

Esophagogastrostomy before proximal gastrectomy in patients with early gastric cancers in the upper third of the stomach

Yasumasa KONDOH, Akiko ISHII, Kazuhiro ISHIZU, Tomoko HANASHI, Yuichi OKAMOTO*, Mari MORITA*, Kazuhito NABESHIMA*, Kenji NAKAMURA*, Jinichi SOEDA*, Kyoji OGOSHI* and Hiroyasu MAKUUCHI*

Department of Surgery, Tokai University Tokyo Hospital

**Department of Gastrointestinal Surgery, Tokai University School of Medicine*

(Received July 18, 2006; Accepted September 6, 2006)

Objective: This study was designed to assess the outcome of esophagogastrostomy before proximal gastrectomy in patients with early gastric cancers in the upper third of the stomach.

Methods: From 1997 through 2004, we studied 10 consecutive patients. A stapler was introduced into the stomach, and an esophagogastrostomy was performed before proximal gastrectomy. Hill's posterior gastropepy and Dor's anterior fundic wrap were performed to prevent reflux esophagitis.

Results: The operation time was 171 ± 44 minutes, and the intraoperative bleeding volume was 294 ± 228 mL. There was no anastomotic leakage. Anastomotic stenosis, occurring in 40% of the patients, required endoscopic balloon dilatation. Symptoms of reflux esophagitis, occurring in 40% of the patients, resolved within 2 years after operation. As compared with the preoperative value, body mass index was significantly decreased 1 and 2 years after operation, but was similar at 3 to 5 years. The percent decrease in body weight after operation fluctuated between 6% and 8% between 2 and 5 years. Postoperative weight loss was thus mild.

Conclusions: Esophagogastrostomy before proximal gastrectomy may be less invasive, simpler, and produce better outcomes than conventional procedures for the surgical treatment of early gastric cancer in the upper third of the stomach.

Key words: gastric cancer, proximal gastrectomy, esophagogastrostomy

INTRODUCTION

Surgical procedures for resection and reconstruction in patients with resectable gastric cancer are dictated by tumor size, location, and whether resection margins are macroscopically and microscopically free of tumor. Tumors confined to the proximal third of the stomach are generally treated by total gastrectomy to ensure adequate resection margins. Reconstruction after proximal gastrectomy can be done by esophagogastrostomy [1-3], interposition of a jejunal pouch [4, 5], or the jejunal-pouch double-tract technique [6]. Whether functional outcomes after proximal gastrectomy are better than those after total gastrectomy with reconstruction remains controversial. We developed a modified procedure for esophagogastrostomy before proximal gastrectomy. We describe this procedure and the results of postoperative follow-up.

MATERIALS AND METHODS

Patients

Esophagogastrostomy was indicated in patients with gastric cancer who were scheduled to undergo curative resection of one third or less of the proximal stomach, with preservation of the distal two thirds or more of the stomach.

From 1997 through 2004, we studied 10 consecutive patients who underwent proximal gastrectomy for stage 1a [7] gastric cancer arising in the upper third of the stomach. Operation time, intraoperative blood loss,

starting date of oral intake, white blood cell counts, lymphocyte counts, hemoglobin levels, total protein, serum albumin, total cholesterol, body mass index, and percent decrease in body weight as compared with the preoperative value were examined for 5 years after operation.

The *t* test was used for statistical analysis. *P* values of less than 0.05 were considered to indicate statistical significance.

Surgical procedures

Surgery was performed as follows. The distal margins were at least 3 cm below the tumor (Fig. 1A). The esophagus was divided, and a stapler was inserted into the stomach. An end-to-side esophagogastrostomy was performed (Fig. 1B). To perform proximal gastrectomy, a linear stapler was placed and fired across the upper third of the stomach (Fig. 1C).

After 2-0 nylon purse-string sutures were placed at the transection line of the esophagus, the esophagus was sharply transected. The anvil of a CEEA stapler (US Surgical Corp., Norwalk, Conn., USA) was inserted into the proximal end of the esophagus (Fig. 2A). The CEEA stapler was inserted through the distal end of the esophagus into the stomach. The center rod was exposed from the greater curvature of the upper body of the stomach and connected to the anvil. An end-to-side direct anastomosis was performed between the esophagus and the greater curvature of the upper body of the stomach (Fig. 2B). The upper third of the

