RESULTS OF LAPAROSCOPIC THORACIC-ABDOMINAL SURGERY TO REPLACE THE ESOPHAGUS WITH THE STOMACH TO TREAT CANCER OF THE LOWER 2/3 ESOPHAGUS AT MILITARY HOSPITAL 175

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ABSTRACT

Objective: To evaluate the effectiveness and safety of laparoscopic thoracic-abdominal esophagectomy and create a replacement gastric tube in the treatment of lower 2/3 esophageal cancer at Military Hospital 175

Subjects and methods: A prospective study, cross-sectional description of 34 cases of lower 2/3 esophageal cancer undergoing laparoscopic thoracoabdominal esophagectomy and creating a replacement gastric tube at Military Hospital175 from July 2015 to March 2022. Initially, technical support was provided by Cho Ray Hospital.

Results: All patients were male; the mean age was 55.2 ± 10.2 (28-79) years, 76.5% with a history of smoking and drinking alcohol. Cancer was located in the lower third of the esophagus in 58.8% of cases, middle third accounted for 41.2%. All cases (100%) were squamous cell carcinoma. According to AJCC 8th edition, the disease stages were stages II, III, and IV at rates of 50%, 47.1%, and 2.9% respectively. The ratio of successful surgery was 100%. The average duration of surgery was 387.4 ± 69.6 minutes, of which the thoracic phase was 174.9 ± 61.6 minutes, the abdominal phase was 150.3 ± 34.9 minutes, and the cervical phase was 62.2 ± 22.3 minutes. Complications in operation accounted for 14.7% of cases and were all managed

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Receipt date: March 24, 2024 . Review date: April 19, 2024.

Accepted : June 30, 2024

successfully. The postoperative complication rate was 44.1%, including pneumonia was 14.7%, hoarseness was 35.3%, collapsed lung 5.9%, anastomotic leak was 5.9%, and and no mortality (0%). Quality of life after surgery: good 58.6%, average 31.0%, poor 10.3%. The average survival time after surgery was 25.5 ± 2.5 months, one year 77.4%, two years 56.7%, three years 24.3%.

Conclusions: Laparoscopic thoracoabdominal esophagectomy and the creation of a replacement gastric tube were successfully performed at Military Hospital 175 with a favorable complication rate, survival time, and significantly improved quality of life.

**Keywords: Laparoscopic esophagectomy, esophageal cancer.*

1. INTRODUCTION

Esophageal cancer (EC) is a malignant disease of the gastrointestinal tract with a poor prognosis. It ranks 8th in frequency among all cancer types and 6th in mortality due to cancer worldwide [1], [2], [3]. The 5-year survival rate is approximately 10% to 15%, and the average survival time is 9 months. EC is more common in men, typically occurring between the ages of 60-70, and is often associated with a history of alcohol consumption and smoking [2], [4], [5].

Diagnosis of EC is mostly at a late stage. The treatment of EC is multimodal, with surgery playing an important role. Radical surgery for treating esophageal cancer must ensure complete tumor resection, lymph node dissection, and restoration of digestive continuity. This is a heavy surgery in terms of technique, anesthesia, resuscitation, and postoperative care, with an early complication rate of up to 50% [2], [6].

Currently, radical surgery for EC is mainly performed at large centers and commonly involves laparoscopic thoracic-abdominal surgery to reconstruct the esophagus with a gastric pull-up and cervical anastomosis [1]. At 175 Military Hospital, we have been performing this surgery since 2015. This study aims to evaluate the outcomes of thoracoabdominal laparoscopic esophagectomy with gastric pull-up reconstruction.

2. SUBJECTS AND METHODS

2.1. Subjects

The subjects included patients with EC who underwent laparoscopic thoracic-abdominal esophagectomy with gastric pull-up reconstruction at the Abdominal Surgery Department of 175 Military Hospital from July 2015 to March 2022.

2.2. Methods

Prospective study, cross-sectional description with longitudinal follow-up.

