Minimally invasive abdominal and left thoracic approach for Siewert type II adenocarcinoma of the oesophagogastric junction: Novel technique for simultaneous combined use of laparoscopy and thoracoscopy

Yuma Ebihara, Yo Kurashima, Soichi Murakami, Toshiaki Shichinohe, Satoshi Hirano

Department of Gastroenterological Surgery II, Hokkaido University Graduate School of Medicine, Sapporo, Hokkaido, Japan

INTRODUCTION

The incidence of adenocarcinoma of the oesophagogastric junction (AEG) has been increasing in both Eastern and Western countries. Recently, the value of intra-abdominal and mediastinal lymph node dissection for AEG has been investigated. The Siewert classification of AEG is universally used because it reflects differences in tumour behaviour depending on location. Of these types, Siewert type I is usually treated by oesophagectomy, and Siewert type III is treated by total gastrectomy. Meanwhile, Siewert type II is considered to be a tumour from the true cardia, and the optimal surgical approach has not yet been agreed. In this study, a minimally invasive abdominal and left thoracic approach (MALTA) was performed for Siewert II AEG. This report describes the novel technique...
for MALTA for Siewert II AEG and the results of a small series.

Patients
Seven consecutive patients who underwent MALTA due to a pre-operative diagnosis of Siewert type II AEG at Hokkaido University Hospital between February 2013 and August 2017 were enrolled. The eligibility criteria included preoperative >T3 (tumour invading the subserosa) tumour diagnosed by endoscopy, computed tomography (CT) and endoscopic ultrasound. The operative procedures in these patients included proximal gastrectomy and distal oesophagectomy with double-tract reconstruction. Written informed consent to participate in the study was obtained from all patients. In general, specimens were evaluated according to the Japanese Classification of Gastric Carcinoma established by the Japanese Research Society for Gastric Cancer.\[^6\]

SURGICAL TECHNIQUE

Patients were placed in the reverse Trendelenburg position, and the legs were split, with the left side of the upper body up with the patient under general anaesthesia [Figure 1]. The patient’s position could be tilted up to about 10° to the right. Abdominal procedures were performed with the patient tilted to the right (7°–10°). During the thoracic or simultaneous thoracic and abdominal part of the procedures, the patient was in the original position [Figure 2]. During the procedure, the surgeon stands between the patient’s legs; we use the term ‘valdivia position’. Five trocars (Exel; Ethicon Endo-Surgery, Cincinnati, OH, USA) were passed through a 12-mm paraumbilical port that was subsequently extended to 5.0 cm when using the circular stapler for the oesophagojejunostomy and removing specimens. After carbon dioxide (CO₂), pneumoperitoneum was achieved at a pressure of 10 mmHg, an electrolaparoscope (WA50013; Olympus Medical Systems, Tokyo, Japan) was introduced through the port, and four other trocars (three and one through 12- and 5-mm ports, respectively) were positioned. Two 5-mm trocars were placed in the eighth and eleventh spaces at the left midaxillary line. One 12-mm trocar was placed in the ninth space at the left posterior axillary line, as shown in Figure 3. A pneumothorax using CO₂ at a pressure of 8–10 mmHg, which allows ventilation of both lungs, was performed. An ultrasonically activated device (SONOSURG-X; Olympus Medical Systems, Tokyo, Japan or Harmonic Ace; Ethicon Endo-Surgery) was used for lymph node dissection and vessel coagulation. The basic extent of lymph node dissection in the present series was D1 + LNs dissection (No. 1, 2, 3, 4sa, 4sb, 7, 8a, 9, 11p, 11d, 19, 20) [Figure 4], and distant mediastinal lymph node dissection (No. 110, 111, 112Ao) was performed [Figure 5]. Regions of lymph nodes and lymph node dissection were defined according to the Japanese Classification of Gastric Carcinoma.\[^6\] Following this resection, double-tract reconstruction was performed. The surgical procedures were as follows. Intracorporeal circular stapling oesophagojejunostomy was performed using the transoral anvil (OrVil; Covidien, Mansfield, MA, USA) and a circular stapler (EEA25; Covidien) in MALTA [Figure 6]. The oesophagus was resected with more than a 20-mm proximal margin to decide the transection line using preoperative enhanced sagittal CT. The thoracic oesophagus was exposed and transected using an Echelon 60 Endopath 60-mm linear stapler (Ethicon Endo-Surgery) in the horizontal direction. The orogastric tube was introduced by the anaesthetist into the oesophagus through the mouth and pushed down to the oesophagus section line. After an incision was made at the centre of the section line using the scissors, the tube was retrieved.

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**Figure 1:** Patient’s position ‘valdivia position’ the patients are placed in the supine position, with the legs split in the reverse Trendelenburg position under general anaesthesia. The surgeon stands between the patient’s legs. We use the term ‘valdivia position.’ Abdominal procedures are performed with the patient tilted to the right (7°–10°) (a). For the thoracic or simultaneous thoracic and abdominal part of the procedures, the patient is placed in the original position (b).