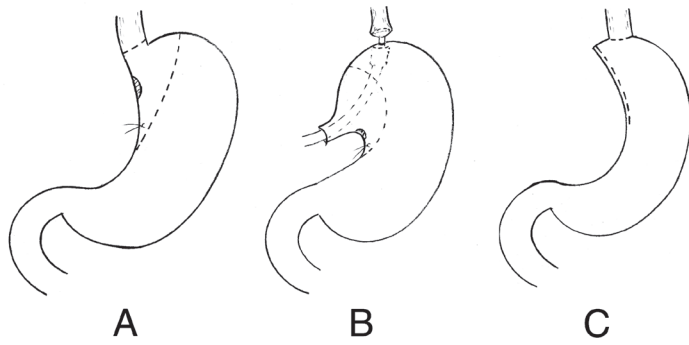


Fig. 1 Schematic surgical techniques for esophagogastrostomy with proximal gastrectomy.
A: The distal margins were at least 3 cm below the tumor.
B: A stapler was inserted through the margins of the resected esophagus into the stomach. An end-to-side esophagogastrostomy was performed before proximal gastrectomy.
C: To perform proximal gastrectomy, a linear stapler was placed and fired across the upper third of the stomach.

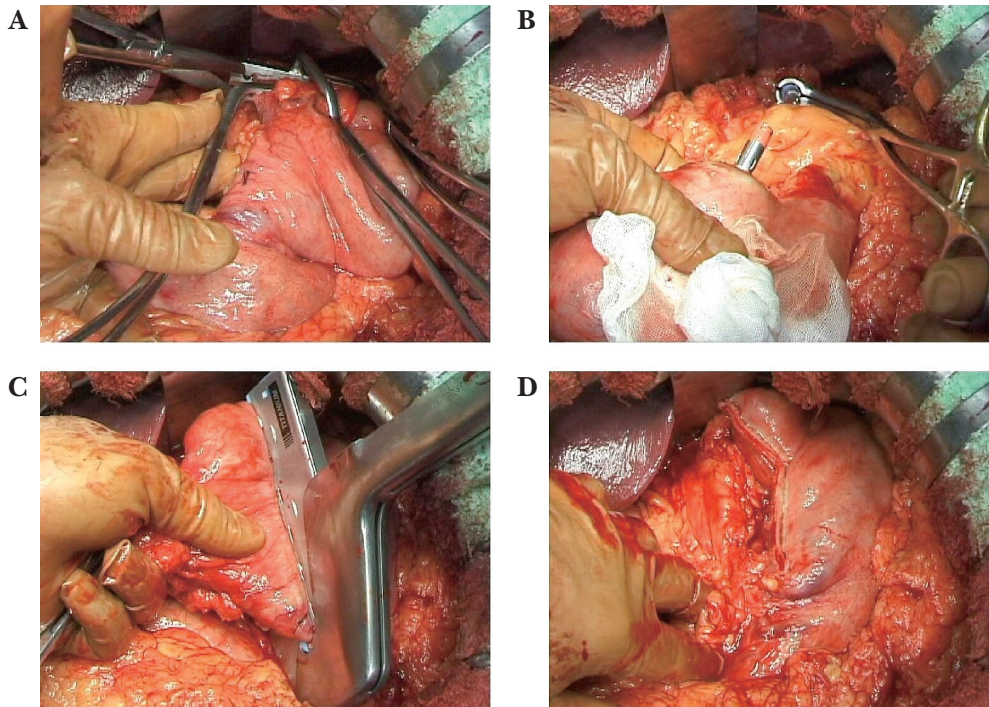


Fig. 2 Surgical techniques for esophagogastrostomy with proximal gastrectomy.

- A:** After purse-string sutures were placed at the transection line of the esophagus, the esophagus was sharply transected. An anvil of a CEEA stapler was inserted into the proximal end of the esophagus.
- B:** The CEEA stapler was inserted through the distal end of the esophagus into the stomach. The center rod was exposed from the greater curvature of the upper third of the stomach and was connected to the anvil. An end-to-side direct anastomosis was performed between the esophagus and the greater curvature of the upper third of the stomach.
- C:** The upper third of the stomach was tightly held to resect the tumor, including a safety margin marked with fixed sutures.
- D:** A proximal gastrectomy was performed with a TA stapler.

stomach was tightly held to resect the tumor, including a safety margin marked with fixed sutures. A proximal gastrectomy was performed with a TA stapler (Fig. 2C and 2D). Interrupted, nonabsorbable serous-muscular sutures (3-0 silk) were placed at the transection line of the stomach and the site of esophagogastrostomy. A pyloroplasty was performed manually. To prevent sliding hernia at the site of esophagogastrostomy, the dorsal anastomosis was sutured to the median arcuate ligament with 2 to 3 interrupted serous-muscular sutures, according to Hill's posterior gastropexy. A cardioplasty was performed by Dor's anterior fundic wrap technique. The serous membrane of the greater curvature of the stomach near the anastomosis was sutured to the anterior wall of the abdominal esophagus with 2 to 3 sutures (3-0 silk).