Selection Criteria: Patients with lower 2/3 esophageal cancer were detected through esophagogastroduodenoscopy and confirmed by pathology results to be cancerous. They must be at stage IIIb or lower as diagnosed by imaging on a CT scan according to the ASSC. There were no prior gastric lesions or surgeries, and no contraindications for surgery.

Exclusion Criteria: Contraindications to laparoscopic surgery and presence of right pleural adhesions.

Surgical Preparation: Patients diagnosed with EC through esophagogastroduodenoscopy and confirmed by pathology, staged by CT scan as IIIb or lower, and evaluated preoperatively for respiratory and anesthesia fitness without surgical contraindications. Patients received nutritional intervention if needed, and surgical scheduling was planned. Patients were included in the study after signing the surgical consent form and agreeing to participate in the study.

Technical Procedure:

- Anesthesia: endotracheal anesthesia with a double-lumen Carlen tube to collapse the right lung.

- Thoracic Phase: The patient lies prone with a pillow under the right chest or in a left lateral decubitus position with a pillow at the waist (Figure 2.1). Four trocars were placed: two 10mm trocars at the 4th intercostal space midaxillary line and 6th intercostal space anterior axillary line, and two 5mm trocars at the 4th intercostal space anterior axillary line and 7th intercostal space midaxillary line (Figure 2.2).

Figure 2.1: Patient position during the thoracic phase

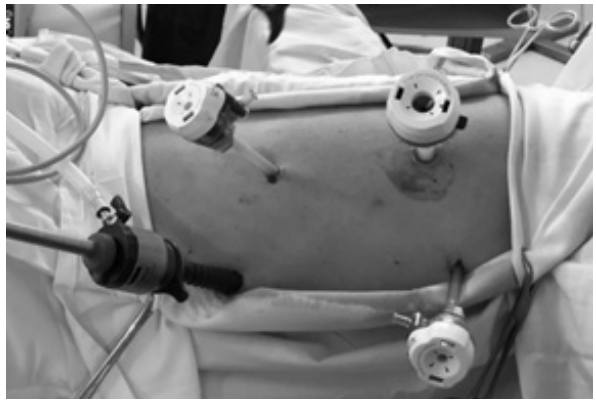

Figure 2.2: Trocar placement positions in

Figure 2.3: Surgeon's position

Entering the right thoracic cavity, evaluate if the tumor is still resectable. Sever the Azygos vein, avoiding damage to the thoracic duct and the sympathetic chain (Figure 2.4). Free the esophagus up to the cervical base and down to the diaphragmatic hiatus. Dissect the lymph nodes around the esophagus (Figure 2.5).

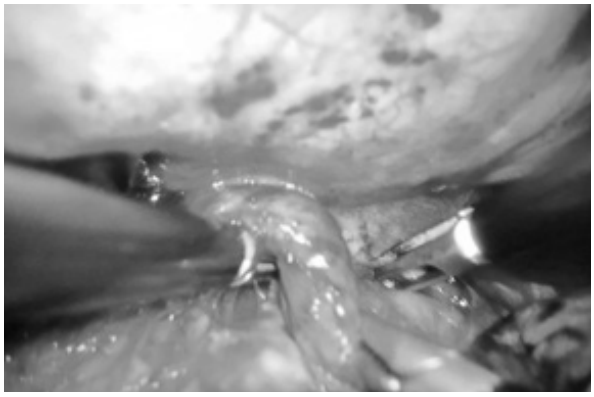

Figure 2.4: Dissection of the Azygos vein for clamping and cutting.

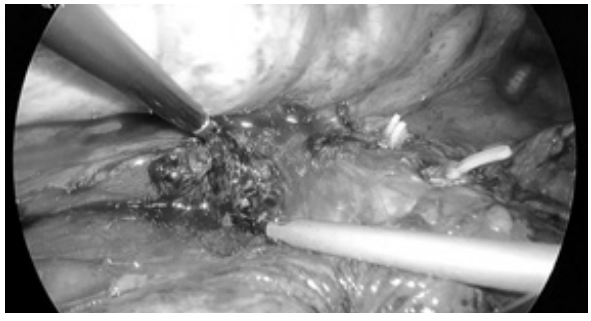

Figure 2.5: Lymph node dissection around the esophagus.

