Case Report

Robotic-assisted McKeown esophagectomy

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Abstract: A patient with a history of dysphagia for 3 months was diagnosed as upper esophageal cancer by gastroscopy. After sufficient preoperative preparation, the patient underwent esophagectomy of McKeown procedure by Robotic-assisted approach. The five-port method was used in both thoracic and abdominal part. A jejunostomy tube was placed for enteral nutrition. At last, a cervical esophagogastric anastomosis was performed. No complications occurred during the 6-day postoperative hospitalization. The TNM stage was T3N0M0, stage IIA.

Keywords: Robotic-assisted surgery; esophageal cancer; esophagectomy

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Clinical data

The patient was a 53-year-old woman with a history of dysphagia for 3 months without nausea, vomiting, hematemesis, or stomachache. A protruding mass was detected 25–30 cm from the incisors by gastroscopy. The pathological biopsy result was esophageal squamous cancer. The patient lost 5 kg without anorexia. A physical examination showed no positive sign, and results of preoperative biochemical tests were all normal. Enhanced computed tomography (CT) scan revealed a thickened upper esophagus wall and enlarged lymph node in the superior mediastinum (*Figure 1*). Informed consent for robotic-assisted thoracic lobectomy was obtained from patient before operation.

Operating steps

Anesthesia and position

After general anesthesia, the patient was placed in a left lateral decubitus position with left one-lung ventilation in thoracic part (*Figure 2*). Supine position with two-lung ventilation in the abdominal part (*Figure 3*).

Ports

Abdominal ports (*Figure 4*): 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).

Thoracic ports (*Figure 5*): 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 axillary port were placed on the right anterior axillary line at 7th intercostal spaces (12-mm trocar).

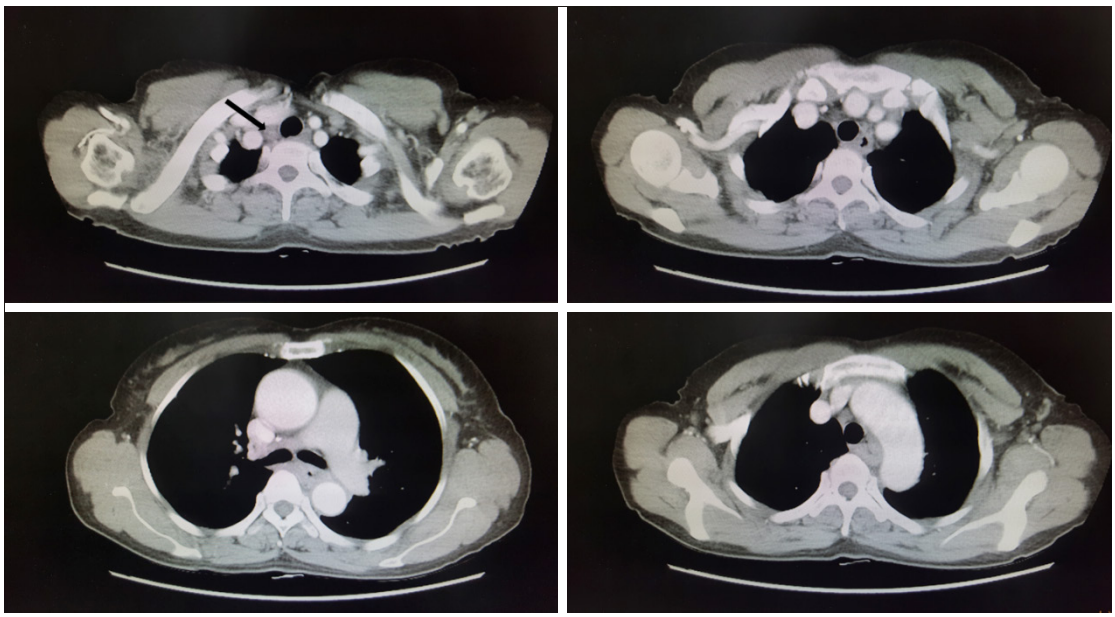

Figure 1 Enhanced CT scan. The black arrow indicates an enlarged lymph node beside the right recurrent laryngeal nerve.

