Outcome for esophageal cancer following thoraco-laparoscopic esophagectomy: A single institution experience

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Abstract

Background: The feasibility and the safety of the thoraco-laparoscopic esophagectomy (TLE) was proved by several prominent academic institutions. This technique is technically challenging and requires advanced laparoscopic and thoracoscopic skills. With experience gained from open esophagectomy as well as laparoscopic surgery, thoraco-laparoscopic esophagectomy was introduced in our hospital in 2016. We report our experience in performing TLE.

Materials and Methods: We conducted a prospective, nonrandomized, observational study in Hue central hospital, which is one of the biggest hospitals in Vietnam, from January 2016 to January 2021. This study included the esophageal cancers that were diagnosed by endoscopy and confirmed by pathology. Esophageal cancer with cT1b-N0M0 using chest CT, ultrasound-endoscopy, abdominal CT was indicated for resection initially, while esophageal cancer with cT4N0M0 or T3N(+)M0 was indicated for resection after neoadjuvant therapy. The patients had the ASA I-III. All the data were analyzed statistically using SPSS software (SPSS, Inc, Chicago, IL).

Results: We used the TLE technique to operate for 52 consecutive patients. All patients were in a semi-prone position. The male/female ratio was 47/5. The mean age was 57.3±6.3 years, and the mean BMI was 20.5±3.3 kg/m². The preoperative location of the esophageal cancer was the upper one-third in two (3.8%), the middle one-third in 24 (46.1%), and the lower one-third in 26 (50.0%). The majority of our patients had cTNM stage II (30, 57.7%). Only seven patients (13.7%) had cTNM stage I, whereas 15 patients (31.4%) had cTNM stage III. Of the 45 patients (stage II and III) who needed the neoadjuvant therapy, 30 (57.7%) received short-courses, 15 (28.8%) received long-course of chemotherapy. For 24 patients (46.1%), the histopathology was squamous cell carcinoma. The remaining 28 patients (53.8%) had adenocarcinomas. The operative time was 311.2±45.9 minutes. We did not record either conversion or intraoperative events. The mortality and morbidity rates were 1.9% and 23%, respectively. The hospital stay was 15.6±7.2 days. The median follow-up time was 22±1.5 months, and the overall survival rate at one year was 84.7%.

Conclusion: Thoraco-laparoscopic esophagectomy for esophageal cancer with the patient in a semi-prone position is safe and effective, including the lower morbidity rate and the shorter operative time while preserving the long-term outcomes.

Keywords: Esophageal Neoplasms, Thoracoscopy, Esophagectomy

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patients.

This study included the esophageal cancers that were diagnosed by endoscopy and confirmed by pathology. Esophageal cancer with c stage Ib-IIa using chest CT, ultrasound-endoscopy, abdominal CT was indicated for resection initially, while esophageal cancer with clinical stage IIb-IIIa was indicated for resection after neoadjuvant therapy. Gastrostomy is always indicated for patients receiving long-term neoadjuvant therapy. The patients had the ASA I-III that was preoperatively determined by an anesthetist.

Exclusion criteria were a history of thoracic or abdominal surgery, which may affect the study, pleural adhesion, or unable to selective tracheal intubation.

Surgical techniques

Thoracoscopic stage:

We initiated all procedures by thoracoscopy on the right with the patient on tilted left 30°. All patients needed endotracheal selective intubation anesthesia (Carlene tube) for right lung exclusion. The surgeon and assistant stand to the right of the patient and the monitor on the opposite. The first 10 mm trocar was placed in the 6th intercostal space on the medial axillary line for a 30° Optique, the second 5 mm trocar was in the ninth intercostal space on the posterior axillary line (surgeon’s left hand) and the third 5 mm trocar in the 4th intercostal space on the anterior axillary line (surgeon’s right hand) (Fig. 1).