Check the lungs and place a pleural drainage tube of 28 - 32 Fr. Let the lung fully expand and suture the trocar holes.

- Abdominal phase: The patient lies supine with legs spread apart, and five trocars are placed (Figure 2.6 B).

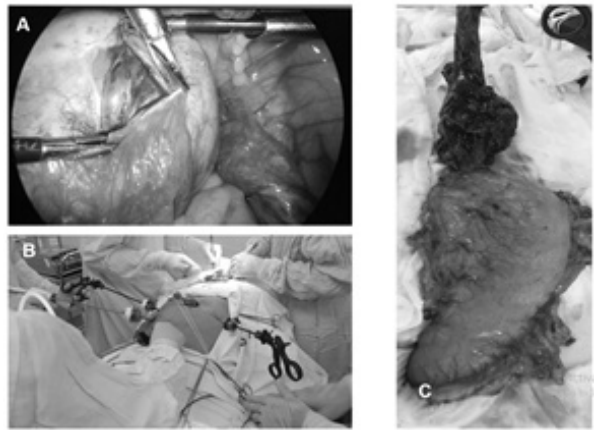

Figure 2.6: A. Gastric clearance process. B. Position for performing the technique. C. Small incision to remove the stomach and esophageal specimen.

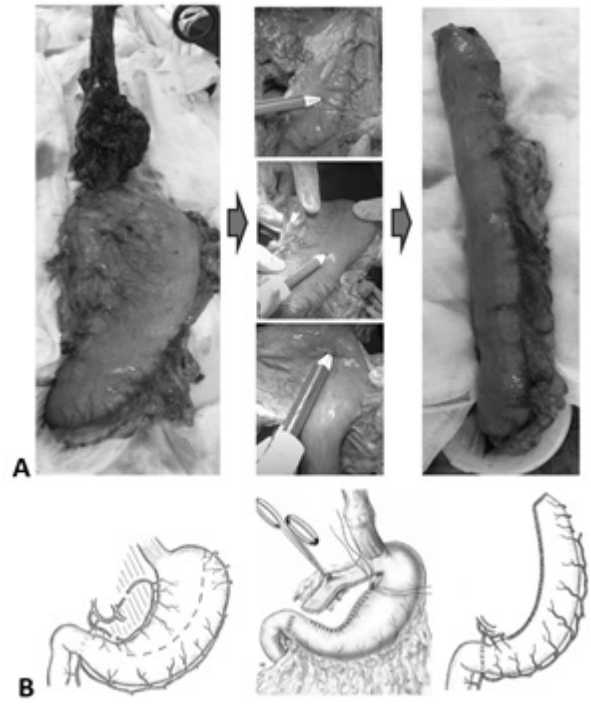

Figure 2.7: A. Gastric tube creation using a Stapler. B. Classic gastric tube creation technique by Akiyama.

Mobilize the stomach, avoiding damage to the right gastroepiploic and right

gastric vessels. Enlarge the diaphragmatic hole (Figure 2.6). Perform lymph node dissection including left gastric lymph nodes, right gastric lymph nodes, lymph nodes along the lesser curvature, lymph nodes at the coronary artery, splenic artery, and hepatic artery.

Make a small midline incision above the umbilicus and create a gastric tube using a Stapler according to Akiyama's technique (Figure 2.7) [9]. Advance the gastric tube through the posterior mediastinum to the left cervical base to perform an anastomosis while avoiding gastric torsion.