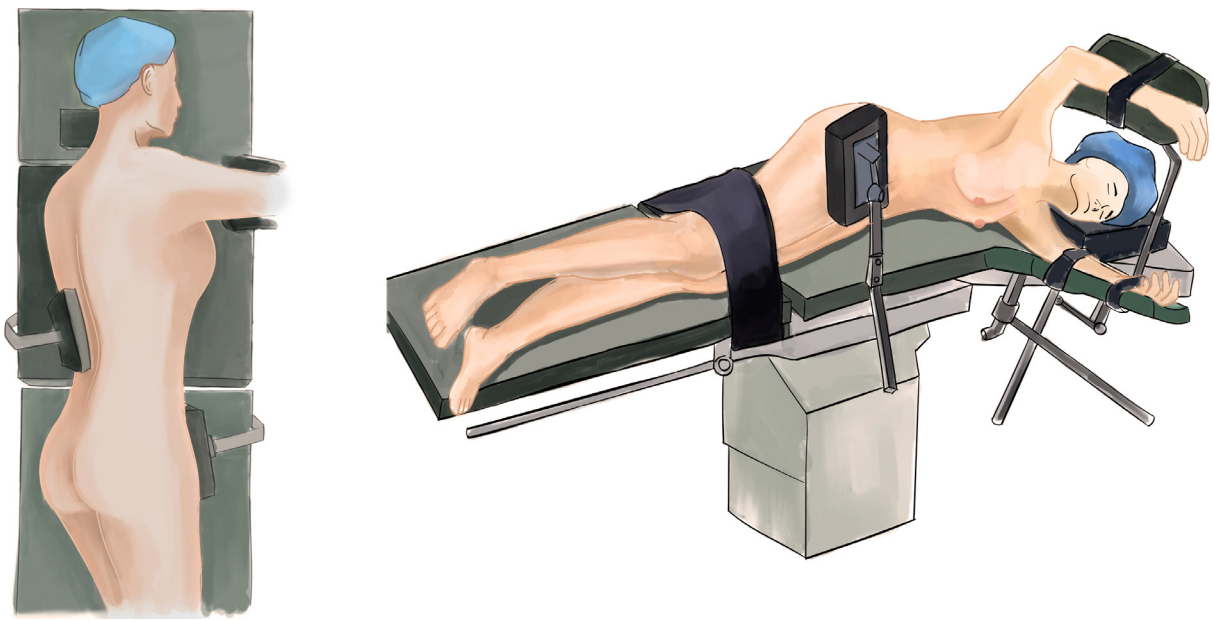

Figure 2 Left lateral decubitus and Jackknife position.

Docking the robotic arms

The robotic arms were docked through the operation table overhead, the #1 robotic arm was connected to a bipolar electric coagulation forceps, and the #2 robotic arm was connected to a hook electrode. A lap-protector was used to avoid incision infection.

Surgical procedures

See *Figures 6-23*.

