotomy for resection of the esophagus, gastric pull-up, and esophago-gastric anastomosis. In this chapter, we will review the critical surgical steps for the operation.

Keywords

Esophageal cancer · Esophagectomy · Laparoscopy · Thoracotomy · Hybrid esophagectomy

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Introduction

The hybrid esophagectomy combines a laparoscopic approach for preparation of the gastric conduit and lymphadenectomy, followed by a right muscle sparing thoracotomy for resection of the esophagus, gastric pull-up, and esophago-gastric anastomosis. This technique offers a safe and effective approach for the surgical treatment of esophageal cancer [1–8].

Surgical Technique

The hybrid esophagectomy combines a laparoscopic approach for preparation of the gastric conduit and lymphadenectomy, followed by a right muscle sparing thoracotomy for resection of the esophagus, gastric pull-up, and esophago-gastric anastomosis. Before starting the operation, the anesthesiologist places an epidural catheter, a double lumen endotracheal tube, and an arterial catheter.

Laparoscopic Phase

The patient is placed over an inflated beanbag and the legs are extended on stirrups with the knee flexed 20 to 30°. Pneumatic compressions stockings are used as prophylaxis against deep vein thrombosis. The surgeon stands between

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the patient's legs, with one assistant on the patient's right side and another on the patient's left side. If the surgeon is right-handed, the scrub nurse will stand over the patient's left foot (Fig. 1).

Five trocars are used for the operation. Port A is placed in the midline, about 18 cm below the xiphoid process, and it is used for the insertion of a 30° scope. Ports B and C are placed about 1 inch below the right and left costal margins (forming an angle of about 120°) and are used for dissection. Port D is placed at the level of port A in the right mid-clavicular line, and it is used for the liver retractor. Port E is placed at the level of port A in the left mid-clavicular line, and it is used for a Babcock clamp, for insertion of a bipolar instrument to take down the short gastric vessels, and for insertion of a stapling device to transect the coronary vein and the left gastric artery. If a pyloroplasty is performed, an additional port is placed in between ports A and D, usually about 2 inches below them (Fig. 2).

The dissection is started by identifying the right gastroepiploic artery and opening the gastro-colic omentum (Fig. 3). The dissection is then continued taking down all the short gastric vessels all the way to the left pillar of the crus, which is then separated from the esophagus. The gastro-hepatic ligament is then divided respecting the right gastric artery. The esophagus is separated from the right pillar of the crus. The phreno-esophageal membrane is then divided, and dissection of the esophagus is performed in the posterior mediastinum for about 2 inches. A window is created between the esophagus, the left pillar of the crus and the stomach, and a Penrose drain is passed around the esophagus and pushed as high as possible. The drain will help with the thoracic dissection, and it will be retrieved from the chest.

The coronary vein and the left gastric artery are dissected all the way to their base in order to retrieve as many lymph nodes as possible (Fig. 4), and then are transected using a laparoscopic stapler with a vascular cartridge (Fig. 5). Upon completion of this step, the blood supply of the stomach is based on the right gastric and right gastroepiploic arteries. Posterior adhesions between the posterior wall of the stomach and the pancreas are then taken down using the cautery. We do not perform a Kocher maneuver.

After a final inspection, the trocars are removed, the trocars sites are closed, local anesthesia is injected, and sterile dressings are applied.

Thoracic Phase

After the laparoscopic component of the operation is completed, the patient is positioned in a left lateral decubitus. The chest is entered through a muscle sparing thoracotomy in the fifth intercostal space (Fig. 6). Resection of a 1.5-cm long segment of the posterior portion of the 6th rib facilitates the positioning of a retractor to achieve the optimal exposure of the surgical field. Initially, the inferior pulmonary ligament is divided, and the pleura is opened above and below the azygous vein. An Endo-GIA linear stapler with a vascular cartridge is used to divide the azygous vein (Fig. 7). Then, the dissection of the esophagus and surrounding lymph nodes is performed beginning about 3 cm above the azygous vein all the way down to the gastroesophageal junction, thus joining the mediastinal dissection previously performed by laparoscopy. The stomach is pulled up into the chest, a window is opened along the lesser curvature about 8 cm below the gastroesophageal junction, and transection of the upper portion of the stomach along the lesser curvature is performed with multiple fires of an Endo-GIA stapler. After the gastric conduit is created, 5 mg of indocyanine green (ICG) are injected intravenously as a bolus in order to assess the adequate perfusion of the conduit with fluorescence imaging (Fig. 8).