- Cervical phase: Make a J-shaped incision along the anterior border of the left sternocleidomastoid muscle, dissect the cervical esophagus, avoiding injury to the recurrent laryngeal nerve. Perform lymph node dissection in the neck region including external cervical nodes, deep lateral cervical nodes, and deep anterior cervical nodes. Transect the cervical esophagus, and pull the gastric tube up to the neck through the posterior mediastinum. Perform an esophagogastric anastomosis, either end-to-end or end-to-side, hand-sewn or using a Stapler (Figure 2.8). Drainage near the anastomosis site for postoperative monitoring.

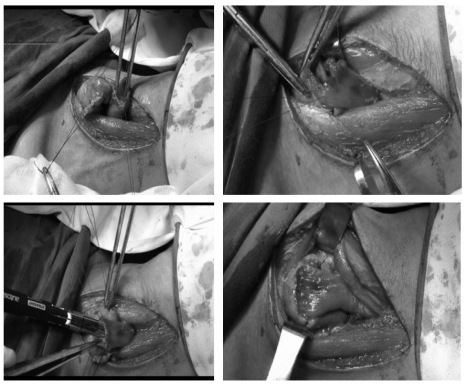

Figure 2.8. Connecting the esophagus - gastric tube with Stapler and PDF thread at the base of the neck.

Postoperative Care and Monitoring:

- After surgery, patients were monitored and cared for in the ICU until their overall condition stabilized and the endotracheal tube could be removed.

- Intensive postoperative supportive treatment included antibiotics, pain relief, nutrition, fluid and electrolyte replacement, and physical therapy. The pleural drainage tube was removed when the lung was fully inflated, and there was no air or fluid. Patients were discharged when their respiratory status was stable, the esophagogastric anastomosis was intact, their overall condition was stable, and patients could eat and drink.

- Follow-up examination after one- month post-surgery, with chemotherapy and radiotherapy initiated two weeks after discharge. Chest and abdominal CT scans were conducted at 1, 2, 3, 6, 9, and 12 months during the first year, and then semiannually or as needed in subsequent years.

Esophagoscopy was performed periodically every three months in the first year and every six months from the second year onwards. For patients with significant dysphagia due to anastomotic stricture, dilation was performed. Postoperative patients were monitored and collected information during postoperative adjuvant treatment, periodic check-ups every three months for the first two years and every six months after, with information recorded from medical records, follow-up visits at 175 Military Hospital, and phone calls for those who did not return for a follow-up examination.

2.3. Information collection and data analysis:

- Anthropometric factors, clinical and paraclinical characteristics, and risk factors. Surgical outcomes, complications during surgery, and treatment.

- Early postoperative outcomes: recovery time, early complications, and evaluation of overall complications according to the Clavien-Dindo classification [10].

- Long-term follow-up outcomes: evaluation of long-term complications, survival evaluation, recurrence, and cause of death. Quality of life was assessed using the Karnofsky Performance Status (KPS) scale, with some changes for simplicity and convenience of application [3], [6]. It was divided into three levels:

- Good: No symptoms or mild symptoms, normal or near-normal activity.

- Moderate: Moderate symptoms, treatable at home, and able to perform light work.

- Poor: Unable to return to activities or with severe complications requiring frequent hospitalization.

- Data processing: Data was processed using SPSS 22.0 software. Postoperative survival time was calculated using the Kaplan-Meier method. Differences in outcomes between groups were considered statistically significant when $p < 0.05$.

3. STUDY RESULTS

3.1. General Characteristics

Statistics from 34 cases, 100% were male, with an average age of 55.2 ± 10.2 (28 – 79) years. The age group 51 – 60 years accounted for 40%, under 40 years accounted for 3.3%, and over 70 years accounted for 6.7%. The majority of patients in the study group smoked and/or drank alcohol, accounting for 76.5%, including 16.7% of patients who both drank alcohol and smoked.

3.2. Clinical and Paraclinical Characteristics

Dysphagia was observed in all patients (100%), mostly mild to moderate, with weight loss (61.8%), chest pain (35.3%), and fatigue (29.4%). The average duration of symptoms was 3.3 ±

3.9 (1 – 24) months, with 26/34 patients hospitalized after 2 months (76.5%). Normal respiratory function was observed in 79.4% of patients, while 20.6% had mild ventilation disorders.

