Clinical data

A 51-year-old man was admitted to our hospital with a 1-week history of progressive dysphagia with solid food. He did not complain of retrosternal pain, gastroesophageal reflux or weight loss. Esophagogastroduodenoscopy identified a 3-cm mass in the esophageal lumen approximately 35 cm from the incisors, which was diagnosed as squamous cell carcinoma by endoscopic biopsy. Computed tomography (CT) of the chest and the abdomen revealed a thick wall around the distal thoracic esophagus with no metastases in the liver or lung, and the lymph nodes were negative (Figure 1). Barium swallow demonstrated a filling defect in the lumen of the distal third of the esophagus. Physical examination revealed no abnormalities. His cardiopulmonary function and laboratory tests were normal. He had no medical history.

Operation steps

Anesthesia and body position

Abdominal phase

After the general anesthesia and double-lumen endotracheal intubation, the patient was placed in a supine position (Figure 2).

Thoracic phase

Once the abdominal phase was completed, the patient was positioned in the left lateral decubitus position, and tilted 45° towards the prone position under double-lumen endotracheal intubation (Figure 3).
Ports

Abdominal phase
Abdominal ports: the five-port method was used. The subumbilical port was used for observation (12-mm trocar), the #1 robotic arm was placed on the left anterior axillary line under the costal arch (8-mm trocar), the #2 robotic arm was placed on the right anterior axillary line at the umbilical level (8-mm trocar), and the manual operative port was placed on the right mid clavicular line at 3 cm under the costal arch (12-mm trocar). An auxiliary port was placed on the left anterior axillary line at the umbilical level (8-mm trocar) (Figure 4).

Thoracic phase
Thoracic ports: the five-port method was used. The observation port was placed on the right anterior axillary line at the 5th intercostal space (12-mm trocar), the #1 robotic arm was placed on right posterior axillary line at the 3th intercostal level (8-mm trocar), the #2 robotic arm was placed on the right posterior axillary line at 8th intercostal space (8-mm trocar), and the manual operative ports were placed on the right posterior axillary line at the 10th (5-mm trocar), and an auxiliary port were placed on the right
Figure 4 Ports for abdominal phase.

Figure 5 Ports for thoracic phase (3th, 5th, 7th, 8th, 10th ICS). ICS, ICS, intercostal space.

Figure 6 The liver was suspended with a purse string suture.

Figure 7 A radical en bloc lymphadenectomy was performed along the common hepatic artery, celiac trunk, and origin of the splenic artery.

Figure 8 The left gastric vessels were dissected and interrupted, and the surrounding lymph nodes were removed.

The anterior axillary line at 7th intercostal spaces (12-mm trocar) (Figure 5).

Installation of the surgical arms

Abdominal phase
The #2 arm was connected to a bipolar cautery forceps, and the #1 arm was connected to an ultrasound knife.

Thoracic phase
The robot was positioned on the dorsal cranial side, with two assistants on the anterior side. The #2 arm was connected to a bipolar cautery forceps, and the #1 arm was
connected to a unipolar cautery hook.

**Surgical procedure**

**Abdominal phase**

See Figures 6-12.

**Thoracic phase**

See Figures 13-22.

**Postoperative condition**

Postoperative treatments included anti-inflammatory
medication, enteral nutrition and phlegm-resolving treatment. The chest cavity drainage tube was withdrawn after 2 days and the liquid diet was started on postoperative day 6. The patient was discharged on postoperative day 8 and tolerated a semi-liquid diet. No complications were observed during hospitalization. Pathologic diagnosis was squamous cell carcinoma infiltrating into the submucosa of the esophagus. All lymph nodes were negative. Postoperative pathologic stage was pT1N0M0 (IA squamous cell carcinoma).

**Discussion**

Surgery is currently the main treatment for esophageal cancer (1). Esophagectomy is technically challenging and is associated with high morbidity and mortality rates. Efforts to reduce these rates have spurred the adoption of minimally invasive techniques (2). But the conventional video-assisted surgery has some limitations such as the two-dimensional view or movement restrictions which could make a complex procedure such as esophagectomy difficult.
Robotic systems have been designed to overcome some of these disadvantages which could provide an amplified three-dimensional view and a greater freedom of movement (3). Most of the published reports on robotic esophagectomy describe two types of anastomosis including cervical or intrathoracic anastomosis that are created by using the suturing technique (4,5). Here we report the robot-assisted Ivor Lewis esophagectomy with intrathoracic stapled anastomosis. Our initial results suggest that the robotic-assisted surgical technique is safe and satisfies the oncological principles. However, the potential of the da Vinci system remains to be proven in future clinical trials.

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None.

**Footnote**

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

*Informed Consent:* Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

**References**


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