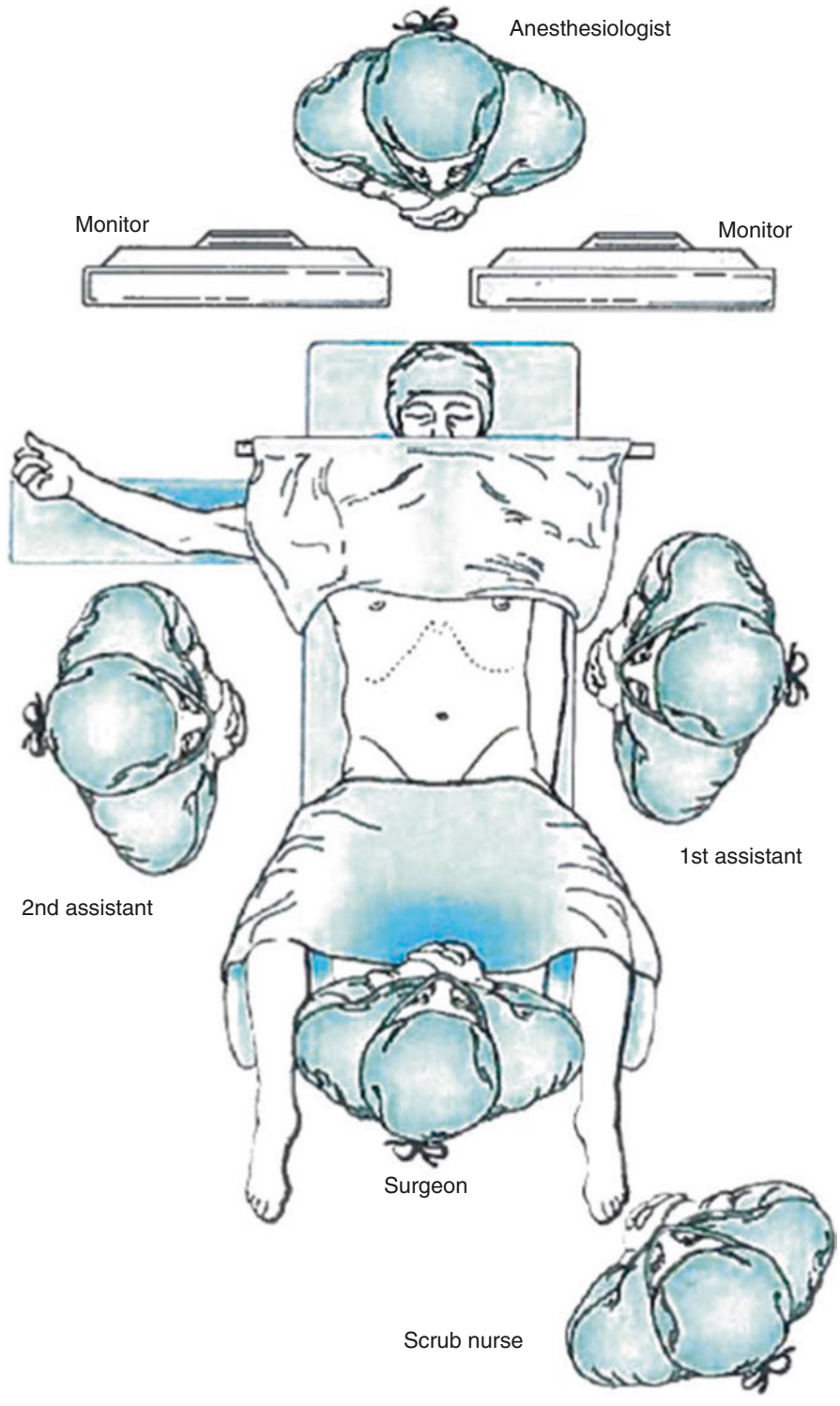

Fig. 1 Position of the operating team. Reproduced with permission from Atlas of Esophageal Surgery, P. Marco Fisichella, Marco G. Patti editors, Springer

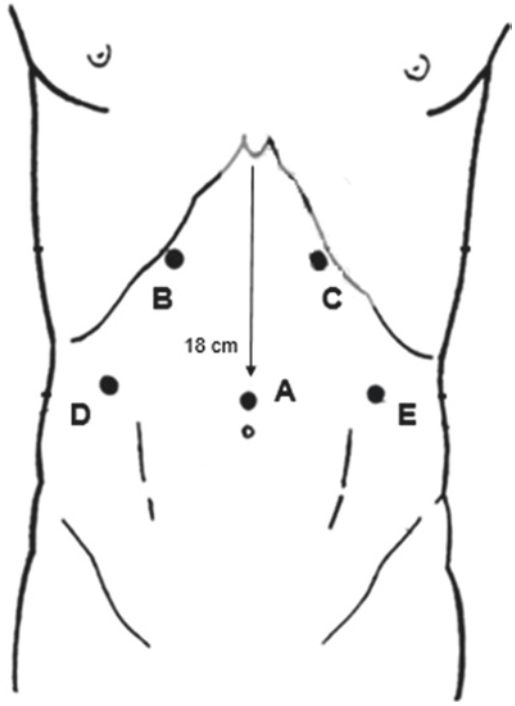

Fig. 2 Placement of abdominal ports

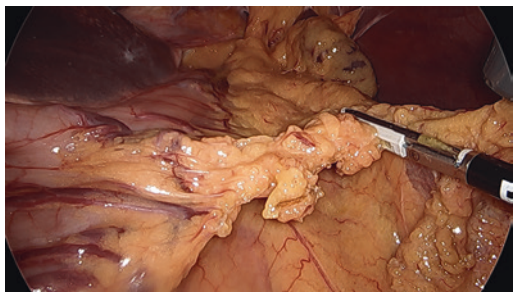

Fig. 3 Dissection along the greater curvature of the stomach