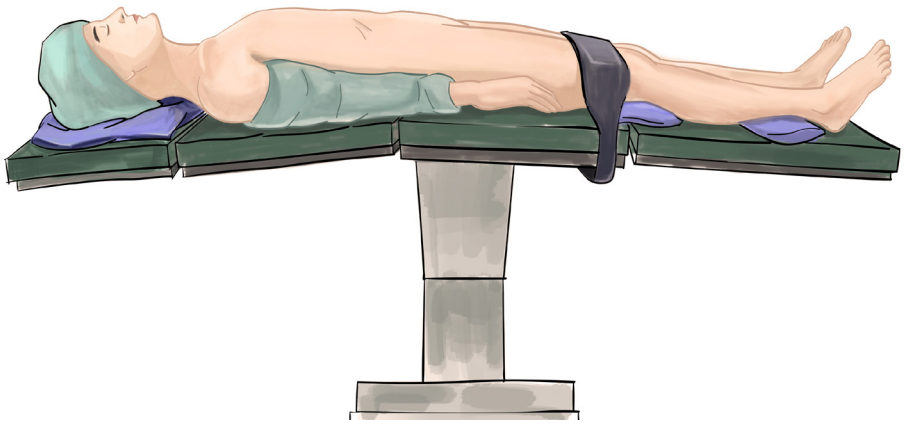

Figure 3 Supine position.

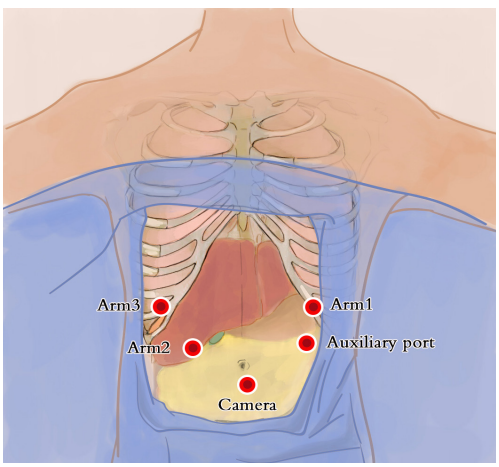

Figure 4 Ports for abdominal phase.

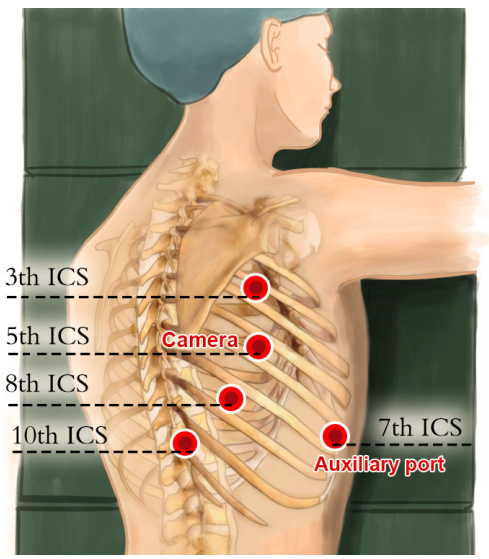

Figure 5 Ports for thoracic phase (3th, 5th, 7th, 8th,10th ICS). ICS, intercostal space.

Postoperative results

The chest tube was removed on the second day postoperative day, and the patient was discharged on the sixth day postoperative day. No complications occurred during hospitalization. Pathologic diagnosis was esophageal squamous cancer (TNM stage was T3N0M0, stage IIA).

Comment

The first robotic-assisted minimally invasive esophagectomy (RAMIE) in the world was reported in 2003 by Dr. Horgan (1). Previously, research focused on RAMIE was limited because of the operative difficulties of minimally invasive esophagectomy, and the McKeown approach was the most widely adopted RAMIE approach. In 2010, Dr. Kim reported 21 cases of RAMIE to verify the feasibility and safety of the McKeown approach (2). In 2014, van der Sluis analyzed the clinical data of 108 patients who underwent RAMIE using the Mckeown approach. The

