

# Combined thoracoscopic and laparoscopic esophagectomy: experience, technique and cautions

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## ABSTRACT

We described a 59-year-old female, who came to our institute with the diagnosis of esophageal squamous cell carcinoma. The preoperative clinical diagnosis was stage II esophageal squamous cell carcinoma. The three-stage minimally invasive esophagectomy (MIE), combined thoracoscopic-laparoscopic esophagectomy with cervical anastomosis, was performed in this case. The lateral-prone decubitus position and Harmonic scalpel facilitate the operation.

## KEYWORDS

Minimally invasive esophagectomy (MIE); thoracoscopic; laparoscopic

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## Introduction

Open approaches to esophagectomy continue to have high morbidity and mortality rates, and efforts to decrease the incidence of complications have stimulated interest in minimally invasive esophagectomy (MIE) (1). First reported in 1995, MIE failed to gain widespread acceptance in part due to its technically challenging nature and a lack of strong evidence for improved morbidity and mortality (2). MIE has become increasingly used and accepted, with reported outcomes comparable with those of open approaches (3). In patients with esophageal cancer, MIE can be used to minimize surgical invasiveness, provide a better operative field and reduce peri-operative complications. Compared with conventional open esophagectomy (OE), MIE is believed to reduce blood loss and shorten hospital stays. The surgical techniques used can be thoracoscopic, laparoscopic, or both (4-6). This paper presents the principal steps of three-stage MIE: combined thoracoscopic-laparoscopic esophagectomy with cervical anastomosis.

## Case report

A 59-year-old female presented with dysphagia was admitted in our institute on April 8, 2013. Gastroscopic examination

showed a tumor with irregular erosion (26-29 cm to cutting teeth). Histological examination of the biopsy specimens led to a diagnosis of moderately differentiated squamous cell carcinoma. The patient underwent preoperative staging and pulmonary function assessment. The preoperative workup was standardized for the staging and consisted of barium swallow, enhancement CT scanning of the thorax and the abdomen and bone scintigraphy. The preoperative clinical diagnosis was stage II esophageal squamous cell carcinoma. Lung function was assessed via formal spirometry with a FEV1 of 1.89 and a MVV of 79%.

## The first stage: video-assisted thoracic surgery (VATS) technique

During VATS, the operation was performed under double-lumen intubation. Briefly, the patient was placed in the left lateral-prone position (lean forward 30°), and the right lung was collapsed during the thoracic procedure. Four trocars were inserted [a 30° 10-mm thoracoscope was inserted through a 12-mm port in the seventh/eighth intercostal space (ICS) on the middle axillary line (AL); two main operating ports (5-mm) were placed in the third/fourth and fifth/sixth ICS on the anterior AL; the adjuvant operating port (12 mm) was placed in the sixth/seventh ICS on the subscapular angle line]. Carbon dioxide (CO<sub>2</sub>) was insufflated at a pressure of 3-5 mmHg for retracting the right lung and stretching the mediastinum.

The surgeon stood at the patient's left side, and the first assistant and camera operator at the patient's right. Esophageal mobilization and dissection was performed essentially in the same manner as in open surgery. The location of the esophageal tumor was confirmed by CT scan, upper gastrointestinal

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**Video 1.** Video-assisted thoracic surgery, esophageal mobilization and lymph nodes dissection.



**Video 2.** Laparoscopic surgery gastric mobilization and lymph nodes dissection.

radiography and gastroscopy. The lung was oppressed laterally by operator with a suction apparatus.

It began with cauterizing the mediastinal pleura near the tumor of the esophagus. The esophagus was circumferentially mobilized from the esophageal hiatus up to the thoracic inlet. Paraesophageal lymph nodes, including subcarinal lymph nodes, lymph nodes along right and left recurrent laryngeal nerve, *etc.* were dissected routinely during the operation. Arch of azygos vein was isolated and divided with endoscopic stapler. During the dissection of subcarinal lymph nodes and lymph nodes along right and left recurrent laryngeal nerve, in order to avoid thermal injury, the surgeon must take great care to maintain some distance between the dissection plane and the airway, right and left recurrent laryngeal nerve when using the ultrasonic shears. The operator could use the thoracoscopic suction to maintain a clear surgical field in this dissection. After esophageal

mobilization and paraesophageal lymph nodes dissection, a thorax tube was placed for drainage of the chest (Video 1).

