Surg Today (2007) 37:754–761
DOI 10.1007/s00595-007-3497-5

SURGERY TODAY

Medium- and Long-Term Results of Jejunal Pouch Reconstruction After a Total and Proximal Gastrectomy

KIMIYA TAKESHITA[1], YOSHIHISA SEKITA[1], and MASAO TANI[2]

[1] Department of Surgery, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo-ku, Tokyo 113-8519, Japan
[2] Department of Surgery, Sanraku Hospital, Tokyo, Japan

Abstract

Purpose. We developed several kinds of jejunal (J)-pouch reconstruction after a gastrectomy for gastric cancer. The aim of this study was to investigate the advantages of these methods.

Methods. As for the treatment of malignant gastric diseases at stage II or earlier, we employed the J-pouch reconstruction (Roux-en-Y method: JPRY, or J-pouch interposing: JPI) following a total gastrectomy. We also used JPI after a proximal gastrectomy for early gastric cancer located in the upper third of the stomach.

Results. Out of a total of 80 patients, JPRY was performed in 40 patients and JPI in 40. No anastomotic leaks were associated with the use of an automatic stapler. The stapler (Endo GIA; U.S. Surgical, Norwalk, CT, USA) with a 60-mm-long white cartridge minimized bleeding from the anastomotic site and reduced the operative time. While two patients died of recurrence, all other patients are alive and well for a maximum of 15 years after surgery. The motility of the J pouch was satisfactory after both surgical procedures, as measured by the bile regurgitation test or the transit test employing radiopaque markers. The mean percentage of the radiopaque markers eliminated from the J pouch 1 h after breakfast was 7.5% in the JPRY group and 0%–33% in the JPI group. After another hour, the corresponding percentage was 19.5% in the JPRY group and 14%–60% in the JPI group.

Conclusion. Our procedures for J-pouch reconstruction are considered to result in a favorable postoperative quality of life and prognosis. J-pouch reconstruction is therefore advantageous in terms of operative morbidity, postoperative clinical signs, symptoms, and dietary status.

Key words Pouch interposition · Total gastrectomy · Proximal gastrectomy · Gastric cancer · Postoperative quality of life

Introduction

The adverse outcomes associated with conventional Roux-en-Y anastomosis and jejunal interposition following a total gastrectomy include postoperative dumping syndrome, an impaired food intake, and reflux esophagitis.[1,2] In addition, the conventional reconstructive methods after a proximal gastrectomy, such as an esophagogastrostomy and jejunal interposition between the esophagus and the distal stomach, may be associated with esophageal regurgitation and a poor reservoir function.[3]

On the other hand, jejunal pouch reconstruction after either a total or proximal gastrectomy is advantageous in terms of the lesser severity of clinical signs and symptoms, especially of reflux esophagitis.[4–6] Furthermore, this method has important advantages in that it allows for a good reservoir function and easy endoscopic examinations.

We have been conducting these pouch operations for the treatment of malignant diseases since 1991.[3,7,8] In this article, we describe the therapeutic outcomes and the medium- and long-term results after these procedures, including the postoperative quality of life (QOL).

Patients and Methods

Patient Profile

The J-pouch procedures following a total gastrectomy were performed in patients with clinical stage I and II

Reprint requests to: K. Takeshita
Received: October 5, 2006 / Accepted: February 25, 2007