After pneumothorax with the pressure of 12 mm Hg and assessment of the location, tumor invasion, lymph nodes as well as the ability of resection, Azygos vein was firstly dissected and cut between two hemolocks 5 mm. The mediastinal pleura was then opened on both sides of the esophagus, altogether remove the thoracic esophagus from the diaphragmatic orifice to the cervical base, avoid damaging the thoracic tube and recurrent nerve, extensive lymphadenectomy surrounding the esophageal tumor and bronchial lymph nodes. At the end of the thoracic stage, a drain of 24 Fr was positioned, checking for bleeding, pulmonary re-expansion, and closed the trocars.

Laparoscopic stage:

The patient then was positioned in dorsal decubitus, the head tilted right, the legs apart, and replaced the double-lumen tracheal tube by a conventional. The monitor was on the patient’s left. The surgeon stood between the legs and the assistant on the patient’s right. A 10 mm trocar for Optique 30° was placed infra-umbically. A 10 mm trocar in the left mammillary line above 3 cm the umbilical line (surgeon’s right hand) and 5 mm trocar in the right mammillary line above 2 cm umbilical line (surgeon’s left hand). The fourth trocar was placed under xiphoid 3 cm (assistant’s hand). After the exploration of the abdominal cavity, the stomach was mobilized by resection the gastrocolic ligament and short gastric vessels with Thunderbeat device (Olympus Medical Systems Corp, Tokyo, Japan) while preserving the gastroepiploic arcade. Then, left gastric vessels were sectioned between hemolocks. The hiatus opened broadly by partially sectioning the left and right diaphragm pillar after radical lymphadenectomy, including 8, 9, 7, 1, 2, 3 groups.

Then, the fourth trocar site was enlarged 5–6 cm longitudinally and covered by a protective bag. The specimen and the stomach pulled out en bloc. The gastric tube of 3 cm was prepared outside the abdominal cavity with 4–5 GIA 60 mm (Medtronic/Covidien, Minneapolis, MN, USA), with reinforcement of the entire Clipping line with a continuous suture of Vicryl 4.0 (Johnson and Johnson, New Brunswick, NJ, USA). The gastric tube was then pulled up to anastomose with the cervical esophagus. The abdominal stage was completed with the pyloroplasty and feeding jejunostomy.

Fig. 1 Semi-prone position in thoracoscopic stage
Cervical stage:
The 5 cm left anterolateral cervicotomy was performed simultaneously with the laparoscopic stage following the anterior border of the sternocleidomastoid muscle, isolating the cervical esophagus. The esophagus was sectioned, and the distal end was sutured with a 24 Fr drain to aid in pulling up the gastric tube. A cervical drain was placed after the cervical anastomosis was done.

In the latter study, side to side with GIA cervical anastomosis was used with the agreement of the institutional ethics committee to avoid the cervical anastomotic stricture.

Statistical data and analysis
All data were collected from the medical record of our hospital for further analysis. The following variables were analyzed: Demographics and preoperative variables (age, BMI, tumor location, histopathology, neo-adjuvant treatment); intraoperative (conversion, operative time, intraoperative complication); postoperative (mortality, morbidity, respiratory complications, cervical fistula, thoracic duct injury, Gastric tube leaks, hoarseness); and follow-up (cervical anastomotic stenosis, recurrence, metastasis). The locoregional lymph nodes comprise intrathoracic and perigastric lymph nodes. Cervical, celiac axis and paraaortic node metastasis were classified as distant recurrence.

All the data were analyzed statistically using SPSS software (SPSS, Inc, Chicago, IL), and expressing data values as percentages, mean, standard deviation, or median values as per data type (qualitative or quantitative). Overall survival was analyzed by the Kaplan–Meier method calculated from the date of operation until the date of death.