RESULTS

The clinicopathological details of the patients are summarized in Table 1. Both mucosal and submucosal cancers were found in 5 patients. Histopathologically, 2 patients had papillary adenocarcinomas, and 8 had tubular adenocarcinomas. None of the patients had lymph node metastasis. The disease stage was thus stage 1a [7]. The age of the patients ranged from 59 to 78 years. Nine of the 10 patients were men. Preoperative body weight was 62.4 ± 7.9 kg (range, 47.6 to 74.2 kg). Body mass index was 23.6 ± 1.8 . Operation time was 171 ± 44 minutes. Intraoperative bleeding volume was 294 ± 228 ml. Oral intake was started 8 ± 0.8 days after operation. There was no anastomotic leakage. Anastomotic stenosis developed

Table 1 Characteristics of the patients.

No.	Age (years)	Sex	Stage	Histological type*	Lymph node metastasis
1.	72	male	1a	tub	0/2
2.	70	male	1a	pap	0/12
3.	67	male	1a	tub	0/21
4.	71	male	1a	pap	0/19
5.	72	male	1a	tub	0/41
6.	65	male	1a	tub	0/2
7.	60	male	1a	tub	0/16
8.	64	male	1a	tub	0/7
9.	59	male	1a	tub	0/3
10.	78	female	1a	tub	0/4

* tub denotes tubular adenocarcinoma and pap, papillary adenocarcinoma

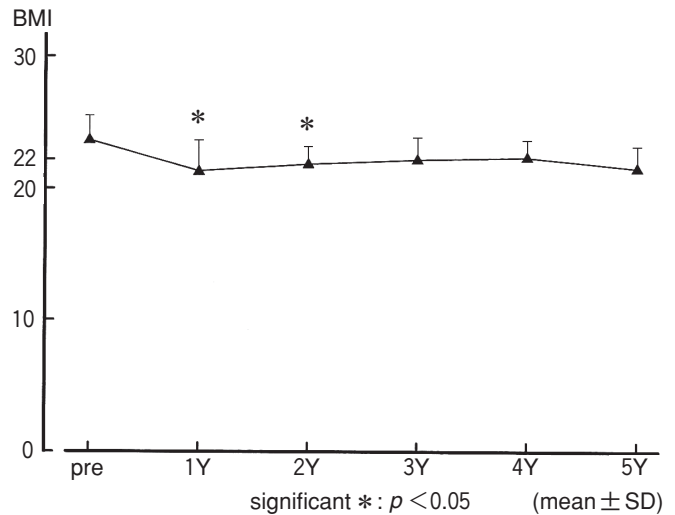
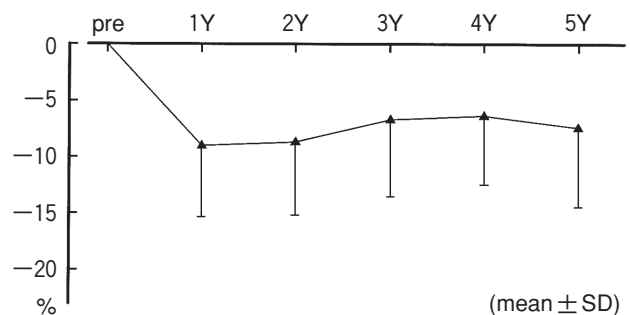
in 4 patients (40%), who required endoscopic balloon dilatation one or two times during 1 to 6 months after operation. Heartburn due to reflux esophagitis was reported by 4 patients (40%). These patients had mild esophagitis on endoscopy. Symptoms were controlled by conservative treatment with antacids for up to 2 years after surgery.

White blood cell counts, lymphocyte counts, and hemoglobin, total protein, serum albumin, and total cholesterol levels were essentially stable and showed no substantial changes from preoperative levels in most patients during the 5 years after operation.