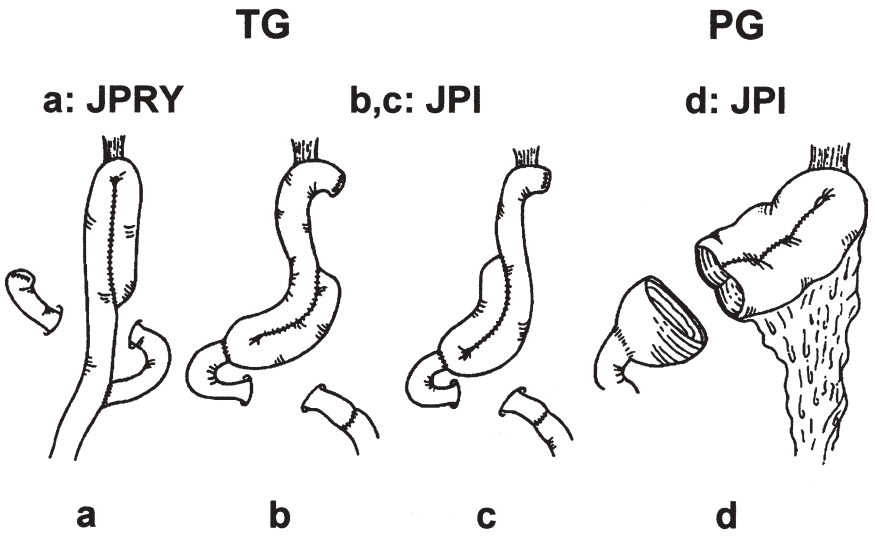


Fig. 1a–d. Reconstruction methods. *TG*, total gastrectomy; *PG*, proximal gastrectomy; *JPRY*, jejunal pouch (Roux-en-Y fashion); *JPI*, jejunal pouch interposition

gastric cancer according to the Gastric Cancer Classification.[9] Forty patients were consecutively recruited and underwent pouch reconstruction after a total gastrectomy as shown in Fig. 1a–c. Figure 1a represents a subgroup (JPRY) in whom the Roux-en-Y method was applied with a pouch constructed on the esophageal side (from 1994 to 1996), and Fig. 1b and c represent subgroups (TG+JPI) in which interposition was achieved by creating a pouch on the duodenal side in an inverted J shape (Fig. 1b) (from 1990 to 1993) or J shape (Fig. 1c) (from 1997 to 2003). Figure 1d shows a schematic drawing of pouch interposition after a proximal gastrectomy (PG+JPI), i.e., interposition of a jejunal pouch between the esophagus and the remnant gastric antrum. This procedure was performed in 40 patients with either early gastric cancer or a submucosal malignant tumor in the upper third of the stomach (from 1994 to 2003).

Hemostatic Procedure

To ensure adequate anastomosis and hemostasis of the jejunal pouch, we usually used a particular stapling device Endo GIA60 (U.S. Surgical). Hemostasis at the site of anastomosis was checked with the use of a vaginoscope.[3,7]

Postoperative Function

The rate of elimination of the radiopaque markers (Sitzmarks; Konsyl Pharmaceutical, Fort Worth, TX, USA) from the J pouch after breakfast was evaluated. The fiberoptic probe (Bilitec 2000; Synectics Medical, Stockholm, Sweden) was placed to identify and qualify the bilirubin contents in the reflux fluid from the duodenum.

Results

Clinicopathological Findings and Prognoses

The results of clinicopathological examinations of the 12 patients who underwent JPRY reconstruction after a total gastrectomy are presented in Table 1. All the patients underwent a D2 lymph node dissection; 8 patients also underwent combined resection procedures. This subgroup included one patient with conclusive stage IIIa cancer. Postoperatively, one patient died of liver metastasis.

Twenty-eight patients underwent a total gastrectomy with JPI reconstruction (Tables 2 and 3). D2 lymph node dissection was also performed in all of the patients. All patients are alive without recurrence except for two patients: one committed suicide (patient 8) and the other (patient 15) died of bone metastasis. Three patients in this subgroup proved to have n2, stage IIIa cancer. A splenectomy was performed in eight patients (30%).

The clinicopathological features of the patients treated by JPI after a proximal gastrectomy were as follows. Malignant invasion was confined to the mucosa in 20 patients, whereas it reached the submucosa in 15, and the proper muscle layer or subserosa in 3. Group 1 lymph node metastasis was found in only one of these patients. There was one patient each with malignant schwannoma and leiomyosarcoma. A resection was judged to be D1+α and curative in all 40 patients.

There were no serious complications and the majority of the patients (39 patients) are alive and well for a maximum of 11 years 6 months after the surgery. However, two patients developed metachronous cancer in either the pancreas or bile duct.

