

# Intracorporeal laparoscopic esophagojejunostomy using endoscopic linear staplers: the experiences of 293 cases

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**Abstract:** Although several investigators have suggested their method to perform a totally laparoscopic total gastrectomy (TLTG), even experts on laparoscopic gastrectomy, it is very hard to perform a safe TLTG in practice because of the complexity of procedure. We developed a secure technique for intracorporeal laparoscopic esophagojejunostomy (EJ) using endoscopic linear staplers and successfully performed the TLTG method. Between September 2006 and January 2013, total of 293 patients with early gastric cancer in the upper third of the stomach underwent TLTG using endoscopic linear stapler in one institution. The laparoscopic EJ was successfully performed in all patients; none of the patients required conversion to open surgery or other laparoscopic anastomosis techniques. All the operations were curative. The intracorporeal EJ procedure can be performed easily and safely, and this method of TLTG may become a powerful alternative procedure for intracorporeal EJ after laparoscopic total gastrectomy.

**Key Words:** Laparoscopic total gastrectomy; intracorporeal anastomosis; esophagojejunostomy



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## Introduction

Due to its safety and efficacy, laparoscopic gastrectomy is becoming a widely used surgical method for treating early gastric cancer (EGC) (1-5). After its introduction in 2002, several types of totally laparoscopic gastrectomy using intracorporeal reconstruction have been made to improve early surgical outcome of laparoscopic gastrectomy (6-10). Recently, we also reported that early surgical outcomes of totally laparoscopic distal gastrectomy using an intracorporeal reconstruction (TLDG) are superior to those of laparoscopic assisted distal gastrectomy using an extracorporeal reconstruction (LADG) (11,12).

More recently, some investigators reported various types of totally laparoscopic total gastrectomy using an intracorporeal reconstruction (TLTG) (13-18). In practice, however, it is very hard to perform or try TLTG. Unlike TLDG method, TLTG demands a high level of surgical technique. Therefore, we introduce more practical TLTG method from our experiences.

## Surgical techniques

Each patient was placed in the reverse Trendelenburg position. A carbon dioxide pneumoperitoneum was formed from the umbilical port, and pressure was maintained between 12 and 15 mmHg. Five trocars were placed in a U-shape. To retract the liver, the attachment site of the lesser omentum to the right diaphragmatic cruse was intracorporeally sutured, and then a thread pulled by a suture-passer was tied onto the skin in the xyphoid process area. If the operating field was not sufficient, an additional 5-mm trocar was inserted into the epigastric area to retract the liver.

Dissection was begun by dividing the greater omentum, from the mid-portion of the gastroepiploic arcade to the left gastroepiploic vessel. The lymph nodes around the left gastroepiploic, and short gastric vessels were dissected. After dissecting the lymph nodes around the short gastric area, the infrapyloric area was dissected. After lymph nodes around the suprapyloric area were dissected, the duodenum

was transected just below the duodenal bulb using an endoscopic linear stapler (ECHELON FLEX™ 60) (*Video 1*). And then, lymph nodes around common hepatic, proximal or distal splenic, celiac, and left gastric arteries; and right paracardial and lesser curvature areas were dissected in that order.

After having cleared all lymph nodes, nearly two-thirds of the esophagus diameter was transected 2 cm above the gastroesophageal junction using the endoscopic linear stapler (ECHELON FLEX™ 60) and the first intracorporeal suture was placed at the end of the stapled line to retract the esophageal stump and this suture was cut 15 cm from the esophageal stump, which it was retracted by first assistant during reconstruction of esophagojejunostomy (EJ). The unstapled esophageal stump was then transected with laparoscopic scissors after grasping the remnant stomach with a laparoscopic intestinal clamp to avoid cancer cell spillage (*Video 1*). To make the lumen of esophagus easier to detect, a second round of intracorporeal suture was placed at the small esophagostomy of the esophageal stump and it was extracted outside the abdomen through the right lower trocar to retract it, which prevented slipping of the esophageal mucosa and submucosa during reconstruction of EJ. The specimen was subsequently removed through another suprapubic incision that was approximately 3–4 cm long. After removing the specimen, the suprapubic incision site was closed by continuous suture to reinstate the pneumoperitoneum. The proximal resection margin of the specimen was examined pathologically.

The jejunum was then divided 20 cm below the ligament of Treitz by using an endoscopic linear stapler (ECHELON FLEX™ 60), and an efferent loop was turned in a counter-clockwise direction to reconstruct the EJ. An enterostomy of jejunum was made in the antimesenteric side of the Roux-en-Y limb by using laparoscopic scissors, and an endoscopic linear stapler (ETS STRAIGHT™ 45) with closed staple height of 1.5 mm was inserted into esophagostomy and enterostomy of jejunum to form an EJ (*Video 1*).