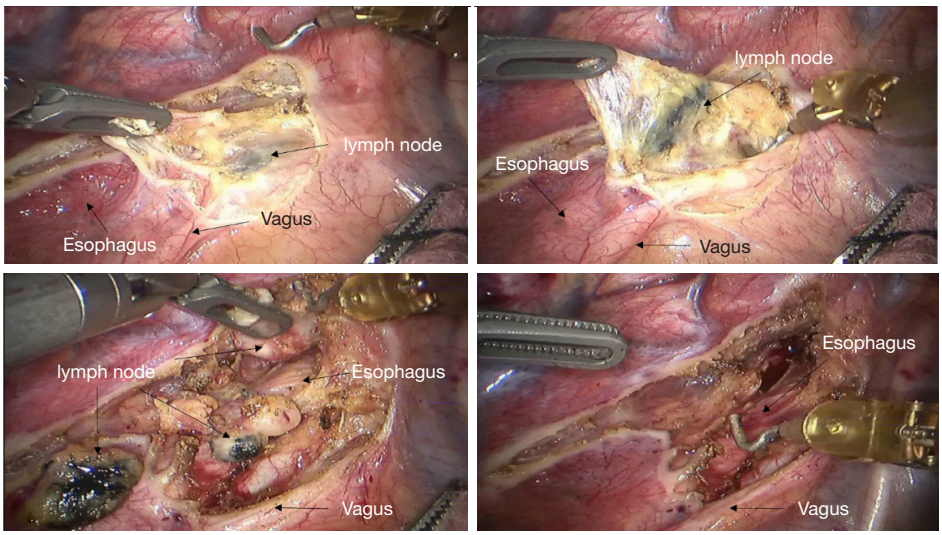

Figure 6 The lymph nodes around the right recurrent laryngeal nerve was dissected.

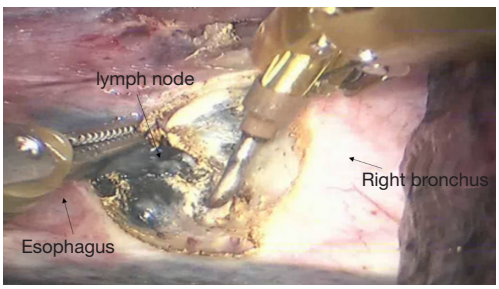

Figure 7 The subcarinal lymph nodes was dissected.

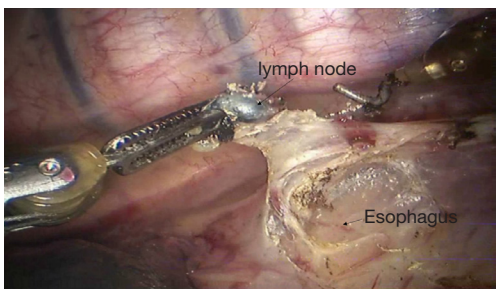

Figure 8 The lymph nodes around lower esophagus were dissected.

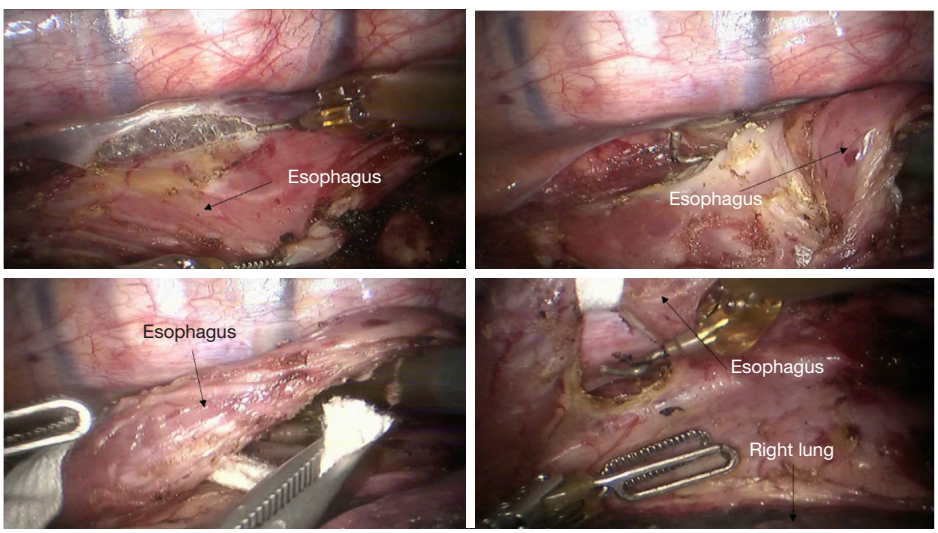

Figure 9 The middle esophagus was dissociated.