Table 1. Total gastrectomy with JPRY

Patient no.	Age (years)	Sex	Macroscopic type	t	n	D	Stage	Combined rest	Prognosis
1	52	M	3	mp	0	2	I b	s	11Y 6M alive
2	67	M	3	ss	1	2	II	ps	11Y 3M alive
3	44	M	II a + II c	sm	0	2	I a	—	11Y 2M alive
4	51	M	2	ss	1	2	II	s	11Y alive
5	64	F	1	ss	0	2	I b	—	10Y 4M alive
6	63	F	Lymphoma	sm	0	2	I a	—	9Y 10M alive
7	23	F	3	ss	2	2	III a	s	9Y 6M alive
8	72	F	1	mp	0	2	I b	s	9Y 5M alive
9	68	M	II a + II c (adv)	<mp	0	2	I b	s	1Y 2M dead
10	46	F	3	ss	1	2	II	s	9Y 2M alive
11	64	M	II a + II c	sm	0	2	I a	s	9Y 2M alive
12	44	F	Lymphoma	sm	0	2	I a	—	9Y 2M alive

JPRY, Roux-en-Y method with J pouch on esophageal side; T, depth of tumor invasion; n, lymph node metastasis; D, lymph node dissection; s, spleen; ps, spleen and tail of pancreas; Y, years; M, months

Table 2. Total gastrectomy with JPI (1): inverted J shape

Patient no.	Age (years)	Sex	Macroscopic type	t	n	D	Stage	Combined rest	Prognosis
1	58	M	II c	m	0	2	I a	—	15Y 3M alive
2	67	M	3	ss	1	2	II	s	15Y 3M alive
3	61	M	II c	m	0	2	I a	—	15Y 2M alive
4	45	M	3	ss	0	2	I b	s	15Y 1M alive
5	65	M	3	ss	1	2	II	s	15Y 1M alive
6	57	M	Lymphoma	sm	0	2	I a	—	15Y alive
7	55	M	II c	m	0	2	I a	—	14Y 8M alive
8	51	M	II c	m	0	2	I a	—	7Y 5M dead
9	56	M	II a	sm	0	2	I a	s	Unknown

JPI, J-pouch interposition

Table 3. Total gastrectomy with JPI (2): J shape

Patient no.	Age (years)	Sex	Macroscopic type	t	n	D	Stage	Combined rest	Prognosis
1	58	M	II c × 4	<sm	0	2	I a	—	8Y 7M alive
2	54	F	II c	sm	1	2	I b	—	8Y 4M alive
3	58	M	II c (adv)	ss	1	2	II	s	7Y 11M alive
4	48	F	II c (adv)	ss	0	2	I b	—	7Y 10M alive
5	57	M	II a × 3	m × 3	0	2	I a	—	7Y 4M alive
6	45	M	II c (adv)	ss	2	2	III a	—	7Y 3M alive
7	57	M	II c (adv)	mp	0	2	I b	s	6Y 8M alive
8	69	M	II c (adv)	mp	0	2	I b	s	5Y 10M alive
9	48	F	4	ss	2	2	III a	s	5Y 9M alive
10	59	M	II c (adv)	mp	1	2	II	—	5Y 8M alive
11	58	F	II c	sm	0	2	I a	—	5Y 4M alive
12	61	M	II c (adv)	mp	1	2	II	—	5Y 2M alive
13	69	F	Lymphoma	sm	0	2	I a	—	5Y alive
14	57	M	II c + II a	sm	1	2	I b	—	5Y alive
15	67	M	II c + II a	ss	2	2	III a	—	1Y 9M dead
16	79	M	II c, II c	sm, m	0	2	I a	—	4Y alive
17	52	F	II c + II b	sm	1	2	I b	—	4Y alive
18	70	M	II a, II c	sm, sm1	1	2	I b	—	3Y 5M alive
19	52	M	II c + II b	ss	0	2	I b	—	3Y 1M alive