Table 3.1: Characteristics of Lesions on Chest-Abdominal CT Scan and Endoscopy

CT	Characteristics	Number	Percentage
Location	Middle third	14	41,2%
	Lower third	20	58,8%
Invasion	T1	0	0%
	T2	5	14,7%
	T3	21	61,8%
	T4	8	23,5%
Lympho-Nodes	Present	10	29,4%
	Not present	24	66,7%
Esophagoscopy	Protruding	20	53,3%
	Protruding + ulceration	9	30%
	Protruding + infiltration	4	13,3%
	Protruding, ulceration, infiltration	1	3,3%
Biopsy	Squamous cell carcinoma	34	100%
Total		34	

Table 3.2: Preoperative Stage assessment according to AJCC 8th before surgery.

Disease Stage	AJCC 8th Criteria	
	Number	Percentage
O	0	0%
I	0	0%
IIa	16	47,1%
IIb	1	2,9%
III	17	50%
IV	0	0 %
Total	34	100%

The tumor was predominantly located in the lower third (58.8%), followed by the middle third (41.2%). All cases were diagnosed with squamous cell carcinoma, with protruding lesions being the most common (100%). Ulceration and infiltration could accompany protruding lesions, with ulceration being more prevalent (26.47%) (Table 3.1). According to the AJCC 8th edition, disease stages II and III accounted for 50% each (Table 3.2).

3.3. Surgical Outcomes

The surgical success rate was 100%. The average surgery duration was 387.4±69.6 minutes, of which thoracic phase was 174.9 ± 61.6 minutes, abdominal phase was 150.3 ± 34.9 minutes, and cervical phase was 62.2 ± 22.3 minutes. Intraoperative complications occurred in 14.7% (5/34) of cases, including three cases of left lung membrane rupture (8.82%), one case of tracheal tear due to Carlen tube insertion (2.9%), and one case of chest tube injury (2.9%), all cases

were managed endoscopically. There were two patients with jejunostomy 14.7%, and two patients with pyloroplasty 5.9%. The average number of dissected lymph nodes was 13.7 ± 2.8, the average number of metastatic lymph nodes was 3.4 ± 4.1.

Postoperative disease stages according to AJCC 8th edition were II, III, and IV in 50%, 47.1%, and 2.9% of cases, respectively. There was one case of preoperative diagnosis of stage III and liver metastases were detected during surgery, however, the surgery was continued, and the patient remained stable and survived for an additional 26 months postoperatively.

The average hospital stay was 15.9 ± 5.6 (8 – 35) days, with an average oral feeding time of 6.4 ± 2 days, the time to remove the pleural drainage tube was 4.6 ± 1.1 days and the time to remove drains next to the anastomosis was 5.7 ± 1.8 days.

Overall postoperative complications occurred in 15/34 patients (44.1%), including pneumonia (14.7%), hoarseness (35.3%), lung collapse (5.9%), anastomotic leak (5.9%), and no early postoperative deaths (0%); the average Clavien-Dindo score was 2.2. Most cases of hoarseness recovered well within 2 – 3 weeks postoperatively.

Anastomotic stricture was common in the first 2 - 3 months after surgery, occurring in 13/34 cases, accounting for 38.2%, of which mild dysphagia in 10 cases (29.4%), moderate dysphagia in two cases (5.9%), and severe dysphagia in one case (2.9%).