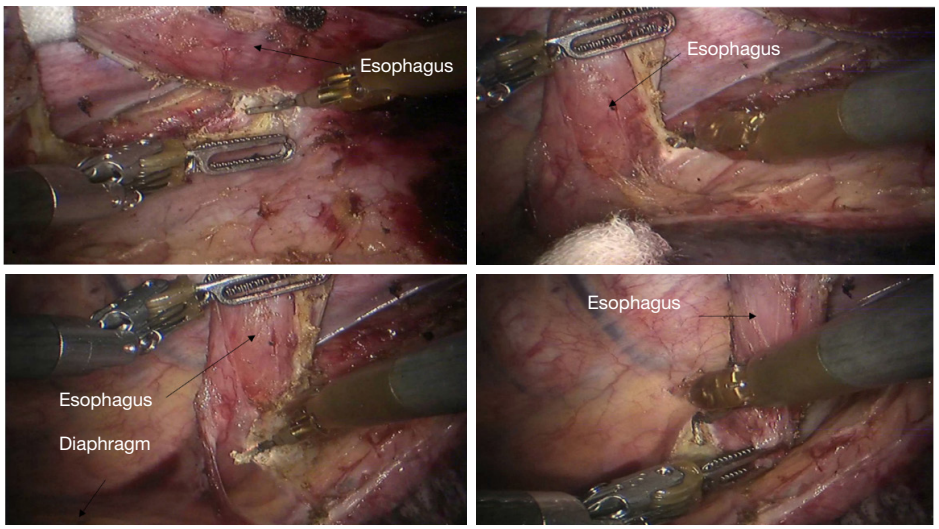

Figure 10 The lower esophagus was dissociated.

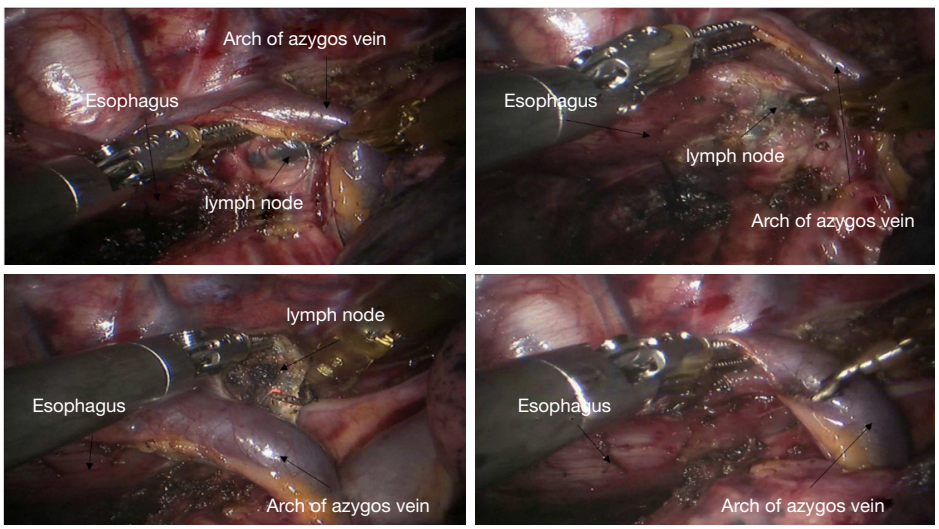

Figure 11 The lower esophagus was dissociated.