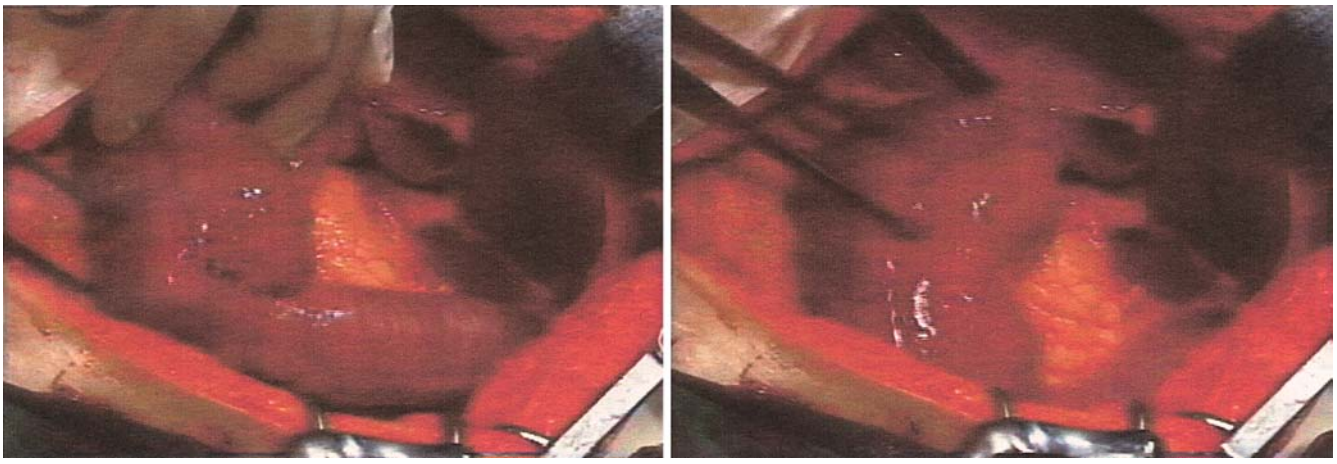


Fig. 2. Complete reconstruction by jejunal pouch interposition after a total gastrectomy

Table 4. Factors related to total gastrectomy with jejunal pouch

Patient no.	Length of pouch (cm)	Time required for pouching (min)	Type of stapler	No. of applications	No. of hemostatic procedures	Complications
Roux-en-Y						
1	18	38	GIA90P	2		Leakage
2	18	40	GIA90P	2	25	(—)
3	20	31	EndoG1A: 2.5	3	8	Leakage
4	20	44	3.5	2	5	Leakage
			2.5	1	2	
5	15	26	2.5	3	5	(—)
6	18	30	2.5	4	3	(—)
7	25	38	2.5	6	3	(—)
8	22	18	2.5	6	2	(—)
9	17	25	2.5	5	2	Leakage
10	18	13	2.5	3	3	(—)
11	18	18	2.5	3	2	(—)
12	22	12	2.5	5	1	(—)
JPI J shape						
1	15	8	EndoG1A: 2.5	4	0	(—)
2	15	16	2.5	3	2	(—)
3	15	12	2.5	4	3	(—)
4	18	11	2.5	4	1	(—)
5	15	8	2.5	3	0	(—)
6	15	8	2.5	3	2	(—)
7	9	6	2.5	3	0	(—)
8	12	12	2.5	3	1	(—)
9	17	13	2.5	3	2	(—)
10	15	9	2.5	4	0	(—)
11	11	6	2.5	2	0	(—)
12	16	12	2.5	3	1	(—)

Operative Factors

Figure 2 shows the operative view of a completed reconstruction by JPI after a total gastrectomy. The frequency of the use of hemostatic procedures and the time required for the pouching were also remarkably reduced, as measured by the Endo GIA2.5 (Table 4), in the 24 cases in which the time required for the pouching and the frequency of use of the hemostatic procedure could be determined. Complications mainly occurred in the early period as anastomotic leakage in four patients due to the type of the stapling device employed and/or the lack of technical proficiency.

Regarding the factors related to a proximal gastrectomy with JPI, the data from 40 consecutive patients are herein described. The GIA 90P stapler was used in one

patient and the Endo GIA60 stapler in the others. A blue cartridge containing 3.5-mm-long staples was used in three patients, and a white cartridge containing 2.5-mm staples in the remaining 36. The time required for the pouch formation was less than 10 min in the most recent cases. Bleeding and leakage as complications were encountered in only one patient with liver cirrhosis; however, there were no operative deaths.

The mean number of hemostatic procedures required per application of the surgical stapler is shown in Fig. 3; it was 6.3 when the GIA 90P stapler was used, 5 when Endo GIA60 with 3.5-mm staples (closed height, 1.5 mm) was used, and 0.6 when Endo GIA60 with 2.5-mm staples (closed height, 1.0 mm) was used. Therefore, the number of the hemostatic procedures was the smallest with the use of Endo GIA60 with 2.5-mm staples.