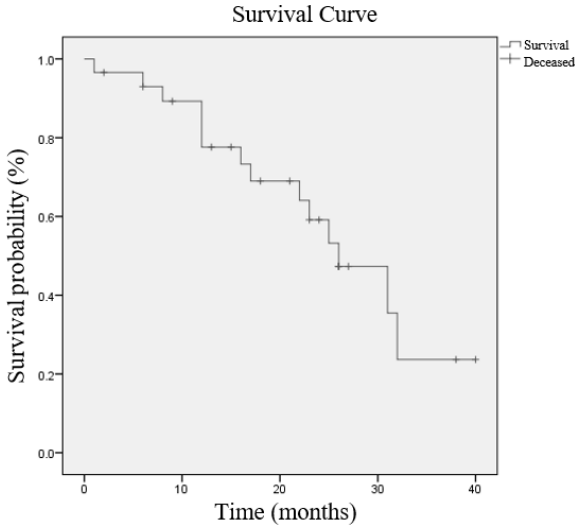

Chart 3.1: Kaplan-Meier Survival monitoring chart.

The long-term follow-up results of 29/34 patients, among which five patients lost information, the median follow-up time was 26 (1 – 40) months. Postoperative quality of life: good in 58.6% of cases, average in 31.0%, and poor in 10.3%. The overall survival rate was 24.3%, with an average survival time of 25.5 ± 2.5 months. The cumulative survival rates at 1, 2, and 3 years were 77.4%, 56.7%, and 24.3%, respectively (Chart 3.1).

4. DISCUSSION

Our study was conducted with 34 surgical cases, all were male (100%). The absence of female patients could be attributed to the low incidence of the disease among females, combined with

the real situation that Military hospitals mainly encounter male patients. The average age of the study group was 55.2 ± 10.2 (28 – 79) years, with the majority falling in the 51 – 60 age group (40%). A significant proportion, 76.5% had a history of smoking and/or alcohol consumption, both of which were high risk factors for thoracic esophageal cancer.

Nearly 80% of the patients hospitalized after 2 months have the first symptoms. This number showed that the majority of patients were hospitalized late for treatment. Dysphagia was observed in 100% of the patients, with 63.33% experiencing weight loss. Therefore, dysphagia or swallowing difficulties serve as early warning symptoms [1].

All patients (100%) were definitively diagnosed through gastric endoscopy combined with biopsy, showing that this was a leading important test in detecting and diagnosing the disease. In our study, all patients with esophageal cancer had a preoperative biopsy-confirmed diagnosis of cancer. Among them, squamous cell carcinoma was observed in 100% of cases, indicating that this was the predominant type of injury in esophageal cancer. Less common injuries did not appear in our study may be due to the limited sample size.

CT scans of the chest and abdomen were highly valuable in assessing tumor location, size, invasion of surrounding organs, lymph node evaluation, and gastric status, all of which we performed in 100% of cases.

In our study, tumors in the lower third accounted for 58.8%, while those in the middle third accounted for 41.2%. According to the AJCC 8th edition, the disease stage was II in 50% of cases and III in 50%. However, one case was diagnosed as stage III before surgery, but intraoperatively, liver metastasis was discovered, leading to upstaging to stage IV. Although the surgery did not encounter significant difficulties, it did not strictly adhere to the NCCN treatment recommendations [7]. However, the patient survived an additional 26 months postoperatively, which is significant. Therefore, accurately predicting the preoperative disease stage was not straightforward.

Respiratory function played an important role in ensuring surgical safety, particularly in the thoracic phase, where patients only have one functioning lung. In our study, 20.6% had mild respiratory disorders. These patients received preoperative and postoperative respiratory training.

All 34 patients underwent successful surgeries (100%). There were two patients jejunostomy (14.7%), and two patients underwent pyloroplasty, (5.9%). Opening a jejunostomy for feeding, as reported by Luketich, is 95%;

however, we only performed this in 14.7% of cases. The feeding jejunostomy in Luketich's study was 95%, however we only opened the feeding jejunostomy in 14.7% of patients. These were cases where the gastric coil was short or was stretched when connecting the esophagus-stomach, we assessed the high risk of anastomotic leakage [8]. Because the length of the gastric coil affects the tension of the esophagogastric anastomosis, which was one of the factors related to complications of postoperative anastomotic leakage. During the gastroplasty process, we stretch the stomach further to increase the length of the coil.