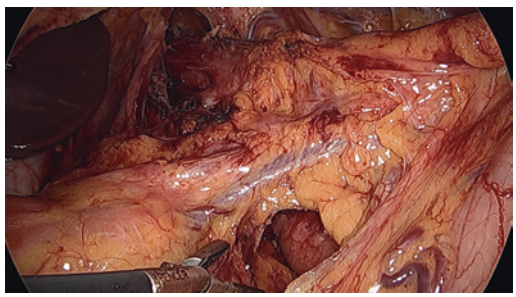

Fig. 4 The coronary vein and left gastric artery are dissected all the way to their base

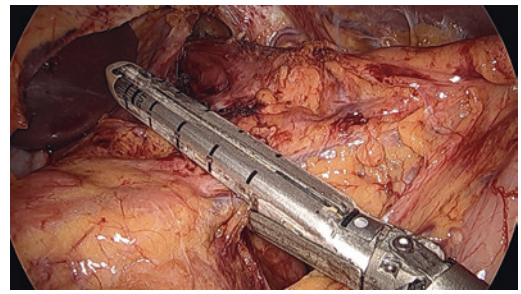

Fig. 5 An Endo GIA™ stapler (Covidien, Minneapolis MN) with a 45-mm vascular cartridge is used for the transection of the coronary vein and left gastric artery