Body mass index was 23.6 ± 1.8 before operation, 21.3 ± 2.1 at 1 year, 21.9 ± 1.2 at 2 years, 22.2 ± 1.5 at 3 years, 22.3 ± 1.4 at 4 years, and 22.0 ± 1.6 at 5 years. The values at 1 year and 2 years were significantly lower than the preoperative value (both $p < 0.05$) (Fig. 3), whereas there were no significant differences at 3 to 5 years. As compared with the preoperative value, the percent decrease in body weight was 9.0 ± 6.2 at 1 year, 8.5 ± 6.3 at 2 years, 6.7 ± 6.6 at 3 years, 6.3 ± 5.9 at 4 years, and $7.1 \pm 7.1\%$ at 5 years. The percent decrease in body weight after operation thus ranged from 6% to 9% (Fig. 4).

DISCUSSION

Total gastrectomy with extended lymph node dissection has been recommended for the treatment of early gastric cancer in the proximal third of the stomach [8, 9]. Recent studies have shown that early gastric cancer in the proximal third of the stomach is free of metastases to the suprapyloric and infrapyloric lymph nodes, with similar survival and recurrence rates in patients undergoing proximal gastrectomy and those undergoing total gastrectomy [10-12]. Both procedures were shown to be equally safe. Although proximal gastrectomy and total gastrectomy were shown to be similar in terms of survival and recurrence, further studies are necessary to assess patients' nutritional status and quality of life. Some studies have demonstrated an improved quality of life after subtotal gastrectomy as compared with total gastrectomy [13, 14], whereas others have shown that proximal gastrectomy results in a poorer quality of life than total and distal subtotal gastrectomy [15]. A previous study showed that proximal gastrectomy with gastric-tube reconstruc-

**Fig. 3** Body-mass indexes before and after surgery.**Fig. 4** Percent decreases in body weight after surgery as compared with the preoperative value.

tion had a shorter operation time [1-3] and less blood loss [1, 3] than jejunal interposition in patients with gastric cancer. Our study demonstrated that esophagogastrostomy had an operation time of less than 3 hours and an operative blood loss of less than 300 ml. Esophagogastrostomy was a safe procedure, with no anastomotic leakage.

Interposition of a jejunal pouch [4, 5] and the jejunal-pouch double-tract technique [6] have been used for reconstruction after proximal gastrectomy. Because construction of a small-bowel reservoir after total gastrectomy improves early postoperative food intake, body weight, and the quality of life [16], pouch reconstruction is considered useful for patients undergoing wide proximal gastrectomy, with preservation of less than two thirds of the stomach rather than those undergoing limited resection. Esophagogastrostomy is indicated for patients who undergo curative resection of one third or less of the stomach, with preservation of two thirds or more of the stomach, ensuring adequate dietary intake. Esophagogastrostomy requires fewer anastomotic sites than jejunal pouch interposition and jejunal-pouch double-tract technique. As compared with these procedures, we found that esophagogastrostomy before proximal gastrectomy was simpler and easier to perform.

Anastomotic stenosis and heartburn due to reflux esophagitis are well-known postoperative disturbances after proximal gastrectomy for cancer arising in the upper third of the stomach. Several studies have reported that anastomotic stenosis can be effectively managed by endoscopic balloon dilatation, and reflux esophagitis successfully treated with antacids [1, 2]. In our study, anastomotic stenosis, which occurred in 40% of the patients after esophagogastrostomy, required treatment by endoscopic dilatation within 6 months after operation. Two studies have reported that the incidence of reflux esophagitis is low in patients receiving Roux-en Y reconstruction after total gastrectomy [17, 18]. In both of these studies, a distance of 40 to 50 cm was left between the esophagus and the Roux-en Y anastomosis. In our study, symptoms due to reflux esophagitis, reported by 40% of the patients after esophagogastrostomy, responded to conservative treatment with antacids within 2 years after operation. Hill's posterior gastropexy and the anterior fundic wrap of Dor appeared to prevent esophagogastric reflux.

White blood cell counts, lymphocyte counts, hemoglobin levels, and blood chemical findings such as total protein, serum albumin, and total cholesterol levels were essentially stable, and in most patients did not substantially differ from preoperative levels during the first 5 years after operation. Total or subtotal gastrectomy causes nutritional disturbances due to delayed gastric emptying and reduced gastric motility, often resulting in severe weight loss. Energy intake has been shown to be significantly related to increased body mass index after operation. A previous study reported that body mass index was normal preoperatively, but decreased until the sixth postoperative month, subsequently stabilizing or increasing slightly within 2 years after operation [19]. In our study, body mass index 1 and 2 years after operation was significantly lower than the preoperative level (both $p < 0.05$), whereas there were no significant differences at 3 to 5 years. Patients lose weight during the first 3 to 6 months after total gastrectomy. Weight loss often exceeds 10% of preoperative body weight. Weight changes beyond 6 months are more variable [16]. The percent decrease in body weight after operation was lowest at 1 year (9%), and then fluctuated between 6% and 8%. Postoperative weight loss was thus mild.

