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ORIGINAL ARTICLE

Laparoscopic intracorporeal stapling of the gastric tube on the basis of surface blood supply after minimally invasive esophagectomy

Bing-Yen Wang [a,b,c], Zhen-Chian Chen [d], Chih-Shiun Shih [e], Chia-Chuan Liu [e,*]

[a] *Division of Thoracic Surgery, Department of Surgery, Changhua Christian Hospital, Changhua, Taiwan*
[b] *Institute of Medicine, Chung Shan Medical University, Taichung, Taiwan*
[c] *School of Medicine, National Yang-Ming University, Taipei, Taiwan*
[d] *Division of Thoracic Surgery, Department of Surgery, Mackay Memorial Hospital, Taipei, Taiwan*
[e] *Division of Thoracic Surgery, Department of Surgery, Koo Foundation Sun Yat-Sen Cancer Center, Taipei, Taiwan*

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Abstract *Background/Introduction:* Minimally invasive esophagectomy is a complex operation in which creating a healthy gastric substitute is crucial. The present study evaluated a novel method of reconstructing the intracorporeal laparoscopic gastric tube on the basis of surface blood supply to the stomach.
Purpose: To study the feasibility and safety of a novel method of laparoscopic gastric tube reconstruction.
Methods: After the complete mobilization of the stomach, the stomach was intracorporeally stapled along the watershed area between the blood supplies of the lesser and greater curvatures. Subsequently, the gastric tube was pulled up to the neck for end-to-side cervical esophagogastrostomy. Perioperative data were prospectively collected for the first 20 patients who had undergone this novel laparoscopic gastric reconstruction at our institute. The descriptive statistics are reported in this paper.
Results: We enrolled 20 patients (18 men and 2 women) with esophageal cancer who were admitted to the Koo Foundation Sun Yat-Sen Cancer Center, Taipei, Taiwan between January 2013 and December 2013. The mean operative time was 7.10 ± 1.08 hours, and the mean operative blood loss was 118.00 ± 79.71 mL. The average length of the gastric tubes above the

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* Corresponding author. Division of Thoracic Surgery, Department of Surgery, Koo Foundation Sun Yat-Sen Cancer Center, 125 Lih-Der Road, Pei-Tou District, Taipei 112, Taiwan.
E-mail address: 156283@cch.org.tw (C.-C. Liu).

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sternal notch was 7.65 cm (~5.0—15.0 ± 2.40 cm); the average width of the gastric tubes was 3.74 ± 0.47 cm. No case required conversion to open surgery, and only one patient (5%) experienced a minor anastomotic leak. The overall complication rate was 45% (predominantly involving postoperative transient hoarseness), and no surgical mortality was observed in this study.

Conclusion: Total laparoscopic intracorporeal gastric tube reconstruction based on anatomical characteristics of the surface blood supply to the stomach is safe and feasible.

1. Introduction

Advances in endoscopic instruments and surgical techniques have considerably improved minimally invasive esophagectomy (MIE). The minimally invasive approach to esophagectomy described by Luketich et al[1—3] has resulted in morbidity, mortality, and oncological outcomes comparable with those of conventional esophagectomy.

Gastric tube reconstruction after esophagectomy is associated with a high risk of anastomotic leakage.[4,5] Anastomotic leaks are multifactorial, with insufficient blood supply at the anastomotic site of the gastric tube being the major cause.[6] Maintaining sufficient blood supply and ensuring adequate gastric tube length are crucial while planning cervical anastomosis. MIE and laparoscopic gastric tube construction were adopted at our institution in 2006 and 2007, respectively. We developed a safe and effective method of gastric tube construction that ensures adequate gastric tube length and vascular supply. Here, we describe this novel procedure and analyze its postoperative outcomes.

2. Methods

2.1. Patients

Twenty patients with esophageal cancer had undergone minimally invasive McKeown esophagectomy at the Koo Foundation Sun Yat-Sen Cancer Center, Taipei, Taiwan between Jan 2013 and Dec 2013. According to our institute's Preoperative Standards of Care, before receiving a definitive treatment, all patients were comprehensively evaluated through a physical examination, routine lab examination, upper gastrointestinal panendoscopy, endoscopic ultrasound, bronchoscopy, chest and upper abdominal computed tomography (CT), and positron emission tomography—CT. Informed consent was obtained from each patient before treatment.

Primary esophagectomy was performed in patients with T1bN0M0. Neoadjuvant chemoradiotherapy was provided to patients with esophageal cancer staged as T1b or higher, or if lymph node involvement without distant metastases was suspected. After the neoadjuvant treatment, all patients were restaged, and only those without distant metastases and T4b lesions were considered for esophagectomy. We used endoscopic surgery as the first operative approach in all resectable patients. If complications, such as uncontrolled bleeding, occurred during the operation, surgeons converted the MIE to open thoracotomy or laparotomy.

We collected clinical data, namely age, sex, comorbidities, perioperative measures, operative time, blood loss, gastric tube reconstruction details, ventilation days, postoperative complications, length of hospital stay, and tumor characteristics. Anastomotic leakage was defined as the spillage of saliva or gastric contents at the cervical wound or contrast extravasation during esophagography.

The diameter of the gastric tube was measured using a hand-held ruler under a laparoscopic view. Chest length was defined as the distance from the sternal notch to the xiphoid process. Gastrostomy was performed at the apex of the gastric tube for applying the circular stapler before performing end-to-side cervical esophagogastrostomy. Arterial and venous bleeding on the cut edge of the gastrostomy were meticulously recorded, which served as a useful real-time indicator of perfusion at the apex of the gastric tube.

Regarding postoperative complications, pneumonia was defined as fever with positive sputum cultures and chest radiographic evidence of consolidation. Hoarseness was defined as clear voice changes after extubation. Surgical mortality was defined as death during the postoperative hospitalization period or within 30 days of the operation.

2.2. Procedure

After thoracoscopic esophageal mobilization, the patients were placed supine in the reverse Trendelenburg position, with the bilateral lower extremities placed in the abduction on footboards. Five abdominal trocars were placed at standardized locations. The first 12-mm trocar was placed at the umbilicus for carbon dioxide insufflation and laparoscope insertion. The second 12-mm trocar was placed at the right paramedian site for applying the Endo-GIA stapler (Ethicon Endo-Surgery, Somerville, New Jersey, USA). Furthermore, three 5-mm trocars were placed at the left epigastrium and bilaterally at the subcostal plane of the midclavicular line for dissecting and cutting instruments. The stomach was mobilized with a careful preservation of the right gastroepiploic artery and right gastric vessels while surgeons harvested the adjacent lymph nodes.

Before stapling the stomach into the gastric tube, surgeons identified three anastomotic characteristics: the incisura angularis, surface blood supply to the stomach, and fundus. First, the incisura angularis of the stomach was