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Original research

Laparoscopic assisted versus open gastric pull-up following thoracoscopic esophagectomy: A cohort study

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HIGHLIGHTS

- This study evaluated a feasibility of laparoscopically assisted gastric pull-up (LAG) following thoracoscopic esophagectomy (TE).
- LAG was compared with open laparotomy gastric pull-up (OLG) following TE.
- No significant difference was found between two groups in the technical and oncological outcomes.
- LAG following TE was feasible in patient with thoracic esophageal cancer.

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ABSTRACT

Background: Thoracolaparoscopic esophagectomy (TLE) is a type of minimally invasive esophagectomy (MIE) for esophageal cancer which consists of thoracoscopic resection and laparoscopic reconstruction. The aim of the present study was to evaluate the technical and oncological feasibility of alimentary tract reconstruction with laparoscopically assisted gastric pull-up (LAG) following thoracoscopic esophagectomy in the prone position (TSEP) in comparison with reconstruction with open laparotomy gastric pull-up (OLG) following TSEP, to establish TLE with extended lymph node dissection as a standard operation for esophageal cancer.

Methods: Sixty-four patients with esophageal cancer underwent TSEP with 3-field lymphadenectomy from 2008 through 2010: for reconstruction after TSEP, 31 patients underwent LAG, and 33 patients underwent OLG. We retrospectively evaluated the technical and oncological feasibility of TLE with 3-field lymphadenectomy and compared surgical outcomes after reconstruction with OLG and that with LAG.

Results: TLE with 3-field lymphadenectomy was successfully completed in 30 of 31 (97%) patients, and no surgery-related postoperative deaths occurred. No significant difference was found between LAG and OLG in the mean number of dissected abdominal lymph nodes, amount of blood loss, incidence of postoperative complications, mean postoperative hospital stay, restoration rate of respiratory function, or rate of complete resection or locoregional control, but the mean duration of abdominal procedures was significantly longer with LAG than with OLG.

Conclusion: This study demonstrates that the quality and safety of surgery and the oncological effectiveness of LAG for esophageal cancer. TLE consisting of LAG following TSEP with extended lymph-node dissection is a feasible surgical technique for thoracic esophageal carcinoma.

1. Introduction

Surgical resection is the standard treatment for carcinoma of the thoracic esophagus. However, the procedure is a complex; involves the cervical, thoracic, and abdominal fields; and includes thoracotomy or laparotomy or both. Accordingly, resection of carcinomas of the thoracic esophagus can be associated with significant morbidity and mortality and a delay in return to preoperative activity levels. Thoracolaparoscopic esophagectomy (TLE) is a type of minimally invasive esophagectomy (MIE) for esophageal cancer which comprises both thoracoscopic resection and laparoscopic reconstruction. Such an MIE can produce less morbidity than open operations and allows a quicker return to normal function [1]. We have assessed the technical and oncological feasibility of

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thoracoscopic resection and thoracoscopic esophagectomy in the prone position (TSEP) in comparison with open thoracotomy for the treatment of carcinoma of the esophagus [2].

Regardless of tumor location, nodal metastasis is often widespread in the 3 operative fields. In one series, the rates of abdominal lymph-node metastasis from tumors in the upper, middle, and lower thirds of the thorax were 10%, 74%, and 40%, respectively [3]. Both the open and laparoscopic approaches are associated with a significant incidence of reconstruction-related complications. Anastomotic leakage is a leading cause of operative mortality and remains responsible for approximately one-third of operative deaths [4]. For these reasons, the method of alimentary tract reconstruction is of particular importance in determining perioperative outcomes and the oncological completeness of resection. However, the laparoscopic approach for reconstruction and abdominal lymph-node dissection has not, to our knowledge, been reported, and its technical and oncological feasibility has not been evaluated in comparison with open laparotomy.

The aim of the present study was to evaluate the technical and oncological feasibility of alimentary tract reconstruction with laparoscopically assisted gastric pull-up (LAG) following TSEP in comparison with open laparotomy gastric pull-up (OLG) following TSEP, to establish TLE with extended lymph node dissection as a standard operation for esophageal cancer.