RESULTS
From January 2016 to January 2021, 52 consecutive esophageal cancer patients were operated by thoraco-laparoscopic esophagectomy with the patients in semi-prone position. In the whole cohort, there were 47 men (90.4%) and five women (9.6%); the mean age was 57.3±6.3 (44–69) years and mean BMI 20.5±3.3 (16.3–24.8) kg/m². The preoperative location of the esophageal cancer was the upper one-third in two (3.8%), the middle one-third in 24 (46.1%), and the lower one-third in 26 (50.0%) (as shown in Table 1). The majority of our patients had cTNM stage II (30, 57.7%). Only seven patients (13.7%) had cTNM stage I, whereas 15 patients (31.4%) had cTNM stage III. Of the 45 patients (stage II and III) who needed neoadjuvant therapy, 30 (57.7%) received short-courses, 15 (28.8%) received long-courses of chemotherapy. All patients who received long-course adjuvant therapy had gastrotomies. For 24 patients (46.1%), the histopathology was squamous cell carcinoma. The remaining 28 patients (53.8%) had adenocarcinomas.

The operative time was 311.2±45.9 minutes. We did not record either conversion to open both thoracoscopic stage and laparoscopic stage. There were no intra-operative events, and blood transfusion did not need in all cases.

Gastric tubes were pulled up through the posterior mediastinum in 50 patients (96.2%), and two remainings were through the retrosternal space.

Postoperative complications were experienced by 12 patients (23.1%). The details were showed in Table 2. Four pneumonia (7.7%) and three cervical fistulae (5.7%) were managed conservatively. Four patients (7.7%) experienced hoarseness, which resolved without any treatment. There was one death (1.9%) due to gastric tube leakage.

The cervical anastomoses were performed by the end to side technique in 35 patients, and in 17 remaining patients, we performed the side to side technique using endo GIA. There were nine (17.3%) anastomotic stenosis,
which were all in the end to side anastomotic group. All anastomotic stenosis was resolved by endoscopic dilatation from one to several times.

The hospital stay was 15.6±7.2 days (7–25).

Fourteen patients (40%) were sent to the oncology center for adjuvant chemotherapy due to positive lymph nodes. The median follow-up time was 22±1.5 months. We recorded three intrathoracic recurrences (8.6%) and three (8.6%) distal metastasis (one lung, one oral base, one multi-organ). The overall survival rate at one year and two years was 84.7% and 73.9%, respectively (Fig. 2).

**DISCUSSION**

Our results demonstrated the feasibility and the safety of the thoraco-laparoscopic esophagectomy with the patient in a semi-prone position. Overall morbidity and pulmonary complications were 23.0% and 7.7%, respectively. These results were comparable to those of the TLE group but lower in the open esophagectomy group.

There are a variety of patient positions that are used in the thoraco-laparoscopic esophagectomy. TLE with the patient in the left lateral decubitus position was firstly reported by Luketics et al in 2003. This technique showed several advantages comparing with open esophagectomy, such as lower blood loss, less postoperative pain, a lower percentage of pleuropulmonary complications, faster postoperative recovery with reduction of hospital stay. However, these initial reports showed high rates of conversion to open thoracotomy and postoperative respiratory complications, and therefore did not show a clear advantage of the TLE.

A prone position for TLE has been proposed as an alternative to the lateral approach by a few authors, citing potential benefits such as better surgeon ergonomics and operative exposure, shorter operative time, and decreased potential benefits such as better surgeon ergonomics and alternative to the lateral approach by a few authors, citing experience practical problems.

The semi-prone position is that the patients were intubated with a double-lumen endotracheal tube. However, the benefit of single-lumen tube ventilation which is required in the prone position, is minor because we changed into a single-lumen endotracheal tube in the laparoscopic stage.

We changed the anastomotic technique from end to side to side to using endo-GIA (Medtronic/ Covidien) in the latter of the study due to the high rate of our anastomotic leakage (5.7%). With this technique, we did not recognize any anastomotic leakage as well as anastomotic stenosis.

Related to long-term results, although the study was far from ideal, the overall survival rate of one year was 84.7% was similar to that of the systemic review of Dantoc et al as well as the study of Lazzarino.

**CONCLUSION**

Thoraco-laparoscopic esophagectomy for esophageal cancer with the patient in a semi-prone position is a method with many advantages, including the lower morbidity rate, shorter operative time while preserving the long-term outcomes. However, a more significant number of patients need to be studied for an accurate evaluation of long-term results.
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. The study was approved by the ethics committee of Hue Central Hospital. Written informed consent was obtained from all patients.

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

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