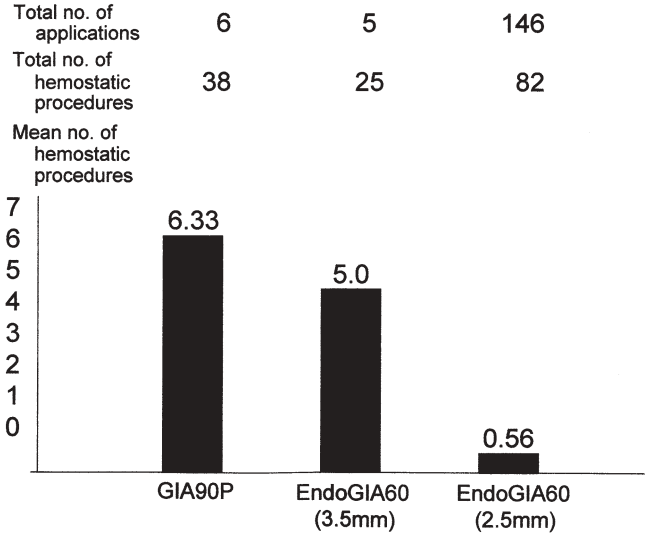


Fig. 3. Number of hemostatic procedures

Postoperative QOL

The postoperative QOL, symptoms, and the rate of elimination of radiopaque markers (Sitzmarks) from the J pouch 1 or 2 h after breakfast are shown in Table 5. Among the 12 patients with JPRY reconstruction after a total gastrectomy, 2 reported regurgitation and postprandial fullness. Both of these patients had undergone a splenectomy, and these symptoms were considered to have been caused by the long pouch sections (25 and 18 cm) trapped in the left subphrenic space after splenectomy. The rate of elimination of the radiopaque markers after breakfast was relatively short and satisfactory (6.8% at 1 h and 17.7% at 2 h). The amount of meals consumed was also, in general, satisfactory.

The clinical and motility data in the patients undergoing a total gastrectomy with JPI are described in Table 6. In the patients with the inverted J shape in the early period, about one-half suffered from symptoms such as dumping and abdominal fullness, and their food intake was insufficient. Consistent with these symptoms, the rate of elimination of the radiopaque markers after breakfast was high (33% at 1 h and 60% at 2 h). The results obtained in those who received the J-shape curved form, which has been adopted in the patients operated on more recently, are shown in the lower section. In contrast to the subgroup with the inverted J-shape JPI, no dumping was noted in any of the six patients for at least 6 months in those with the J-shape JPI. The rate of elimination of the radiopaque markers after breakfast was almost the same as that in normal individuals (0% at 1 h and 27% at 2 h).

On the other hand, among 20 random patients who underwent a proximal gastrectomy 6 months or more prior to evaluation, four reported reflux symptoms, i.e., mild pyrosis, and three reported slight postprandial fullness (Table 7). No other complications were encoun-

Table 5. Total gastrectomy with JPRY

Patient no.	Dumping	Regurgitation	Postprandial fullness	% of Expelled radiopaque markers		Volumes of each meal	No. of meals	Length of pouch (cm)
				1 h after	2 h after			
1	–	+	–	0%	0%	80% ↑	3	18
2	–	–	–	0%	15%	70%	3	18
3	–	–	–	0%	10%	80% ↑	3	20
4	–	–	–	0%	0%	80% ↑	3	20
5	+	–	–	20%	55%	80%	3	15
6	+	–	–	35%	50%	50%	3	18
7	–	+	+	0%	5%	80% ↑	3	25
8	–	–	–	0%	10%	80% ↑	3	22
9	–	–	–	15%	35%	70%	3	17
10	–	–	–			80% ↑	3	18
11	–	+	+	0	0	80% ↑	3	18
12	–	–	–	5%	15%	80% ↑	3	22
		Mean value		6.80%	17.70%			