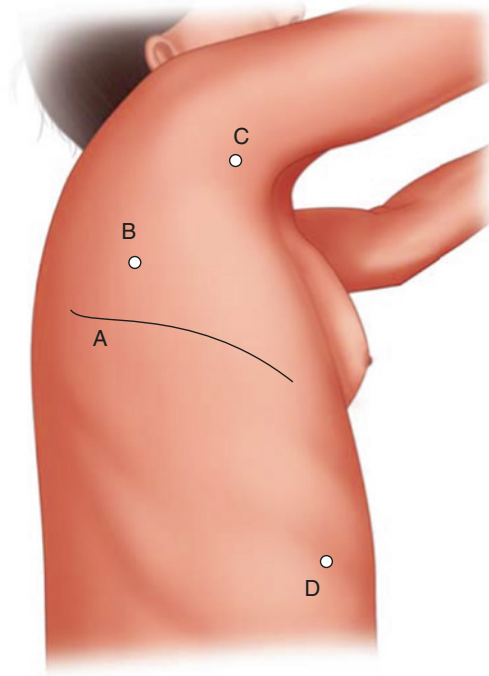

Fig. 6 Position of patient for right thoracotomy. **a** Thoracotomy in 5th intercostal space. **b** Inferior angle of scapula. **c** Posterior axillary line. **d** Port for *Ligasure* dissection and chest tube in 8th or 9th intercostal space, anterior to anterior iliac spine

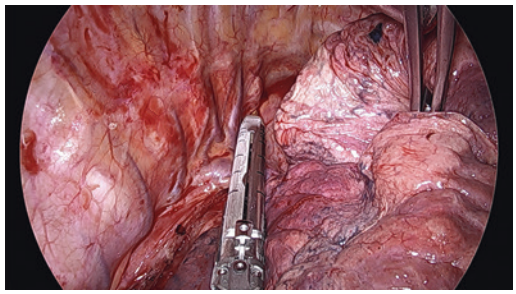

Fig. 7 Division of azygous vein with an Endo GIA™ stapler (Covidien, Minneapolis MN) with a 45-mm vascular cartridge

Intrathoracic Anastomosis

The esophagus is placed over the anterior wall of the stomach, clamped with a Satinsky clamp to avoid separation of the mucosa from the muscular layers, and transected about 3 cm above the azygous vein (Fig. 9). Full-thickness 3-0 silk stay sutures are placed to keep the posterior wall of the esophagus aligned with the anterior wall of the gastric fundus. Sliding of the esophageal mucosa when the stapler is inserted is avoided by placing 3-0 silk stay sutures at the four edges of the esophageal opening that keep together the mucosa with the other layers of the esophageal wall (Fig. 10). The anterior wall of the stomach is opened just distal to the esophageal transection line and interrupted 3-0 silk stiches are used to fix the gastrotomy to the posterior wall of the esophagus. After inserting the thinner branch of a 45 mm Endo-GIA stapler into the stomach and the thicker branch into the esophagus, the stapler is fired, thus constructing a 4 cm long side-to-side anastomosis between the posterior wall of the esophagus and the anterior wall of the stomach (Fig. 11). A nasogastric tube is passed under direct vision into the stomach so that the tip is above the diaphragm. The closure of the anterior aspect of the anastomosis is obtained in two layers: an inner layer of running 3-0 absorbable suture, followed by an outer layer of interrupted 3-0 silk sutures (Fig. 12).

One chest tube is placed, and after direct visual evaluation of the expansion of the lung, the thoracotomy is closed in layers.

Postoperative Course

The patient is extubated in the operating room and transferred to the intensive care unit. Liquid diet is often started on postoperative day 4 and advanced as per tolerance. Patients are usually discharged on postoperative day 7–10.