### Postoperative management

Gastrograffin studies were performed on postoperative day 3 to evaluate leakage after certain intraoperative events that occurred in nine patients during reconstruction of the esophagojejunostomy. A soft diet was commenced on the day when each patient felt comfortable enough to eat soft foods. The patients were discharged when they had no problems eating a soft diet and were generally comfortable,

and inflammatory conditions, including leukocytosis, unstable vital signs, and abrupt onset of abdominal pain, were absent. The final decision about discharge was made by the patient.

### Clinical analysis of early surgical outcomes of TLTG

The study sample included 185 men (63.1%) and 108 women (36.9%) with mean age 57.0 years (range, 22–84 years). The average body mass index was 24.8 kg/m<sup>2</sup> (range, 16.6–32.4 kg/m<sup>2</sup>). Intracorporeal esophagojejunal anastomosis using an endoscopic linear stapler was successful in all patients. None of the patients required conversion to open surgery or other laparoscopic anastomosis techniques. All the operations were curative. The mean operation time was 141.8±43.9 min. The mean time to first flatus was 3.47±0.9 days and the mean post-operative day on which patients commenced a soft diet with no morbidity was 4.52±8.0 days. The mean length of hospital stay of patients with no morbidity was 7.80±3.6 days. *Table 1* shows the postoperative complications and managements of the patients who underwent TLTG. The overall postoperative complication rate was 15.7%, the mild postoperative complication rate was 11.3%, and the severe postoperative complication rate was also 4.4%.

### Discussion

Recently, several types of totally laparoscopic gastrectomy using intracorporeal reconstruction were introduced. We also reported the benefits of totally laparoscopic distal gastrectomy with gastroduodenostomy using endoscopic linear staplers. Despite several articles about experiences for totally laparoscopic total gastrectomy using intracorporeal reconstructions reported, however there are few reports to evaluate early surgical outcomes of totally laparoscopic total gastrectomy. In practice, TLTG is rarely performed because of the complicated procedures. Therefore, we would like to introduce our method to perform TLTG safely and reduce the possibility of cancer cell spillage from our experiences.

In practical procedures, it is needed to prevent the slipping of esophageal stump during reconstruction of EJ because the resected esophageal stump moves easily into the thoracic cavity. To prevent the slipping of esophageal stump and perform the anastomosis in abdominal cavity during the reconstruction, we had devised improved techniques

**Table 1** Postoperative complications and treatments of TLTG

Type	Morbidity	N (%)	Treatment
Major	Internal herniation	3 (1.02)	3 Laparoscopic hernia reductions
	Extra luminal bleeding	2 (0.68)	1 Laparoscopic management 1 Interventional pig-tail catheter insertion + antibiotics
	Anastomotic leakage	1 (0.34)	1 Long-term parenteral nutrition + interventional pig-tail catheter insertion + antibiotics
	Duodenal stump leakage	2 (0.68)	1 Laparoscopic surgical drainage 1 Laparoscopic tube duodenostomy insertion + conservative therapy
	Anastomosis structure	2 (0.68)	2 Stent insertion
	Intra-abdominal abscess	2 (0.68)	2 Interventional pig-tail catheter insertion + antibiotics
	Post-operative ileus	1 (0.34)	1 Laparoscopic adhesiolysis
Minor	Intra-luminal bleeding	1 (0.34)	1 Conservative treatment
	Extra-luminal bleeding	1 (0.34)	1 Conservative treatment
	Anastomotic leakage	10 (3.41)	10 JP Drainage + antibiotics
	Anastomosis structure	5 (1.71)	5 Conservative treatment
	Intra-abdominal abscess	2 (0.68)	2 JP Drainage + antibiotics
	Post-operative ileus	8 (2.39)	8 Conservative treatment
	Wound infection	3 (1.02)	3 Conservative treatments
	Other	3 (1.02)	3 Conservative treatments

TLTG, totally laparoscopic total gastrectomy; JP, Jackson-Pratt

as follows. Two intracorporeal suturing using black silks were in the end of stapled line and opened esophagostomy of esophageal stump. To prevent slipping of esophageal slipping during the reconstruction, first assistant pulled first thread toward operator side in abdominal cavity and second assistant pulled second sutured thread outside the abdominal cavity through right lower trocha. This retraction would have enabled operator to prevent falling of the anastomosis into thoracic cavity and confirm the safety of anastomosis. And, operator could insert without great difficulty an endoscopic linear stapler between opened hole of esophageal stump and jejunal stump to make common channel. As a result, we could minimize the size of remnant anterior hole of common channel. After completion of the EJ, we could confirm the safety of posterior and anterior side of the anastomosis.

In conclusion, we strongly believe that TLTG could be a best way to improve early surgical outcomes in gastric cancer patients. However, inexperienced surgeons for laparoscopic gastrectomy should be careful in performing TLTG because TLTG is made up of complex processes. Therefore, it is conceivable that our TLTG method from high volume center experiences can help surgeons decrease or overcome the learning period.

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