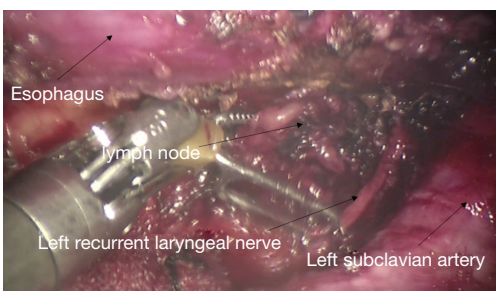

Figure 12 The lymph nodes around the left recurrent laryngeal nerve were dissected.

results showed that in-hospital mortality was 5%, 5-year-survival was 42%, and 47.2% cases had local or systemic recurrences. In this case, to avoid potential local recurrence, we removed the tumor during the thoracic part of the operation and connected the stumps of the upper and lower esophagus by using ribbon gauze. We found that the three-dimensional vision and robotic arm provided great accessibility for the subtle manipulations, especially while dissecting lymph nodes around the recurrent laryngeal nerves. It was reported that RAMIE could reduce the

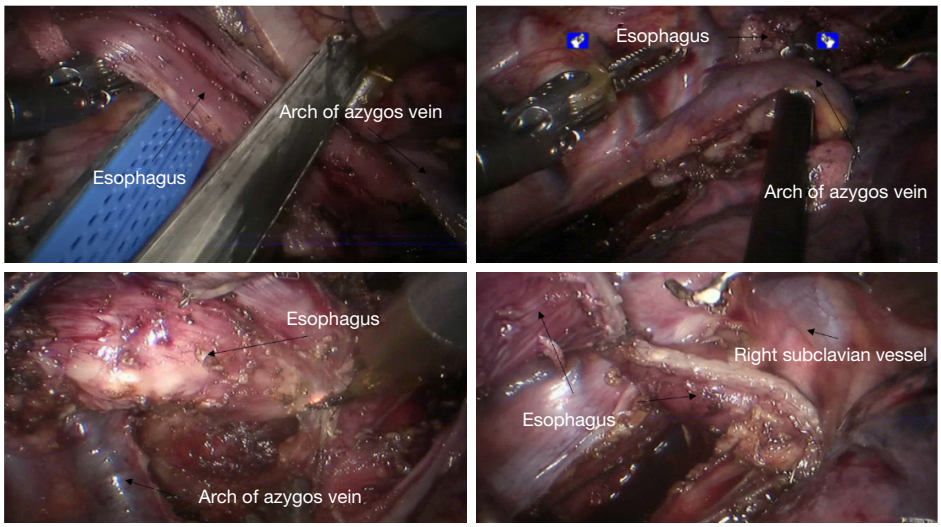

Figure 13 The upper esophagus was dissociated.

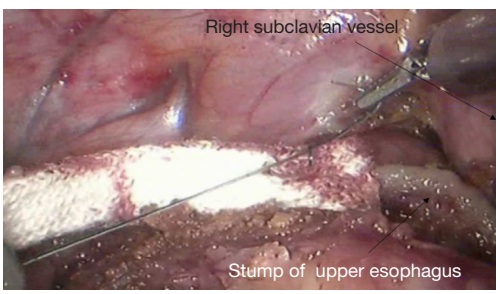

Figure 14 The stump of the upper esophagus was connected with ribbon gauze.

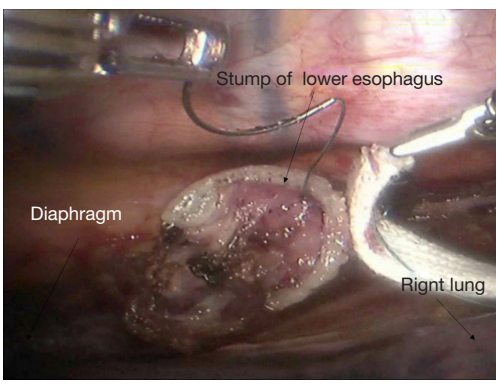

Figure 15 The stump of the lower esophagus was connected with ribbon gauze.