There were two cases (6.67%) with short gastric coils, we proactively shaped the pylorus to increase the length. In addition, it was possible to move the pyloric and duodenal bulbs to increase the length of gastric coils, but we have not applied it yet. Regarding nutritional support, we prioritize early feeding via nasojejunal tube combined with intravenous feeding and do not recommend jejunostomy.

In our study group, the average surgical duration was 387.4 ± 69.6 minutes (approximately 6 – 7 hours), of which the thoracic phase was 174.9 ± 61.6 minutes, the abdominal phase was 150.3 ± 34.9 minutes, and cervical phase was 62.2 ± 22.3 minutes. The prolonged surgical time for patients with esophageal cancer significantly affects postoperative recovery.

Surgical duration varies due to many factors such as tumor characteristics, location of the tumor, surgical team skills, anesthesia team coordination, and available surgical equipment. In addition, during the surgery, the patient's position must be changed from prone to supine, and sometimes parallel surgical teams operate simultaneously on the abdominal and cervical phases, so the time calculation was only relative. Surgical time reflects the part of the complexity of the surgery.

Regarding complications during surgery, we encountered 5/34 cases (14.7%), including three cases of left lung membrane tears (8.82%), one tracheal tear due to Carlen tube placement (2.9%), and one thoracic duct injury (2.9%). All three lung membrane tears were caused by tumor invasion into the left lung, resulting in small tears in the left mediastinal pleura We did not suture these tears but placed continuous chest tube drainage, requiring continuous suction. After surgery, all patients remained stable.

There was one patient with a tracheal tear after Carlen tube placement. When thoracoscopy detected a small horizontal tear of less than 1cm, we performed endoscopic restoration using Maxon 4.0 thread. This patient had no respiratory abnormalities after surgery. Another thoracic duct injury was detected during surgery and ligation was performed to avoid chylous fistula.

The average hospital stay for our study group was 15.9 ± 5.6 (8 – 35) days, and the average time to oral intake was 6.4 ± 2 days, similar to other studies [1], [6], [8]. Of which, one patient had an extended hospital stay due to pneumonia complications, and died on the 35th day after surgery

Early postoperative complications occurred in 15/34 patients (44.1%), with hoarseness being the most common (35.4%), and were also the mildest complications, with most patients recovering afterward. Pneumonia occurred in 14.7% of patients, representing the most severe complication, and the main cause of death.

Pulmonary collapse and anastomotic leaks occurred in 5.9% each, and all cases were conservatively managed and recovered well. There were no complications requiring re-operative intervention, and the overall complication rate according to the Clavien-Dindo classification was 2.2, which was promising. In our study, one patient died on the 35th postoperative day due to respiratory complications, although this was not categorized as a surgical cause of death.

Assessing the quality of life after surgery was often difficult because the survival time after surgery was short and functional disorders were often related to disease progression or recurrence, complicating the process of objectively assessing the quality of life after surgery. We categorized postoperative quality of life based on the Karnofsky performance status index, with modifications for simplicity and convenience of application. According to this classification, 58.62% had good results,, 30.03% had average results, and 10.34% had poor results.

The results of postoperative survival, calculated using the Kaplan-Meier method, indicated a median survival time of 25.51 ± 2.46 months in the study group. Survival rates at six months, one year, two years, and three years were 92.8%, 77.38%, 56.74%, and 24.31%, respectively. Although this was a prospective, uncontrolled study with a small sample size, these numbers were encouraging, demonstrating the effectiveness of surgery in treating esophageal cancer pathologies. However, compared to other gastrointestinal cancers, the postoperative survival rate for esophageal cancer was still limited, consistent with findings from other studies by different authors [1], [4], [8].

CONCLUSION

The results of endoscopic thoracoabdominal esophagectomy, with gastric replacement, were a feasible and safe surgical procedure with a favorable complication rate, promising postoperative survival time, and improved quality of life.

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