Int J Clin Exp Med 2015;8(4):5541-5546
www.ijcem.com /ISSN:1940-5901/IJCEM0004136

Original Article

Gastric-jejunum pouch side-to-end anastomosis: a novel and safe operation of gastrojejunostomy for preventing reflux gastritis

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Received November 25, 2014; Accepted March 26, 2015; Epub April 15, 2015; Published April 30, 2015

Abstract: Purpose: This study aims to introduce a simple operation method of gastrojejunostomy for preventing reflux esophagitis --gastric-jejunum pouch side-to-end anastomosis. Methods: Based on Billroth II anastomosis (Billroth II) method, we designed a new technique of anastomosis between stomach wall and jejunal pouch. The technique was named gastric-jejunum pouch side-end anastomosis. We retrospectively analyzed the clinical data which was collected from March 2012 to February 2014. Among all the recruited 66 patients, 51 gastric cancer patients and 7 pyloric obstruction patients were implemented with hand-assisted laparoscopic distal gastrectomy plus D2 lymph node dissection. The remaining 8 patients were malignant pyloric obstruction; they were treated with small exploratory incision on the upper abdomen and distal gastric partial transection. All the patients were treated with gastric-jejunum pouch side-to-end anastomosis. Results: The surgical incision was small, the operative time was short, their bleeding volume was little, the recovery time of the bowel function and hospitalization time was relatively short. Postoperatively, there was neither mortality and gastroparesis, nor anastomotic leakage and jejunal pouch leakage. Minor postoperative complications were detected followed up for 12 months, no acid reflux and reflux esophagitis symptoms was reported. Conclusions: Gastric -jejunum pouch side-to-end anastomosis is a simple operation technique with highly surgical safety.

Keywords: Gastrojejunostomy, jejunal pouch, reflux gastritis

Introduction

There are lots of debates on the digestive tract reconstruction methods of patients with implementation of distal gastrectomy or pyloric obstruction exist within the medical community [1-3]. Compared with Billroth I/II gastrojejunostomy, gastric -jejunum Roux-en-Y anastomosis is an ideal model of digestive tract reconstruction after distal gastrectomy, which can effectively reduce reflux esophagitis for the ceremony with mild postoperative reflux and acid reflux symptom. In 2012, Lee *et al*. reported that bile reflux was developed in 3.7% of the Roux-en Y gastrojejunostomy group after distal gastrectomy [4]. However, the operative and Hospitalization time was longer and blood loss was relatively more, in addition, the occurrence rate of reflux esophagitis is as high as 21.2% postoperatively [5, 6].

Some patients were treated by the combination of Billroth II gastrojejunostomy with Braun anastomosis to prevent reflux gastritis, however, the clinical effect wasn't as good as expected [4]. Some patients were treated with jejunal pouch anastomosis between the remnant stomach and duodenum after distal gastrectomy [8], this treatment retained the advantages of Billroth I gastrojejunostomy to maintain normal food passage, however, the incidence rate of the reflux gastritis was as high as 68.8% [4, 8]. Therefore, our hospital carried out the side-to-end gastrojejunostomy for the patients with pyloric obstruction or distal gastrectomy. On the basis of Billroth II gastrojejunostomy, the only requisite was the combination of stomach posterior wall with jejunal pouch anastomosis directly, instead of jejunum. The operation was relatively easy, and the clinical effect on preventing reflux esophagitis was very good. Now we reported as follows.

Figure 1. Jejunum was taking up ahead of colon and measuring the length as Billroth II anastomosis. The small intestine taken in the palm of the surgeon was the jejunum, which was measured in hand. On the top of it was the transverse colon.

Patients and methods

From March 2012 to February 2014, there were 66 patients, including 39 males and 27 females, aged 25 to 83 years, mean 61.35 years. The patients had primary gastric cancer or pyloric obstruction. They were treated with gastric-jejunum pouch side-to-end anastomosis. After preoperative endoscopy or/and pathological examination, 59 patients had been diagnosed with primary gastric cancer. Among these patients, 51 cases were implemented with hand-assisted laparoscopic distal gastrectomy plus D2 lymph node dissection according to the 14th edition of the gastric cancer treatment guidelines of the Japanese Gastric Cancer Association [9, 10]. The remaining 8 patients were malignant pyloric obstruction, and they were treated with small exploratory incision on the upper abdomen and distal gastric partial transection. The other 7 patients were pyloric obstruction caused by benign disease, and they were treated with hand-assisted laparoscopic subtotal gastrectomy. All the patients were treated with gastric -jejunum pouch side-to-end anastomosis. All patients were informed of the nature of the study and authorized their inclusion by signing an informed consent. The study was approved by the ethics committee of our hospital.