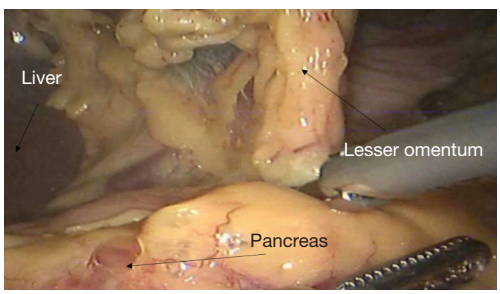

Figure 16 The lesser omentum was separated.

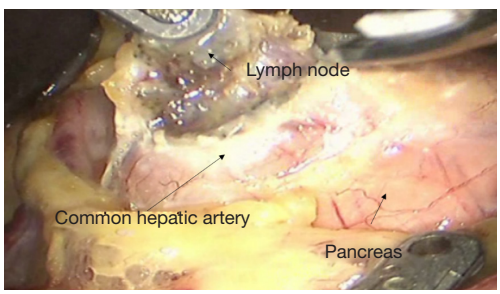

Figure 17 The lymph nodes around common hepatic artery were dissected.

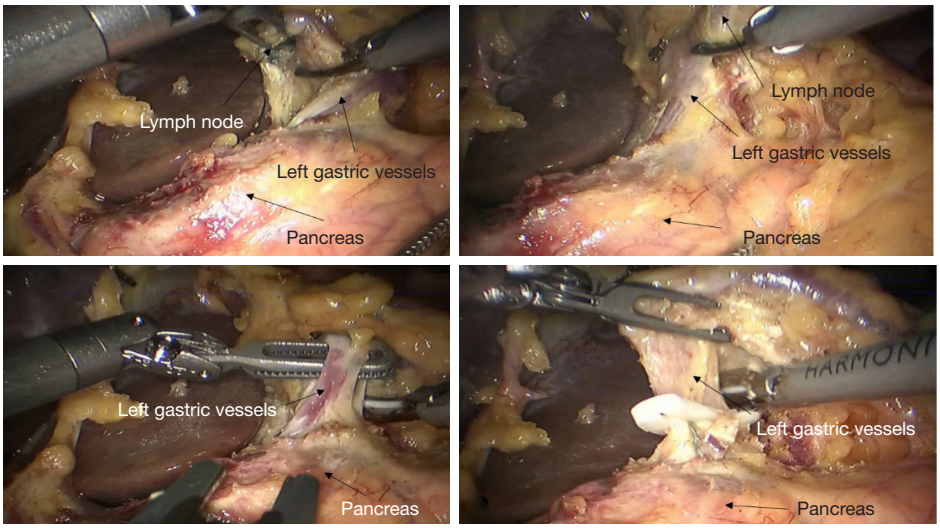

Figure 18 The lymph nodes around the left gastric vessels were dissected, and the left gastric vessels were cutting off.