### The second stage: laparoscopic surgery technique

During laparoscopic surgery, the patient was placed in a supine position (the reverse Trendelenburg position, 30°). Five trocars were inserted. A midline 12-mm camera port was placed below the umbilicus. Peritoneal distention was accomplished with standard CO<sub>2</sub> insufflation (at a pressure of 11-13 mmHg). A standard 10-mm, 30-degree laparoscope was used for the initial inspection of the peritoneal cavity and port placement. A 12-mm port (main operating port) was placed to approximately 4 cm above the umbilicus beside the right margin of right rectus abdominis. A 5-mm port (main operating port) was placed approximately 2 cm below the right costal margin on midclavicular line. A 10-mm port (adjuvant operating port) was placed approximately 2 cm above the umbilicus on the left midclavicular line. A 5-mm port (adjuvant operating port) was placed at the left costal margin on anterior AL.

The surgeon and camera operator stood at the patient's right side, and the first assistant at the patient's left. The entire greater curvature of the stomach was mobilized by dividing the gastrocolic ligament with the Harmonic scalpel, preserving the right gastroepiploic vessels. The short and posterior gastric vessels were then divided along the greater curvature of the stomach with the Harmonic scalpel. The left gastric vessels were isolated and divided with the Harmonic scalpel before doubled-ligated with hemoclips. The lesser omentum was then incised, and the esophageal hiatus was isolated with the Harmonic scalpel. Lymph nodes around the left gastric vessels, common hepatic vessels and celiac trunk were dissected during division of left gastric vessels with the Harmonic scalpel (Video 2).

### The third stage: anastomosis technique

A 3-5-cm incision was made on the left neck and the cervical esophagus was isolated and divided. Then a midline 3-5-cm incision was made below the xiphoid. The distal stump of the esophagus was divided from the cervical esophagus and sutured with two #10 silk sutures, and the dissected mediastinal tissue were then extracted from the thorax outside of the abdomen. A 28-42-cm gastric conduit (width 3-4 cm) was then formed with multiple applications of the linear stapler along the lesser curvature from the right gastric vessels to gastric fundus. The gastric conduit and a tube were pulled up through the posterior mediastinum. The anastomosis was completed by joining the anvil with the 24-mm end-to-end anastomosis stapler inserted through a gastrotomy at the tip of the gastric conduit. A nasogastric tube and nasointestinal tube were then passed into the gastric conduit and duodenum. The gastrotomy was then



**Video 3.** Gastric conduit formation and cervical esophagogastrostomy.

resected with one linear stapler. The mediastinal and abdominal tube was placed for drainage of the mediastinum and abdomen (Video 3).

### Comments

We have described the practical aspects of the three-stage MIE. In VATS, the patient was placed in the left lateral-prone decubitus position (lean forward 30°). The left lateral decubitus position is preferable for lymphadenectomy along the left recurrent laryngeal nerve and facilitates conversion to thoracotomy (7). The prone position enables excellent exposure of the operative field, particularly in the region of the middle to lower mediastinum, and provides the surgeon with superior ergonomics (8,9). The lateral-prone decubitus position with patient in two different positions facilitates a more radical mediastinal lymphadenectomy and improves disease control (10). The small incision below the xiphoid helps the formation of gastric conduit and lowers the cost. Harmonic scalpel could have functions as electric knife, pliers and gripper at the same time. The adoption of Harmonic scalpel effectively avoids time wasting and intraoperative bleeding, especially for those with rich vascularity. The advantages of adoption of Harmonic scalpel in the dissection of lymph nodes include effective of lymphatic vessels and significant reduction of postoperative drainage as we previously described (11).

In addition to the lateral-prone decubitus position and Harmonic scalpel, our experience also including the following:

- (I) In VATS, one gauze is used to guide the mobilization of esophagus rather than pulling esophagus with traction belt, which be named esophagus mobilization guided with gauze by us;
- (II) CO<sub>2</sub> pressure of pneumothorax at 3-5 mmHg could retract the right lung and stretch the mediastinum and

- avoid serious acidosis;
- (III) Suction apparatus in operator's left hand and Harmonic scalpel in the right hand facilitate the mobilization of esophagus;
- (IV) The thoracic duct could be seen during the isolation of the esophagus, especially above the arch of azygos vein. We should keep it uncontact, but must ligate it double with hemoclips above the diaphragm and the local damage if damaged;
- (V) In laparoscopic surgery, retraction of liver by a private apparatus is not necessary;
- (VI) The blood in gastric conduit is discharged before the gastric conduit is pulled up to the left neck in order to decrease the damage to gastric wall and postoperative fistula;
- (VII) Two #10 silks can be used to pull up the gastric conduit to the left neck;

Our experience and the available data from the literature demonstrates that combined thoracoscopic-laparoscopic esophagectomy with cervical anastomosis is a well defined and standardized surgical technique which may be used to treat esophageal carcinoma.

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