Table 6. Total gastrectomy with JPI

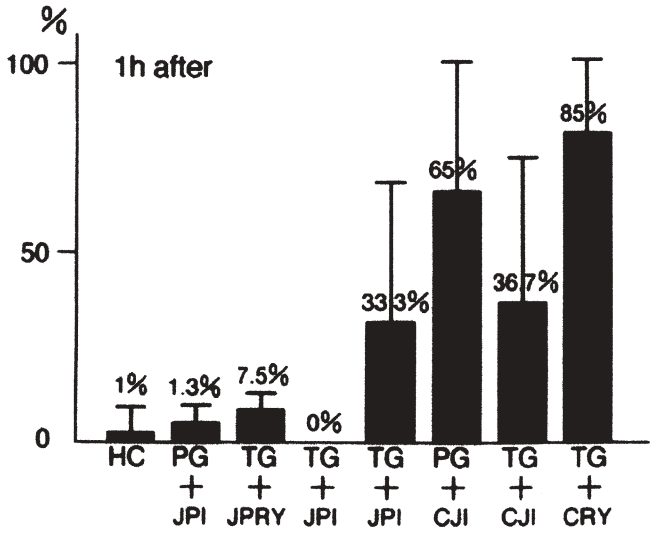
Patient no.	No. of meals	Volumes of each meal	Postprandial fullness	Regurgitation	Dumping	Length of pouch (cm)	% of Expelled radiopaque markers	
							1 h after	2 h after
Inverted J shape								
1	3	50%	−	−	−	9	15%	30%
2	3	70%	+	−	+	15	10%	90%
3	3	80% ↑	−	+	+	12	45%	55%
4	4	50%	+	−	+	20	60%	75%
5	3	50%	−	−	−	8	40%	70%
6	3	80% ↑	+	+	−	15	30%	40%
						Mean value	33%	60%
J shape								
1	3	80% ↑	−	−	−	15	0	0
2	3	80% ↑	−	−	−	15	0	60%
3	3	80% ↑	±	−	−	15	0	10
4	3	80% ↑	−	−	−	18		
5	3	70%	±	−	−	15		
6	3	80% ↑	−	−	−	15		
						Mean value	0%	27%

Table 7. Proximal gastrectomy with JPI

Patient no.	No. of meals	Volumes of each meal	Postprandial fullness	Regurgitation	Dumping	Length of pouch (cm)	% of Expelled radiopaque markers	
							1 h after	2 h after
1	3	>80%	−	+	−	15	0	55%
2	3	80%	−	−	−	24	5%	10%
3	3	80%	−	−	−	21	0	0
4	3	>80%	−	−	−	25	0	5%
5	3	80%	−	−	−	25	0	0
6	3	80%	−	+	−	20	0	10%
7	3	>80%	−	−	−	15	0	0
8	3	80%	−	−	−	20	0	10%
9	3	100%	−	−	−	14	4.5%	45%
10	3	>80%	−	−	−	15		
11	3	70%	+	−	−	20		
12	3	100%	−	+	−	15	0	0
13	3	80%	−	−	−	15	0	0
14	3	70%	+	+	−	20		
15	3	100%	−	−	−	18		
16	3	>80%	−	−	−	12	10%	10%
17	3	100%	−	−	−	22		
18	3	>80%	±	−	−	19	0	0
19	3	70%	+	−	−	16	0	0
20	4	70%	−	−	−	12		
						Mean value	4.3%	10.4%

tered in any of the patients. The postoperative dietary status was also favorable. The volume of each meal was 80% or more of the preoperative level in almost all patients. The elimination of the radiopaque markers was achieved in 4.3% at 1 h and 10.4% at 2 h after breakfast, with uniform and consistent results in all of the patients.

The rates of elimination of the radiopaque markers after each surgical approach are compiled in Fig. 4. It is evident that healthy controls and the three procedures,



