Single-position, minimally invasive Ivor Lewis oesophagectomy for lower thoracic oesophageal cancer

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Abstract

Although several surgical approaches exist for lower thoracic oesophageal cancer, standardized techniques for minimally invasive oesophageal resection and intrathoracic anastomosis have not yet been established. Thus, optimization of the approach and identification of the ideal anastomosis technique are needed. Seven consecutive patients with lower thoracic oesophageal cancer were treated using a single-position, minimally invasive surgical technique with laparoscopy and thoracoscopy. In the present article, we describe this technique in detail and discuss the outcomes of these patients. No adverse events occurred intraoperatively, no failures in the intrathoracic oesophagogastrostomy were detected and favourable short-term outcomes were obtained. Thus, the procedure described is safe and technically feasible and appears to be promising as an alternative approach for the treatment of patients with lower thoracic oesophageal cancer.

Keywords: Oesophageal cancer • Minimally invasive surgery • Ivor Lewis oesophagectomy

INTRODUCTION

The minimally invasive oesophagectomy (MIO) technique, first introduced in 1995, has been repeatedly modified [1]. Although MIO reportedly lowers intraoperative blood loss and reduces hospitalization time, while maintaining the oncological principles that are similar to open surgical techniques, standardized techniques for MIO and anastomosis construction have not been established [2, 3]. Therefore, optimization of this approach and identification of the ideal anastomosis technique are needed. Here, we describe the use of a single-position, minimally invasive Ivor Lewis oesophagectomy technique with slight modifications in patients with lower thoracic oesophageal cancer.

SURGICAL PROCEDURES

The procedure described comprises three steps. The patient is intubated using a double-lumen tube and is placed in the supine position with the right side of their body supported at an angle of ~30° for the entire procedure.

Laparoscopic procedures

Five abdominal ports are used (Fig. 1). Mobilization of the stomach and complete coeliac lymph node dissection are performed as previously reported [4]. The lower oesophagus is isolated from the oesophageal hiatus along the crus of the diaphragm towards the mediastinum. Approximately 5 cm of the lower oesophagus can be isolated with the dissected lymph nodes (Fig. 2A). The right and left crura are also partially divided to prevent gastric tube outlet obstruction. A feeding jejunostomy tube is then placed, depending on the patient’s diagnosis and preoperative nutritional status; drains are inserted into the space below the left diaphragm.

Thoracoscopic procedures

The patient remains in the same position for the thoracoscopic procedures. Four thoracoscopic ports are used (Fig. 1). The thoracoscopic procedures include circumferential mobilization of the lower oesophagus and dissection of its accompanying lymphatic tissue. The oesophagus is completely mobilized from the hiatus to the right inferior pulmonary vein. After a
hand-sewn, purse-string 3–0 Prolene suture is made, a 25-mm end-to-end anastomotic (EEA) anvil is then inserted and secured with the purse string (Fig. 2B). The distal oesophagus is divided beyond the ligature, leaving a cuff that is sufficiently wide for a stapled anastomosis.

### Intrathoracic oesophagogastrectomy

The sub-costal port is enlarged to 5 cm to facilitate the passage of the EEA stapler. A gastric conduit is constructed by dividing the stomach extracorporeally under direct vision, using the linear stapler (Fig. 2C). Thereafter, the anterior wall distal to the end of the gastric conduit is opened, and the EEA stapler is advanced into the gastrostomy incision created at the tip of the gastric conduit. Under the guidance of a 10-F urinary catheter, the gastric conduit and stapler are carefully delivered from the abdominal cavity using the trans-hiatal approach up to the transected oesophagus, until a sufficient length can be obtained for oesophagogastrostomy, after which a stapled, end-to-side oesophago-gastric anastomosis is created (Fig. 2D). A nasogastric tube, with or without a jejunal feeding tube, is placed across the anastomosis under direct vision and secured. The remaining gastrostomy incision is closed with a linear stapler. A single 28-F chest tube is placed along the posterior mediastinum, and the abdominal and thoracic incisions are closed.

### RESULTS

None of the patients converted to an open procedure or underwent positional changes, and no intraoperative complications were noted. The mean operative time was 186 min (range: 160–225 min). The median blood loss was 238 ml. All patients...
underwent Gastrografin swallows at 6 days postoperatively; there was no evidence of gastric leaks, and we confirmed that the stomachs were emptying adequately. No mortality was noted, and all patients were discharged 9 or 10 days after the operation and could tolerate food intake.

No residual cancer cells were observed in the surgical margins of the excised specimens. The median number of nodes harvested was 19. The final pathological diagnoses were carcinoma in situ in 2 and invasive cancer in 5 patients. All 7 patients were alive and did not show any evidence of cancer at the 9-month median follow-up assessment. No postoperative strictures have occurred thus far.

**DISCUSSION**

MIO has attracted increasing attention as an alternative to conventional open surgery to reduce morbidity and mortality in patients with cancer [5]. However, methods for optimizing MIO and, in particular, creating the perfect anastomosis need to be determined. Here, we describe our procedure for performing a single-position, minimally invasive Ivor Lewis oesophagectomy in patients with lower thoracic oesophageal cancer, and the results appear promising.

Our procedure has the following advantages compared with other established MIO procedures: (1) the patient is placed in the supine position with their right side supported at an angle of ~30°, and no positional changes are required intraoperatively; (2) extracorporeal stapling of the gastric conduit is performed under direct vision; (3) the thoracoscopic anastomosis is created using a circular stapled oesophagogastrostomy reconstruction technique, mini-laparotomy and trans-hiatal approach, instead of a mini-incision into an inter-costal space.

Thoracoscopy primarily appears to influence the overall operative duration [6, 7]; in this study, the laparoscopic procedures took 47 min. The overall operative duration in this study (131 min) was shorter than that previously reported for other MIO approaches.

Our procedure has certain limitations. The limited direct dissection of the mid- and upper-thoracic oesophagus means that our procedure is applicable only to patients with lower thoracic oesophageal cancers requiring intrathoracic anastomoses. Furthermore, the patients needed preoperative assessments using PET-CT scans to evaluate the status of the mid- and upper-mediastinal lymph nodes. This approach cannot be applied to patients who have positive mid- and upper-mediastinal lymph nodes or positive cervical lymph nodes.

Thus, our procedure appears safe and technically feasible, and with proper patient selection, our procedure may be used as an alternative approach to treat patients with lower thoracic oesophageal cancer.

**Conflict of interest**: none declared.

**REFERENCES**


