

Clinical benefit of Totally Laparoscopic over Laparoscopically Assisted Distal Gastrectomy with Roux-en-Y Reconstruction for Early Gastric Cancer

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Abstract: Background. Laparoscopic gastrectomy for early gastric cancer has become popular. Most laparoscopic gastrectomies were performed as laparoscopically assisted distal gastrectomy (LADG). Totally laparoscopic distal gastrectomy (TLDG) has increased. This study investigated the safety, feasibility and efficacy of TLDG. **Methods.** One hundred five cases were operated laparoscopically for early gastric cancer from January 2006 to 2009 March. This study compared patients that underwent Roux-en-Y reconstruction (8 LADGs and 28 TLDGs). The study examined the patient demographics, the clinicopathological characteristics of cancer, intraoperative data, and postoperative data.

Results. There were no significant differences the two groups in the operation time, blood loss, postoperative complications, time to oral intake and postoperative hospital stay. The length of the proximal margin from the primary cancer was significantly longer in the TLDG group. The wound length of minilaparotomy was significantly shorter in the TLDG group. **Conclusion.** TLDG is equally safe and effective in comparison to LADG. In addition, TLDG has advantages over LADG including cosmesis and a sufficient proximal margin.

Key words : Gastric cancer, Laparoscopically assisted distal gastrectomy, Totally laparoscopic distal gastrectomy, Roux-en-Y Reconstruction

Introduction

Laparoscopic gastrectomy for early gastric cancer (EGC) has become popular among laparoscopic surgeons in Japan. The tenth nationwide survey conducted by the Japan Society for Endoscopic Surgery (JSES) showed that 25.9% (7,431/28,676) of gastric cancer patients were treated by laparoscopic surgery in 2009¹⁾.

Laparoscopically assisted distal gastrectomy (LADG) was initially the most frequently performed procedure. LADG performs the lymph node dissection laparoscopically. However, resection of the stomach and reconstruction of the digestive tract are performed extracorporeally with

a direct view through a minilaparotomy at the epigastric area. Therefore, LADG surgical procedures were difficult to perform in, patients that were obese and needed subtotal gastrectomy²⁾⁻⁵⁾.

Therefore, the use of totally laparoscopic distal gastrectomy (TLDG), which performs the entire surgical procedure intracorporeally has recently increased. However its safety, feasibility and efficacy have not yet been evaluated.

Patients And Methods

Patients

One hundred five patients underwent laparoscopic surgery for preoperatively diagnosed early gastric cancer

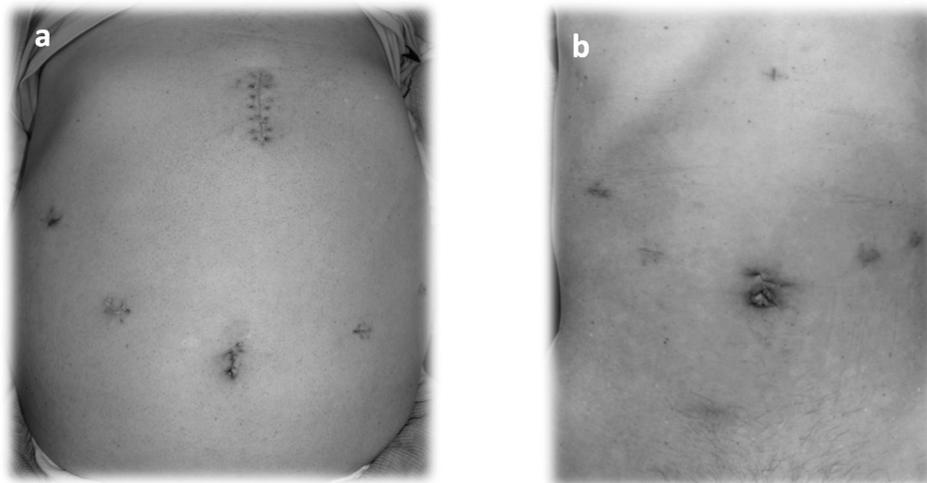


Fig. 1 Wound scar after the surgery
a Laparoscopically assisted gastrectomy
b Totally laparoscopic distal gastrectomy

from January 2006 to March 2009, at the Department of Gastroenterological Surgery, Fukuoka University School of Medicine. Preoperative assessment was done by gastroendoscopy, barium swallowing and computed tomography. Furthermore, all patients were underwent preoperative gastroendoscopic clipping for the surgeon to palpate to detect the tumor. The patient population in this study included 77 LADG patients and 28 TLDG patients. Billroth I reconstruction was selected in 69 LADG patients and Roux-en-Y reconstruction was selected for 8 patients. Roux-en-Y reconstruction was selected for all TLDG patients. No Billroth I reconstruction was selected. Therefore, this study compared patients that underwent Roux-en-Y reconstruction (8 LADGs and 28 TLDGs), to evaluate the advantages of TLDG.