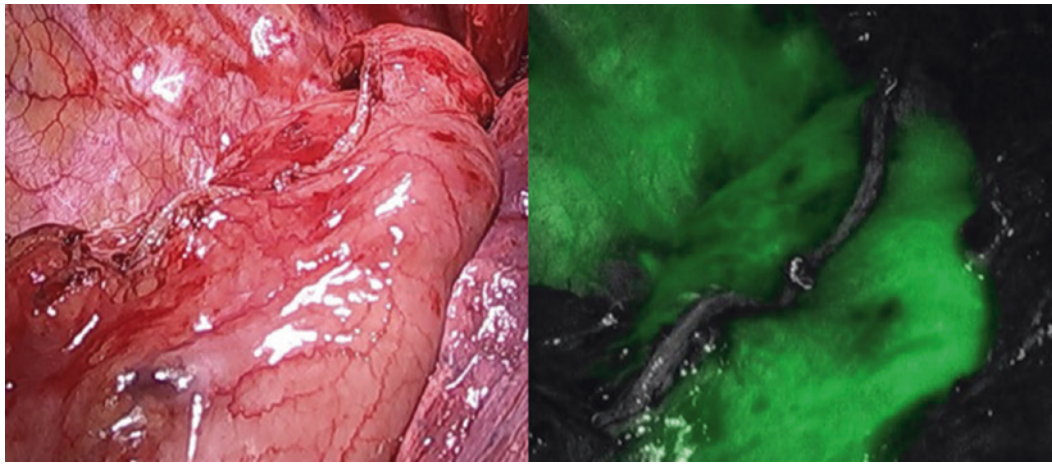

Fig. 8 Perfusion assessment of the gastric conduit with ICG fluorescence imaging

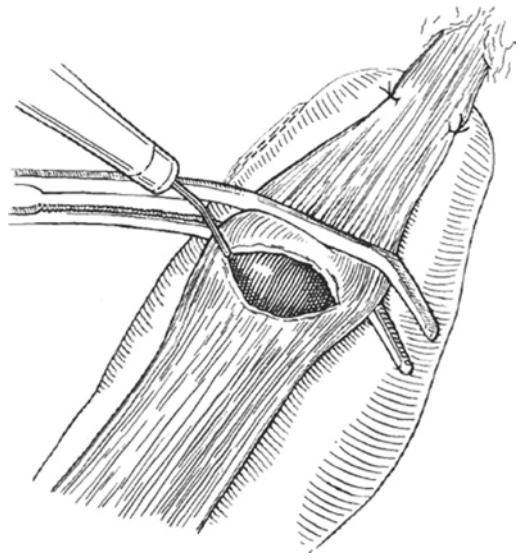

Fig. 9 Transection of the esophagus with electrocautery. The Satinsky clamp is key to avoid separating the mucosa from the muscle layers. Reproduced with permission from Atlas of Esophageal Surgery, P. Marco Fisichella, Marco G. Patti editors, Springer

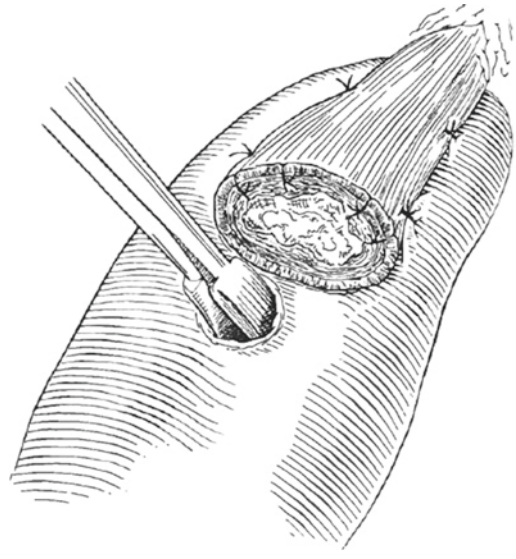

Fig. 10 Placement of stay sutures laterally and anteriorly in the esophagus to avoid sliding of the mucosa when the stapler is inserted. Reproduced with permission from Atlas of Esophageal Surgery, P. Marco Fisichella, Marco G. Patti editors, Springer