**Figure 2:** Positioning of surgical trocars four 12-mm trocars are placed in the paraumbilical, bilateral abdominal, and epigastric regions. One 5-mm trocar is placed in the left hypochondral area (a). Two 5-mm trocars are placed in the eighth and eleventh spaces at the left midaxillary line. One 12-mm trocar is placed in the ninth space at the left posterior axillary line (b). (c) Position of the surgical team.
until the anvil reached the oesophageal stump, at which time the tube was disconnected from the anvil by cutting the connecting thread, and it was then removed from the thoracic cavity. The jejunal loop for subsequent double-tract reconstruction was transected with an Echelon 60 Endopath 60-mm linear stapler at a point on the anal side 20 cm from the ligament of Treitz. The umbilical port was extended to a length of 5 cm, and the circular stapler was introduced into the abdominal cavity through this minilaparotomy using the Alexis wound retractor (Applied Medical, Santa Margarita, CA, USA) to establish the pneumoperitoneum and pneumothorax. The stapler was inserted into the jejunal limb and connected with the anvil to perform anastomosis under the simultaneous laparoscopic and thoracoscopic view. At that time, under the simultaneous view, it was possible to check the condition of the oesophagus and the tension and torsion of the jejunum. Finally, the jejunal stump was closed with an Echelon 60 Endopath 60-mm linear stapler. The jejunogastrostomy was performed with oblique technique. The entry hole was closed with a running suture (3–0 Vicryl; Ethicon, Somerville, NJ, USA). Finally, a side-to-side jejunogastrostomy was created at 20 cm on the anal side of the jejunogastrostomy with an Echelon 60 Endopath 60-mm linear stapler. The entry hole was closed with a running suture (3–0 Vicryl; Ethicon). The specimen was pulled out through the minilaparotomy [Figure 7]. In this study, post-operative complications were defined as surgery-related events occurring within 30 days, in accordance with the Clavien–Dindo classification system.

RESULTS

The seven patients (6 men and 1 woman) had a mean age of 61.7 ± 6.2 years and a mean body mass index of 24.6 ± 3.9 kg/m². The mean surgical duration was 434.0 ± 71.4 min, and mean blood loss was 20.7 ± 16.7 ml. No blood transfusions were required for any of the patients. There were no intraoperative complications and no cases converted to open surgery. On pathological examination, the mean proximal margin was 24.6 ± 12.4 mm, and the mean number of dissected lymph nodes was 30.1 ± 11.0. Three patients were staged pStage IIIB, two patients were
staged pStage IB, one patient was staged pStage IA and one patient was pStage IV. Four patients (pStage IIIB and pStage IV) received adjuvant chemotherapy. The mean durations to resume a soft diet and the post-operative hospital stay were 3.2 ± 0.5 and 18.0 ± 8.1 days, respectively. No patient required re-operation. No anastomotic leakage and complications ≥ Clavien–Dindo III were seen. Recurrence was not observed in any patient during the median follow-up period of 24.5 (range 2–52) months.

**DISCUSSION**

Laparoscopic surgery is now a common type of less invasive surgical procedure that has various applications. The optimal surgical approach and the extent of lymphadenectomy for AEG Type II are controversial. A Japanese group conducted a randomised, controlled trial comparing the left transthoracic and transhiatal approaches to operate on patients with Siewert type I and II tumours (JCOG9502). Despite the assumption that the left transthoracic approach would be better for clearance of the mediastinal lymph nodes because it could provide a direct view, that study demonstrated no survival benefit and higher morbidity with the transthoracic approach. Moreover, the disadvantage of this approach is the invasiveness of thoracotomy, which requires a long skin incision, which may explain the higher complication rate. During mediastinal lymphadenectomy through the transthiatal approach, the operative view tends to be inadequate.

Palanivelu et al. stated that using artificial pneumothorax under two-lung ventilation may decrease respiratory complications. It is possible to perform two-lung ventilation under artificial pneumothorax in MALTA. Phrenic nerve paralysis and post-operative hiatal hernia can be prevented by not transecting the diaphragm; therefore, we believe that the procedures used in the present study decrease the respiratory complications after MALTA.

In MALTA, the oesophagojejunostomy can be performed under a simultaneous laparoscopic and thoracoscopic view, making intrathoracic oesophagojejunostomy easier to perform. We think that the laparoscopy and thoracoscopy provide a magnified view, which may facilitate the performance of accurate and safe surgical procedures.

**CONCLUSIONS**

This novel technique (MALTA) shows considerable advantages, such as achieving an adequate proximal margin, intrathoracic oesophagojejunostomy and increased operative field exposure of the lower mediastinum, for patients with Siewert type II AEG.

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**Conflicts of interest**

There are no conflicts of interest.

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