Surgical procedure

The patients were placed in the supine position with their legs apart. The operation was performed under a pneumoperitoneum that was created by injection of carbon dioxide (8-12 mmHg). Six trocars were placed. The round ligament of the liver was fixed to the abdominal anterior wall for retraction of the liver using 2-0 polypropylene suture (Prolene; Ethicon Inc., Japan).

Lymph node dissections D1+ α or D1+ β , defined according to Japanese classification and treatment guidelines for gastric cancer⁶⁾, was conducted. First, dissection was begun by separation of the greater omentum from the transverse colon and dissection of the lymph nodes along the left gastroepiploic vessels

(no. 4sb). The lymph nodes around right gastroepiploic arcade were dissected (no. 4d), followed by those in the infrapyloric area (no. 6). The duodenum was transected just below to the pyloric ring using an endoscopic linear stapler (Endo GIA; COVIDIEN, Japan). The suprapyloric nodes (no.5) and the nodes along the common hepatic artery (no. 8a), the nodes along the celiac artery (no. 9) and the nodes along the left gastric artery (no. 7) were dissected. Finally, the right cardinal area and lesser curvature areas were dissected (no.1 and no.3).

Procedure for Extracorporeal Roux-en-Y reconstruction in LADG

A small midline superior incision, 4-6 cm in length (Fig.1 a), was made from the epigastric trocar site and a wound retractor (MultiFlap Gate; Ethicon Endo-Surgery, Japan) was placed. The stomach was extracted through the incision and divided using endoscopic linear stapler. The resection line of stomach was determined by palpation of the marking clip that was placed preoperative. Roux-en-Y reconstruction was performed with hand sutures through the incision using a small midline superior incision.

Procedure for Intracorporeal Roux-en-Y reconstruction in TLDG

The resection line of the stomach was determined by appreciating of the marking clips placed preoperatively by intraoperative gastroendoscopy or radiographic imaging. The stomach was divided using an endoscopic linear