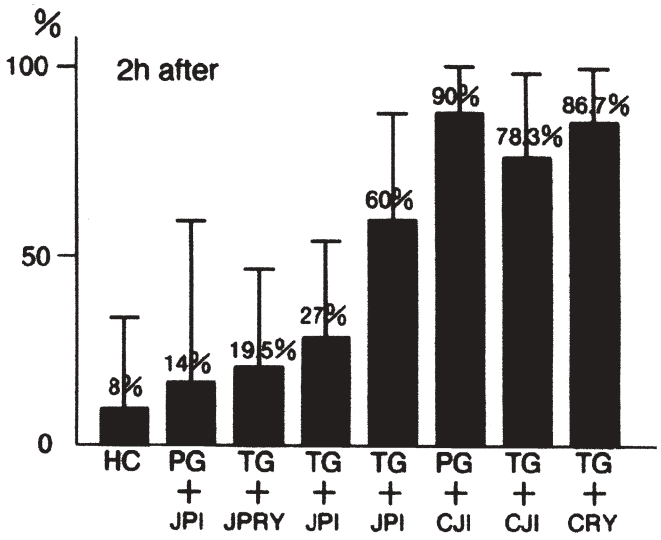


Fig. 4. Percentages of expelled radiopaque markers taken after eating breakfast. *HC*, healthy controls ($n = 4$); *TG*, total gastrectomy; *PG*, proximal gastrectomy; *JPRY*, jejunal pouch (Roux-en-Y fashion); *JPI*, jejunal pouch interposition; *CJI*, conventional jejunal interposition; *CRY*, conventional Roux-en-Y anastomosis

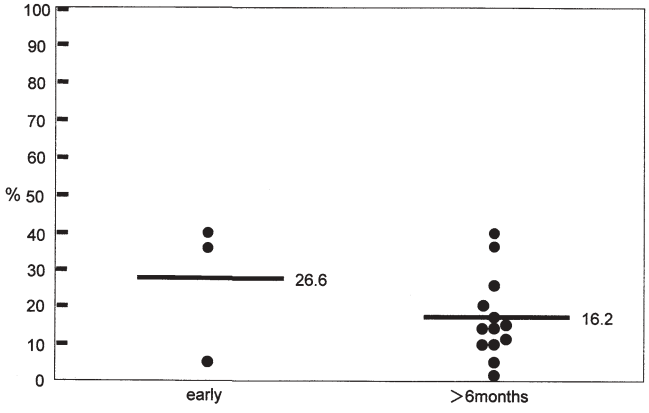


Fig. 5. Extent of bile regurgitation to the esophagus after a proximal gastrectomy with jejunal pouch interposition

i.e., a proximal gastrectomy with JPI, a total gastrectomy with JPRY, and a total gastrectomy with JPI (cephalad side curvature) are associated with favorable outcomes in comparison to the four procedures shown on the right.

Lastly, Fig. 5 shows the extent of the bile regurgitation into esophagus after J-pouch reconstruction following a proximal gastrectomy.

Discussion

Major adverse effects associated with conventional reconstruction methods after a total and proximal gastrectomy have reached a frequency which encourages many surgeons to seek alternative surgical methods in order to provide patients with an improved postoperative QOL.[4,5,10–13] Since 1991, we have combined several kinds of reconstruction methods in order to achieve greater reservoir capacity as a substitute stomach. To create the J pouch, a side-to-side anastomosis of a jejunal loop is performed using a stapling instrument.[3,7,8] The present study on the results of a series of 80 patients demonstrated that the Endo GIA60 with 2.5-mm staples was the best device for creating the J pouch and the long-term QOL indicated the superiority of the J-shaped J-pouch reconstruction after a total gastrectomy and also J-pouch interposition after a proximal gastrectomy.

In summary, those who underwent PG showed a good therapeutic outcome in terms of the postoperative meal intake and rate of elimination of radiopaque markers after breakfast, while those who underwent TG with JPRY tended to show some complications such as the development of postprandial fullness and other symptoms. The marker method was thus found to be a good method for the evaluation of dumping following TG with JPI. The formation of a cephalad curvature of the pouch may be a more promising surgical procedure to prevent dumping in comparison to a caudad curvature.

The complementary results are stated here. In our functional evaluation, the Bilitec 2000 probe (Synectics Medical) was placed at the lower esophagus to measure the degree of bilirubin elimination from the lumen. As shown in Fig. 5, it is evident that the severity of the duodeno-gastroesophageal reflux in patients undergoing a proximal gastrectomy with JPI decreases over time.

In conclusion, our method of J-pouch reconstruction using the Endo GIA60 stapler, vaginoscope, and gastrointestinal edge clamps ensures the secure anastomosis and adequate hemostasis, while producing no postoperative complications. This method also provides important advantages in terms of the patient's postoperative QOL and the prognosis, based on the functional capacity of the gastric substitute, the association with minimal postoperative signs and symptoms, and its acceptable dietary status.

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