Surgical procedures

According to Billroth II gastrojejunostomy, the jejunum was lifted in front of the transverse colon (**Figure 1**). An almost 2 cm vertical incision was made by electric knife at the jejunal mesentery edge which is 15-20 cm far away from the ligament of Treitz. Two robotic arms of a 75 mm linear stapler (TLC75, Johnson Company, USA) were injected into the afferent and efferent loops of jejunum, respectively. The side-side anastomosis was performed at the jejunal mesentery edge, and then the jejunal pouch was formed (**Figure 2**). The needle holder of a straight intraluminal stapler (SDH29, Ethicon endosurgery, Johnson Company, USA) was buried into the jejunal pouch through the 2 cm vertical incision (**Figure 3**). The corresponding main part of the stapler was put into proximal gastric remnant, and was matched with the stapler needle holder. The anastomosis was completed at the posterior wall near the greater curvature of the stomach (**Figure 4**). At last, the incision of gastric remnant was closed.

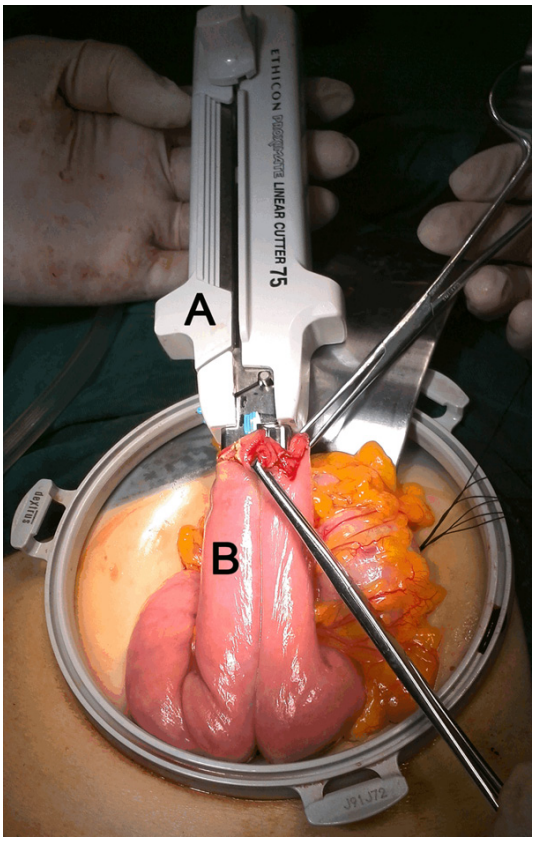

Figure 2. Jejunal pouch was made by side-to-side jejunal anastomosis. An almost 2 cm vertical incision was made at jejunal mesentery edge, which was 15-20 cm far away from the ligament of Treitz. Side-to-side anastomosis at jejunal mesentery edge line was completed by TLC75 through the vertical incision, and then the jejunal pouch was made. A. TLC75; B. the small intestine was the proximal jejunum shown as **Figure 1**.

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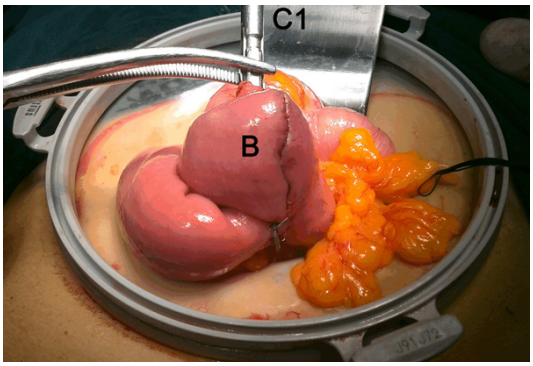

Figure 3. The needle holder of a straight intraluminal stapler was buried on the top of jejunal pouch. A. Needle holder of straight intraluminal stapler SDH29 was buried into top of jejunal pouch through the 2 cm vertical incision at jejunal mesangial side, but the connecting rod was outside the intestine. C1. the anastomat connecting rod was clamped by hemostatic clamp; B. The jejunal pouch.