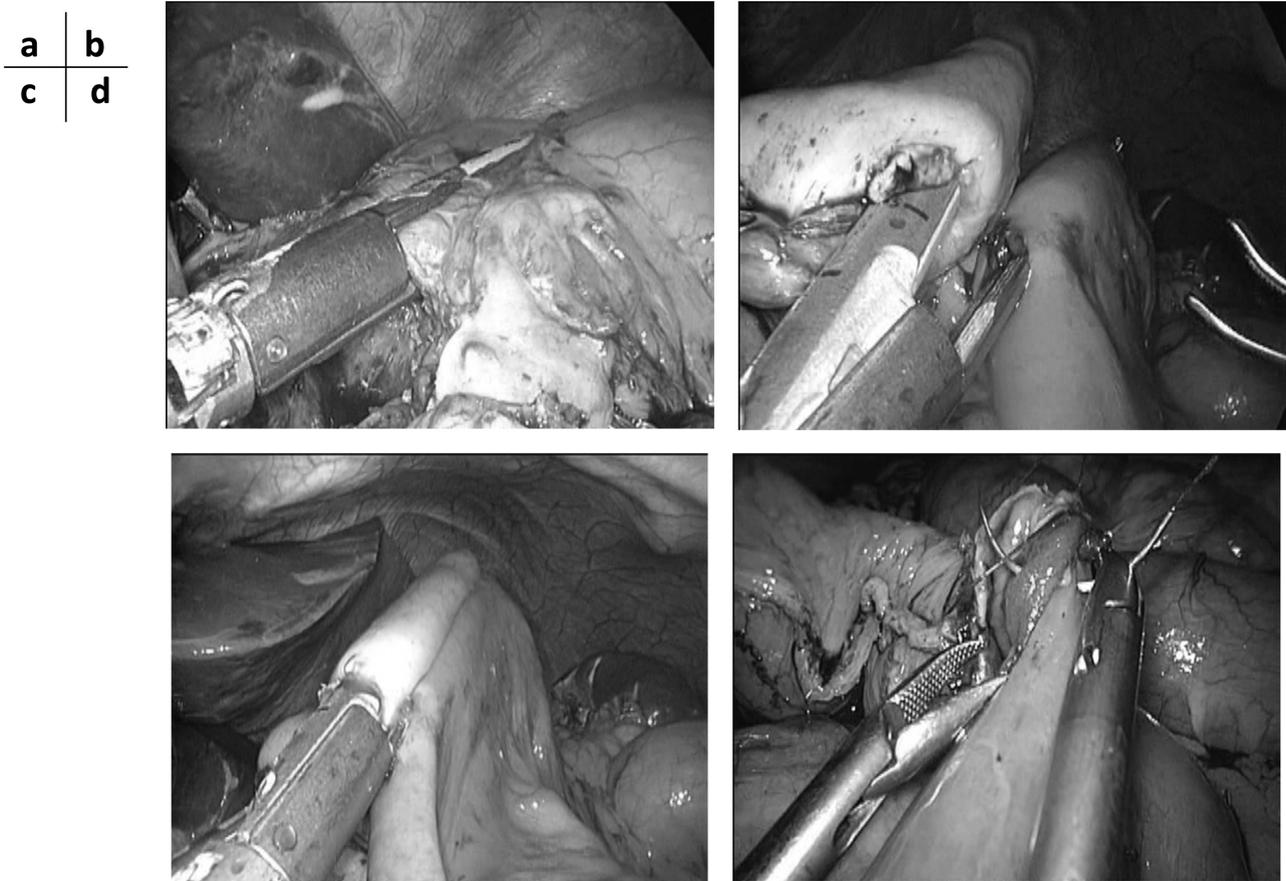


Fig. 2 Intracorporeal Roux-en-Y reconstruction

- a The stomach was divided using endoscopic linear stapler intracorporeally
- b, c Endoscopic linear stapler was inserted into the either small stab holes and fired
- d Common entry hole was closed by hand-sewing intracorporeally

stapler intracorporeally (Fig.2 a). The resected stomach was extracted via a 2.5cm incision at the umbilical port (Fig.1b). The jejunum was transected 20 cm distal from the Treiz ligament with an endoscopic linear stapler, and the jejunum of the anal side (Roux jejunal limb) brought up via the antecolic route. A small stab hole was made in Roux jejunal limb about 6 cm anal from the stump and the great curvature of the gastric remnant, and an endoscopic linear stapler was inserted into the either small stab holes and fired (Fig.2b, 2c). The, common entry hole was closed by hand-sewing or using an endoscopic linear stapler (Fig.2d). A functional end-to-end anastomosis between the Roux jejunal limb and the gastric remnant was completed. Jejunojejunostomy was performed 40 cm from the anal side of the gastrojejunostomy with an endoscopic linear stapler or hand-sewing through an incision at the umbilical port.

Methods

This study examined the patients' characteristics (age, gender, body mass index (BMI), preoperative complications), the clinicopathological characteristics of the cancer (location, macroscopic type, depth of tumor invasion, histological type, number of harvested lymph nodes, extent of lymph node metastasis, length of the proximal margin from the primary cancer) and the early surgical outcome (operation time, blood loss, wound length of minilaparotomy, conversion to open gastrectomy, postoperative complications, time to oral intake and postoperative hospital stay). Furthermore, gastric cancer was described according to the Japanese classification and treatment guidelines for gastric cancer⁶⁾.

Statistical analysis

Statistical analyses were performed using the SAS

Table 1 Patients characteristics

	TLDG (n=28)	LADG (n=8)	p-Value
Age (years)	61.9±9.0	67.6±12.1	NS
Gender (male/female)	22/6	6/2	NS
BMI (kg/m ²)	24.3±3.2	22.7±2.8	NS
Preoperative complication	10(35.7%)	4(50.0%)	NS
Hypertention	6	2	
Heart disease	1	1	
Diabetes mellitus	3	1	
COPD	0	1	

NS.: not significant, BMI: Body mass index, COPD; chronic pulmonary disease

Table 2 The clinicopathological characteristics of cancer

	TLDG (n=28)	LADG (n=8)	p-Value
Main location of gastric cancer L/ M (MU)	2/ 26 (8)	1/ 7 (1)	NS
Macroscopic type 0- I / 0- II a/ 0- II b/ 0- II c /Type3	0/ 4/ 0/20/ 4	1/ 0/ 0/ 2	NS
Depth of invasion m/ sm/ mp/ ss	11/ 12/ 1/ 4	3/ 2/ 3/ 0	NS
Hystologic type tub1/ tub2/ por/ sig/ pap	8/ 4/ 9/ 7/ 0	3/ 2/ 3/ 0/ 0	NS
Number of harvested lymph node	34±16	38±15	NS
Lymph node(LN) metastasis n0/ n1/ n2/ n3	26/ 1 / 1/ 0	7/ 1/ 0/ 0	NS
Proximal margin(cm)	3.6±1.7	2.0±0.9	0.016

NS.: not significant

software package Stat View, version 5.0 (SAS Institute, NC, USA). A result was considered to be statistically significant when the *P* value was less than 5% (*P*<0.05).

Results

Patients' characteristics

Laparoscopic gastrectomy was performed with Roux-en-Y reconstruction for 36 patients (8 LADGs and 28 TLDGs). The patients' characteristics are shown in Table 1. There were no significant differences in age, gender, BMI and preoperative complications.