We conclude that esophagogastrostomy before proximal gastrectomy may be less invasive, simpler, and produce better outcomes than conventional procedures for the surgical treatment of early gastric cancer arising in the upper third of the stomach.

REFERENCES

- 1) Adachi Y, Katsuta T, Aramaki M, *et al.* Proximal gastrectomy and gastric tube reconstruction for early cancer of the gastric cardia. *Dig Surg* 1999; 16: 468-70.
- 2) Ichikawa D, Ueshima Y, Shirono K, *et al.* Esophagogastrostomy reconstruction after limited proximal gastrectomy. *Hepato-Gastroenterology* 2001; 4: 1797-801.
- 3) Kakisako K, Tamura Y, Katsuta T, *et al.* Endoscopic evaluation of reconstruction after proximal gastrectomy for cancer: gastric tube versus jejunal interposition. *Dig Endosc* 2001; 13: 191-4.
- 4) Kameyama J, Ishida H, Yasaku Y, *et al.* Proximal gastrectomy reconstructed by interposition of a jejunal pouch. *Eur J Surg* 1993; 159: 491-3.
- 5) Oka M, Yamamoto K, Nakamura M, *et al.* Reconstruction after proximal gastrectomy using a stapled, U-shaped jejunal pouch. *J Am Coll Surg* 1998; 186: 601-3.
- 6) Ogoshi K, Okamoto Y, Nabeshima K, *et al.* Focus on the condition of resection and reconstruction in gastric cancer- what extent of resection and what kind of reconstruction provide the best outcomes for gastric cancer patients? *Digestion* 2005; 71: 213-24.
- 7) Japanese Gastric Cancer Association: Japanese classification of gastric carcinoma: 2nd English Edition. *Gastric Cancer* 1998; 1: 10-24.
- 8) Kitamura K, Yamaguchi T, Okamoto K, *et al.* Total gastrectomy for early gastric cancer. *J Surg Oncol* 1995; 60: 83-8.
- 9) Tuech JJ, Cervi C, Pessaux P, *et al.* Early gastric cancer: univariate and multivariate analysis for survival. *Hepatogastroenterology* 1999; 46: 3276-80.
- 10) Kitamura K, Yamaguchi T, Nishida, *et al.* The operative indication for proximal gastrectomy in patients with gastric cancer in upper third of the stomach. *Surg Today* 1997; 27: 993-8.
- 11) Tsujitani S, Oka S, Saito H, *et al.* Less invasive surgery for early gastric cancer based on the low probability of lymph node metastasis. *Surgery* 1999; 125: 148-54.
- 12) Harrison LE, Karpeh MS, Brennan MF. Total gastrectomy is not necessary for proximal gastric cancer. *Surgery* 1998; 123: 127-30.
- 13) Díaz de Liaño A, Oteiza Martínez F, Ciga MA, *et al.* Impact of surgical procedure for gastric cancer on quality of life. *Br J Surg* 2003; 90: 91-4.
- 14) Braga M, Molinari M, Zuliani W, *et al.* Surgical treatment of gastric adenocarcinoma: impact on survival and quality of life. A prospective ten year study. *Hepatogastroenterology* 1996; 43: 187-93.
- 15) Buhl K, Schlag P, Herfarth C. Quality of life and functional results following different types of resection for gastric carcinoma. *Eur J Surg Oncol* 1990; 16: 404-9.
- 16) Lehnert T, Buhl K. Techniques of reconstruction after total gastrectomy for cancer. *Br J Surg* 2004; 91: 528-39.
- 17) Liedman B, Bosaeus I, Hugosson I, *et al.* Long-term beneficial effects of a gastric reservoir on weight control after total gastrectomy: a study of potential mechanisms. *Br J Surg* 1998; 85: 542-547.
- 18) Iivonen M, Mattila JJ, Nordback ICH, *et al.* Long-term follow-up of patients with jejunal pouch reconstruction after total gastrectomy. A randomized prospective study. *Scand J Gastroenterol* 2000; 35: 679-685.
- 19) Bozzetti F, Bonfanti G, Castellani R, *et al.* Comparing reconstruction with Roux-en-Y to a pouch following total gastrectomy. *J Am Coll Surg* 1996; 183: 243-248.