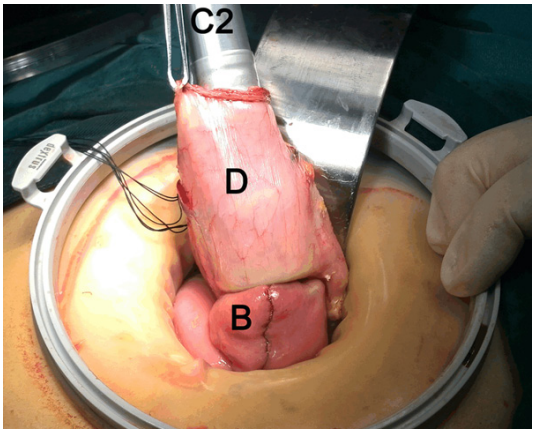

Figure 4. Side-to-end anastomosis was performed between the jejunum pouch and posterior wall of the stomach. The corresponding main anastomat part of straight intraluminal stapler SDH29 (C2) was inserted into proximal gastric stump through the incision at greater curvature of the stomach. The anastomat connecting rod was pulled out through the posterior gastric greater curvature, and matched with the connecting rod of needle holder. Then the stapling adduction was contracted back to the stapler firing position, prepared to stimulate the completion of gastric -jejunum-pouch side-to-end anastomosis. B. The jejunal pouch; D. The posterior wall of stomach adjoined to jejunum pouch.

Results

The clinical data shows that the surgical incisions were 6.5-8 cm (mean 7.1 cm), operative time was 70-205 min (average 165.6 min), bleeding volume was 50-300 ml (average 174.5 ml), flatus time was 2-5 days (average 3.7 days), recovery eating time were 3-7 days (average 4.6 days), and post hospitalization time was 6-13 days (average 8.3 days) (**Table 1**). Compared with the Billroth II (B-II) with Braun anastomosis done by Lee *et al*, both the operative and the hospitalization time were shorter. In addition, the estimated blood loss was less [4].

Table 1. Basic clinical data of the patients trea-ted with gastric-jejunum pouch side-to-end ana-stomosis

Variable	Mean ± SD (range)
Surgical incision (cm)	7.1±0.39 (6.5-8)
Operative time (minute)	165.6±25.27 (70-205)
Estimated blood loss (mL)	174.5±109.13 (50-300)
Flatus time (day)	3.7±0.83 (2-5)
Eating recovery time (day)	4.6±1.06 (3-7)
Hospitalization time (day)	8.3±1.22 (6-13)

The gastric-jejunum pouch side-to-end anastomosis was successful in almost all patients. There was an abdominal vascular hemorrhage 2 h after operation which was cured by a hemostasis surgery. A postoperative chylous ascites and a postoperative pleural effusion with hemoperitoneum readmission were cured by conservative therapy. No gastroparesis and no perioperative death. The complications were very slightly followed up for 1-12 months. There were three cases of mild inflammation anastomosis and two gastric bile refluxes were detected by endoscopy review (**Table 2**). However, no acid reflux and reflux esophagitis symptoms, such as heartburn and acid regurgitation, were reported.

Discussion

In order to improve the quality of life of patients postoperatively, methods of digestive tract reconstructions after gastrectomy have been frequently studied by researchers. Our clinical data indicates that side-to-end gastrojejunostomy is a desirable digestive tract reconstruction method.

Jejunal pouch, which was used to store food instead of the stomach, was originated from digestive tract reconstruction after total gastrectomy in gastric surgery [11, 12]. Gertler *et al* did surgical literature meta-analysis about reconstruction by jejunal pouch take the place of stomach [13]. The results showed that the

Table 2. Postoperative clinical symptoms treated with gastric-jejunum pouch side-to-end anastomosis

Postoperative symptoms	Totle case (N=66)	Occurrence (%)
gastroparesis	0	0
perioperative deaths	0	0
acid reflux	0	0
reflux esophagitis	0	0
mild inflammation anastomosis	3	4.55
Gastric bile reflux	2	3.03
pleural effusion with hemoperitoneum readmission	1	1.51
chylous ascites	1	1.51
abdominal vascular hemorrhage	1	1.51

addition of jejunal pouch based on the Roux-en-Y did not significantly increase gastric cancer recurrence, mortality, operation time and hospitalization. What's more, dumping syndrome and burning sensation in the upper abdomen were significantly lower than the control group. In addition, food intake and quality of life were improved. This advantage can be sustained for 24 months postoperatively. Meanwhile, the addition of jejunal pouch can do better to improve the nutritional status of patients with early postoperative and autonomous symptoms and life quality [4, 14]. Thus, the food storage function of jejunal pouch is similar with the stomach.

The increased storage function of jejunal pouch is weakened because of the presence of gastric storage function in patients with distal gastrectomy and pyloric obstruction caused by malignant tumor [15]. In Billroth I/II anastomosis, and Roux-en-Y anastomosis, the high incidence of gastric reflux of bile and pancreatic juice and other digestive juices is the important cause of postoperative reflux gastritis, gastric paralysis and other complications [16]. Therefore, the principle of gastrojejunostomy reconstruction surgery is to reduce the reflux of bile and other digestive juices. Based on this principle, Roux-en-Y anastomosis combined with Billroth II anastomosis is designed.