The clinicopathological characteristics of the cancer

Table 2 show the clinical and pathological findings of the cancers. There were significant differences in the length of the proximal margin from the primary cancer (*p*=0.016). The length of the proximal margin was significantly longer in the TLDG group (3.6±1.7 vs. 2.0±0.9 cm). The location of the cancer, macroscopic type, depth of tumor invasion, histological type, extent of lymph node metastasis and number of harvested lymph nodes were not statistically different between the two groups.

Early surgical outcome

Table 3 shows the early surgical outcome in all of the

Table 3 Early surgical outcome

	TLDG (n=28)	LADG (n=8)	p-value
Operation time (min)	330±69	374±75	NS
Intraoperative blood loss (ml)	112±96	121±91	NS
Wound length of minilaparotomy (cm)	2.2±0.3	4.8±0.5	<0.01
Conversion to open surgery	0	0	-
Postoperative complication	3 (10.7%)	2 (25%)	NS
Leakage of gastrojejunostomy	1	1	
Leakage of duodenal stump	1	0	
Intra-abdominal abscess	1	0	
Pneumonia	0	1	
Time to first eating (Day)	5.2±3.6	6.2±3.8	NS
Postoperative hospital stay (day)	22±15	16±9	NS

NS.: not significant

patients. There were no significant differences in the operation time, blood loss, postoperative complications, time to oral intake and postoperative hospital stay between the two groups. Significant differences were observed in the wound length of minilaparotomy ($p < 0.01$). The wound length of minilaparotomy was significantly shorter in the TLDG group (2.2 ± 0.3 vs. 4.8 ± 0.5 cm). No patients underwent a conversion to open surgery. In addition, there was no conversion from TLDG to LADG. Postoperative complications, including anastomotic leakage (1 LADG and 2 TLDGs) and intra-abdominal abscess were all conservatively treated.

Discussion

In Japan, laparoscopic gastrectomy for EGC has become popular among laparoscopic surgeons over the last decade; however it is now classified as an investigational treatment by the Japanese gastric treatment guidelines 2010 (ver. 3)⁷⁾. Its advantages over conventional open surgery have been well documented³⁾. Most laparoscopic gastrectomies were treated by LADG, until recently, and the LADG procedure has been established⁵⁾. LADG conducts the lymph node dissection laparoscopically. However, resection of the stomach and reconstruction of the digestive tract are performed extracorporeally with a direct view through a minilaparotomy in the epigastric area. Therefore, it is sometimes difficult to perform resection of the stomach and reconstruction of the digestive tract in LADG procedures in patients that are

obese and need subtotal gastrectomy^{2), 3), 8)}.

On the other hand, TLDG seemed to be a very difficult procedure because of the intracorporeal reconstruction and suturing of the digestive tract. However, the current study found no significant differences in the operation time, blood loss, postoperative complications, time to oral intake and postoperative hospital stay between the LADG and TLDG groups. TLDG can obtain a better laparoscopic view and help the surgeon accurately resect and reconstruct the stomach regardless of the BMI and patient's physique. Furthermore, one of the important advantages of TLDG over LADG is the length of the proximal margin from the primary cancer. The length of the proximal margin was significantly longer in the TLDG group (3.6 ± 1.7 vs. 2.0 ± 0.9 cm). The indications for laparoscopic gastrectomy were mainly early gastric cancer during the early period of the laparoscopic era in Japan, thus the surgeon cannot palpate and cannot recognize tumor from the serosal side of gastric wall. Therefore, marking clips were placed near the oral side of tumor edge prior to surgery and the resection line of the stomach was determined by perorally appreciating the marking clip from the intraoperative gastroendoscopy or radiographic imaging during the operation. Intraoperative peroral gastroendoscopy is more effective than radiographic imaging if the tumor location is very high. Insertion of intraoperative gastroendoscopy perorally into stomach makes it possible to protect the esophagogastric junction from injury and deformation when the stomach is divided intracorporeally using an endoscopic linear stapler.

TLDG only needs a 2.2±0.3 cm incision at the umbilical port for extraction of the resected stomach. This incision is 2.6 cm shorter than that of LADG at the midline superior incision and leads to better cosmesis. A few previous studies have shown that TLDG has advantages over LADG including less blood loss, better postoperative respiratory function, a shorter bowel recovery time, and a shorter hospital stay^{3),9),10)}. Kinoshita et al.⁵⁾ compared TLDG and LADG limited to B-I reconstruction, but other studies include several methods of resection and reconstruction. The current study was limited to Roux-en-Y reconstruction.

In conclusion, this study showed that TLDG is equally a safe and effective in comparison to LADG. In addition, TLDG has advantages over LADG including cosmesis and a sufficient proximal margin.

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(平成 24. 4. 23 受付. 平成 24. 9. 24 受理)