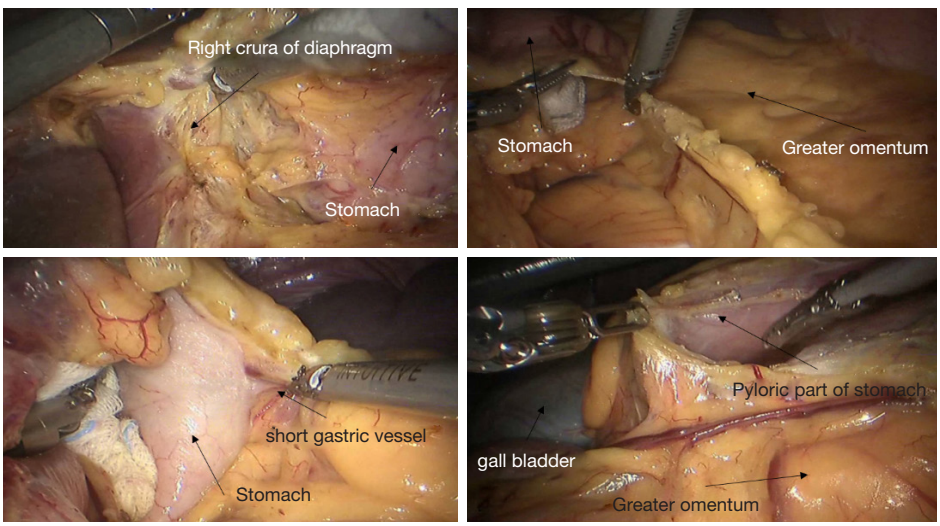

Figure 19 The stomach was mobilized after cutting off the short gastric vessels.

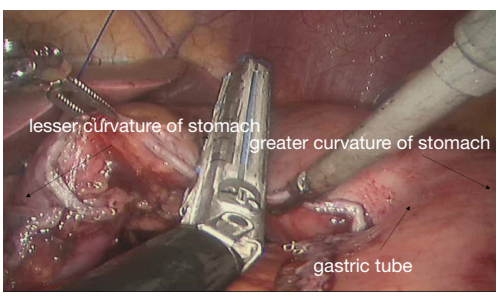

Figure 20 The gastric tube was created using staplers.

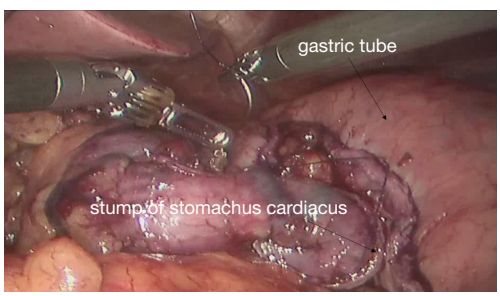

Figure 21 The gastric tube was connected to the stump of the cardia.

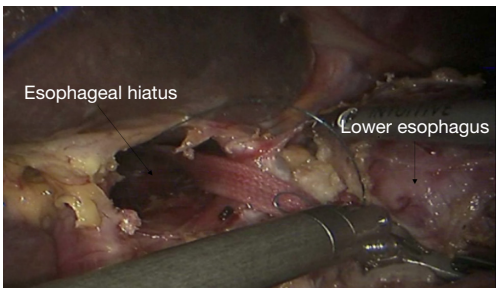

Figure 22 The cardia and abdominal esophagus were separated.

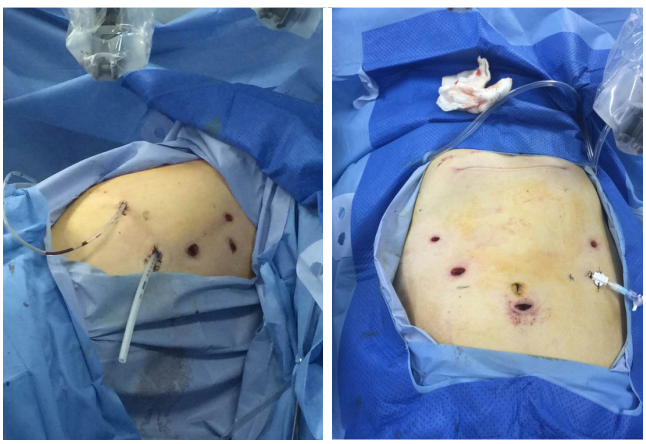

Figure 23 After the operation, a chest tube and a silicone tube were placed in the chest through the operative ports. A jejunostomy tube was placed during the abdominal operation. Subsequently, a cervical esophagogastric anastomosis was performed through the incision on the left side of the neck.

incidence of hoarseness (3) and provide satisfactory short-term outcomes (4). However, whether RAMIE can provide long-term benefits to patients with esophageal cancer needs further study.

Acknowledgements

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Footnote

Conflicts of Interest: The authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/amj.2017.01.18). The authors have no 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 studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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