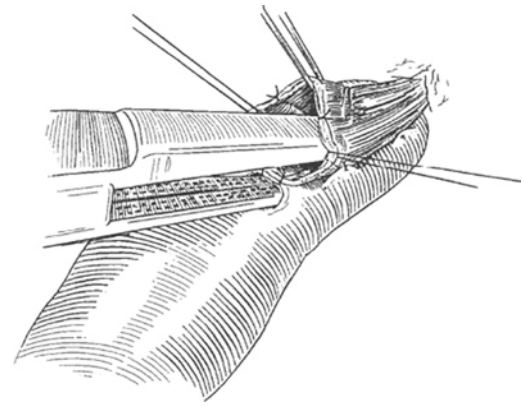

Fig. 11 Insertion of the stapler, with the thinner arm into the stomach and the thicker arm into the esophagus. Reproduced with permission from Atlas of Esophageal Surgery, P. Marco Fisichella, Marco G. Patti editors, Springer

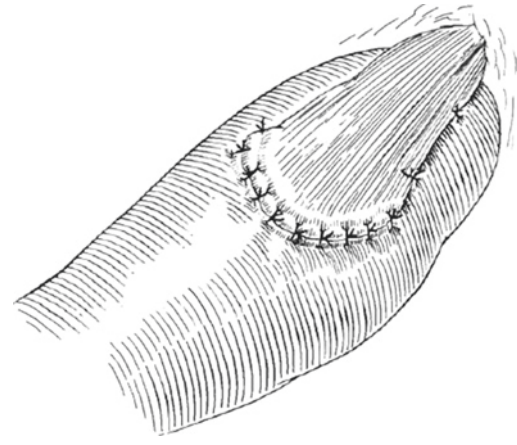

Fig. 12 Closure of the anterior aspect of the anastomosis. Reproduced with permission from Atlas of Esophageal Surgery, P. Marco Fisichella, Marco G. Patti editors, Springer

References

1. Allaix ME, Herbella FA, Patti MG. Hybrid trans-thoracic esophagectomy with side-to-side stapled intrathoracic esophagogastric anastomosis for esophageal cancer. J Gastrointest Surg. 2013;17:1972–9.
2. Nagpal K, Ahmed K, Vats A, et al. Is minimally invasive surgery beneficial in the management of esophageal cancer? A meta-analysis. Surg Endosc. 2010;24:1621–9.
3. Bierre SS, van Berge Henegouwen MI, Maas KW, et al. Minimally invasive versus open

oesophagectomy for patients with esophageal cancer: a multi centre, open-label, randomized controlled trial. Lancet. 2012;379:1887–92.
4. Mariette C, Meunier B, Pezet D, et al. Hybrid mini-invasive versus open oesophagectomy for patients with oesophageal cancer: a multicenter open-label, randomized phase III controlled trial. The MIRO trial. J Clin Oncol. 2015;33(suppl 3; abstr 5).
5. Messager M, Pasquer A, Duhamel A, et al. Laparoscopic gastric mobilization reduces postoperative mortality after esophageal cancer surgery. A French nationwide study. Ann Surg. 2015;262:817–23.
6. Mariette C, Markar SR, Dabakuyo-Yonli TS, et al. Hybrid minimally invasive esophagectomy for esophageal cancer. N Engl J Med. 2019;380(2):152–62.
7. Nuytens F, Dabakuyo-Yonli TS, Meunier B, et al. Five-year survival outcomes of hybrid minimally invasive esophagectomy in esophageal cancer: results of the MIRO randomized clinical trial. JAMA Surg. 2021;156(4):323–32.
8. van Workum F, Klarenbeek BR, Baranov N, Rovers MM, Rosman C. Totally minimally invasive esophagectomy versus hybrid minimally invasive esophagectomy: systematic review and meta-analysis. Dis Esophagus. 2020;33(8):doaa021.