Following the above digestive tract reconstruction principle, we designed the gastric-jejunum pouch side-to-end anastomosis. With the storage capabilities of bile and pancreatic juice and other digestive juices, jejunum pouch might reduce the reflux of digestive juices into remnant stomach. Our clinical data showed that, whether it is malignant pylorus obstruction, or distal gastric resection, all the patients were treated with side-to-end gastrojejunostomy. Their postoperative flatus was earlier, and their diet recovery was more uneventfully. There was no gastroparesis and disorders of postoperative recovery of gastrointestinal function and other complications. Besides, there was no patient with eating disorders needing hospitalization once more. Meanwhile, all the patients had no acid reflux, heartburn and reflux esophagitis during the follow-up study. No reflux gastritis was detected by gastroscopy. The anastomotic inflammation was slightly. Although there was bile visible in stomach but no reported symptoms, which might indicate that there was some bile entering the stomach during the jejunal pouch peristaltic contractions, however, the entry of bile and other digestive juices into the jejunal pouch was accelerated by the attractive function of jejunal pouch in diastole, which reduced the stimulation of bile and other digestive juices on the gastric mucosa, and thus avoided the appearance of readme symptoms and the occurrence of the reflux gastritis [17]. Above all, jejunal pouch functions as storage and collection of bile and other digestive, which contributes to early postoperative recovery and good clinical effect of reflux gastritis prevention.

The operation is easy to perform. Jejunal pouch was formed by side - side anastomosis at jejunum anastomotic ends based on the traditional Billroth II gastric anastomosis. Side-to-side jejunojejunostomy was completed by linear stapler disposable stapler. To reduce the chance of anastomotic bleeding, anastomotic edge was sutured continuously with a 3-0 absorbable suture line, and the hemostasis effect was good. Therefore, the making of jejunal pouch was simple and fast.

At the same time, the jejunal pouch might play a positive role in emptying extrusion effect in the peristaltic contraction and expanding col-

lection effects in relaxation process, which might promote the recovery of gastric motility and gastric emptying, although gastric emptying was slowed down by pyloric obstruction. Therefore, all the patients' diet recovered smoothly after surgery.

The application of hand assisted laparoscopic distal gastrectomy plus D2 lymph node dissection may be essential for patients' uneventful recovery postoperatively. We probed the abdominal cavity and freed part of omentum majus through the median 6.5-7 cm exploratory abdominal incision. Then the main operating was made through laparoscopic port site poked near the upper left rectus umbilicus, and then pneumoperitoneum (13-15 mmHg) was established. The laparoscopic port site was used for observation at the left anterior axillary line subcostal [9]. Harmonic scalpel was used to clean left gastroepiploic vessels and stomach avascular zone, to sweep the proximal splenic artery and celiac lymph node, to transect ligamentum hepatogastri to right side of stomach cardia along the lower edge of the left hepatic ligament. In addition, harmonic scalpel was used to clean No.3 and No.1 lymph node group along the gastric cardia angle to the right of free omental [18]. The distal stomach and omentum tissue were pulled out after transection gastric body. Lymph node groups of No.8a, No.5, No.12a and No.6 were dissected under direct vision, and then duodenal bulb was transected. This lymph node dissection mode is called reverse sweeping lymph node dissection technique [19, 20]. Subsequently, the jejunal pouch was made in front of colon, then anastomosis was performed between the greater curvature of the posterior stomach wall and jejunal pouch, which was similar with Billroth II gastric anastomosis. Our clinical data showed that there was one abdominal bleeding occurred 2 h after operation, which was treated with ligation of bleeding for hepatic flexure of the colon mesenteric vascular, and the postoperative recovery was smooth. There was no anastomotic bleeding and perioperative deaths. Although two cases of gastric bile reflux were detected under endoscopy, however, there was no acid reflux and reflux esophagitis symptoms. That indicated that the bile reflux case was in the easy curable stage. Therefore, gastric-jejunum pouch side-to-end anastomosis is safe, and the risk of surgical gastrojejunostomy does not been increased.

In conclusion, gastric-jejunum pouch side-to-end anastomosis is a simple and novel operation technique with high surgical safety. Jejunal pouch has functions with storage and collection of bile and other digestive, which contributes to early postoperative recovery and prevention of reflux clinical good results.

Disclosure of conflict of interest

None.

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