2. Materials and methods

2.1. Patients population

Since September 2008, previously untreated clinical stage I esophageal cancer has been treated with TSEP and 3-field lymph-node dissection at the National Cancer Center Hospital East. We have previously reported the oncological feasibility of TSEP with 3-field lymph node dissection for clinical stage I esophageal cancer [2]. Since April 2010, the indications for TSEP with 3-field lymph node dissection have been expanded to include clinical stages T1 to T3 without metastasis to thoracic lymph nodes, and reconstruction with LAG after esophagectomy has been performed for patients without metastasis to abdominal lymph nodes. From September 2008 through June 2011, TSEP with 3-field lymph node dissection was performed for 64 patients: 33 of these patients underwent gastric reconstruction with OLG via the posterior mediastinal route, and 31 patients without metastasis to abdominal lymph nodes underwent LAG via the retromediastinal route.

All patients were evaluated and underwent disease staging with preoperative computed tomographic scans of the neck, chest, and abdomen; barium swallow examination; endoscopy with biopsy; and ultrasonography of the neck. Endoscopic ultrasonography was performed to confirm the presence of submucosal cancer, when the tumor was suspected to not be restricted to the mucosa. Indications for definitive operation with extended lymph-node dissection were submucosal cancer and mucosal cancer with circumferential spread, for which endoscopic mucosal resection is not indicated.

Comprehensive evaluations of cardiac and respiratory functions showed that all patients could tolerate anesthesia and operation. Before surgery and just before discharge after surgery, respiratory function was assessed with spirometry, including determinations of vital capacity (VC), percent predicted vital capacity (%VC), forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1.0), and FEV1.0 as a percentage of FVC (FEV1.0%). Informed consent was obtained from all patients. Clinical and pathological staging was based on the 1997 TNM classification of the International Union Against Cancer.

2.2. Statistical analysis

Survival time was measured from the date of surgery until death or the most recent follow-up examination. Length of survival was determined with the Kaplan–Meier method, and the log-rank test was used for comparisons. The x [2] test and Fisher's exact probability test were used for comparing percentages. A p-value of less than 0.05 was considered to indicate significance. All analyses were performed with the IBM SPSS Statistics software package (IBM Corp., Armonk, NY).

2.3. Surgery

The operation consists of 3 stages, as previously described in detail [2]. Stage 1 involves the thoracic field and includes TSEP and thorascopic mediastinal lymph-node dissection through 4 or 5 ports. Stage 2 involves the abdominal field and includes gastric mobilization and abdominal lymph-node dissection with open laparotomy or the laparoscopic approach. Stage 3 involves the cervical field and includes anastomosis and cervical lymph-node dissection.

2.4. Stage 1: thoracic stage (TSEP)

After intubation, the patient is placed in the prone position upon operative beanbags with a blocking balloon in the right main bronchus for single-lung ventilation.

The port positions are as follows (Fig. 1). Port I is 12-mm blunt port in the 4th intercostal space (ICS) on the posterior axillary line. Port II, placed under thoracoscopic guidance, is a 12-mm port in the 5th ICS on the anterior axillary line. Port III is a 12-mm port in the 3rd ICS on the midaxillary line. Port IV is a 5-mm port in the 8th or 9th ICS on the midaxillary line to insert a camera for procedures of the middle-to-lower mediastinum. Port V is a 5-mm port in the 5th ICS just under the angle of the scapula to insert a camera for procedures of the upper mediastinum. Carbon dioxide is insufflated at a pressure of 8 mm Hg to expand the mediastinum.

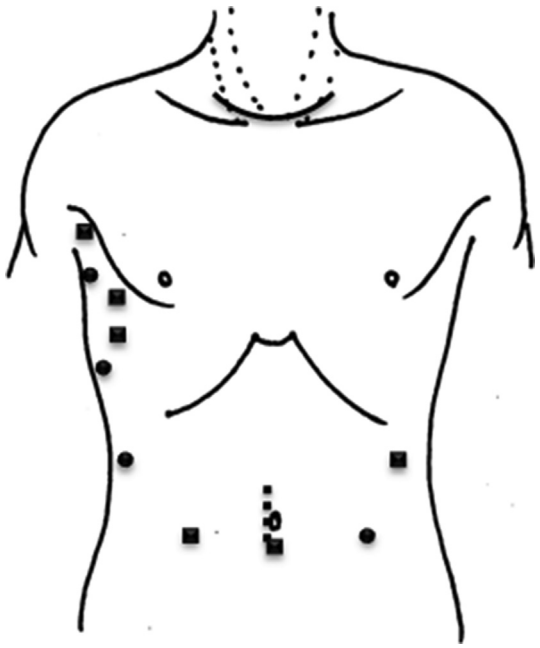

Fig. 1. Port placement and skin incisions. Filled circle, Filled circle: 5-mm port; filled square: 12-mm port. Dotted line is additional minilaparotomy 3–4 cm in diameter.