



TECHNICAL NOTE

# A novel anti-reflux reconstruction after laparoscopic total gastrectomy: jejunal pouch-esophageal anti-reflux anastomosis

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## Introduction

Gastric cancer (GC) is the second most prevalent malignant tumor worldwide; it has a high mortality [1]. The incidence of adenocarcinoma of the esophagogastric junction (AEG) is increasing in both Western and Eastern countries [2–4]. Total gastrectomy is considered the standard treatment of AEG. With the development of standard surgery and chemotherapy for GC, clinicians focus on not only survival outcomes, but also quality of life after comprehensive therapy. For patients undergoing gastrectomy, quality of life has always been affected by various symptoms, such as reflux and abdominal pain. The Roux-en-Y esophagojejunostomy technique has been reported to be commonly adopted by surgeons by using a linear stapler or circular stapler [5–8]. However, these reconstruction procedures have limitations after total gastrectomy, resulting in some common reflux problems including vomiting, heartburn and hemorrhage [9–12]. Although clinicians have used jejunal interposition to try to control reflux disease after total gastrectomy, reflux symptoms are still major complaints. In this manuscript, we present a novel reconstruction technique in an attempt to solve this problem.

## Methods

### Patients and indications for operation

Between March 2017 and July 2017, seven patients with esophagogastric junction adenocarcinoma underwent jejunal pouch-

esophageal anti-reflux anastomosis following total gastrectomy at the Sixth Affiliated Hospital of Sun Yat-sen University (Guangzhou, China). All seven patients agreed with our recommendation and consented to a total gastrectomy with jejunal pouch reconstruction.

The indications for jejunal pouch-esophageal anti-reflux anastomosis were as follows: (i) Siewert classification of the tumor was stage II or III, or the tumor was located in the gastric body; (ii) the tumor was preoperatively considered cT1–3 disease; and (iii) no distant metastasis was found.

### Patient position and placement of trocars

The patient was placed in a 15-degree split-leg reverse Trendelenburg position. We established pneumoperitoneum via a Veress needle beyond the umbilicus. Then, we placed a 12-mm trocar on the lower edge of the umbilicus. The major operative port was placed in the left upper quadrant with a 12-mm trocar and another trocar of 5 mm was inserted in the left lower quadrant. Besides, two additional ports were set in the right upper and lower quadrants, with 5-mm and 12-mm trocars, respectively, for the assistant's use. A 30-degree telescope was placed in the 12-mm trocar, held by another assistant, standing between the patient's legs.

### Gastrectomy and D2 lymphadenectomy

After thorough exploration of the abdominopelvic cavity areas according to the principle of tumor exploration, ensuring that

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there was no distant metastasis, we began to open the gastrocolic ligament, free the greater curvature of the stomach and then dissected blood vessels surrounding it, using ultracision and an unresorbable clip (Hem-o-lok, Teleflex, Morrisville, NC, USA). Afterward, a D2 lymph node (LN) dissection was performed. Next, a mediastinal dissection was performed to ensure that we would have sufficient esophageal length for the anastomosis.

### Reconstruction procedures of jejunal pouch-esophageal anti-reflux anastomosis

#### Creation of a jejunal pouch

We made an incision in the upper abdominal wall, placed the wound protector and then removed the stomach (Figures 1 and 2). First, the small intestine was divided into two 'limbs' approximately 20 cm distal to Treitz's ligament, the biliopancreatic limb and the pouch limb. We transected the jejunum, which was approximately 20 cm in length, and folded it onto itself for a length of approximately 10 cm. We then used a linear stapler to do a side-to-side anastomosis to make a jejunal pouch.

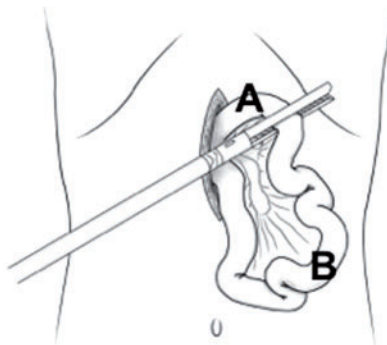


Figure 1. The small intestine is divided into two 'limbs' approximately 20 cm distal to Treitz's ligament, the biliopancreatic limb (A) and the pouch limb (B).

**Anastomosis between the proximal and the distal jejunum**  
Side-to-side anastomosis was made between the proximal and the distal jejunum by a linear stapler (Figure 3). We then used the 3-0 suture to close the entry hole.

#### Anastomosis between the jejunal pouch and the esophagus

The pouch then was re-inserted into the abdomen and a laparoscopic gel port was placed over the wound protector to facilitate the creation of a laparoscopic esophagojejunal-pouch anastomosis (Figures 4 and 5). A hole was made on the posterior wall of the esophagus, 2-3 cm above the ligature rope. Then, another hole was made at the anterior wall of the jejunal pouch. We used another linear stapler to make a side-to-side esophago-jejunal (E-J) anastomosis, making an entry hole. We observed the E-J to avoid bleeding through the entry hole. Thereafter, we used a linear stapler or knotless tissue control device to close the entry hole.

#### Anti-reflux anastomosis

We used a 3-0 suture to attach the two sides of the jejunal pouch together (Figure 6). The most important part of this procedure

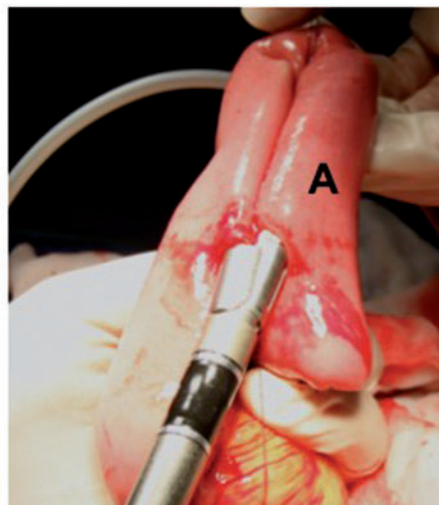
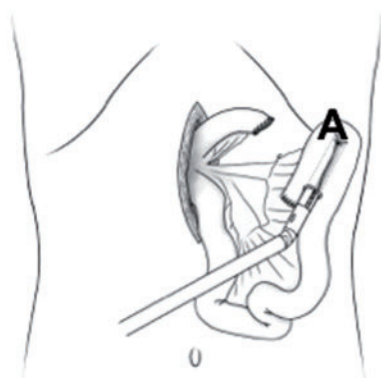
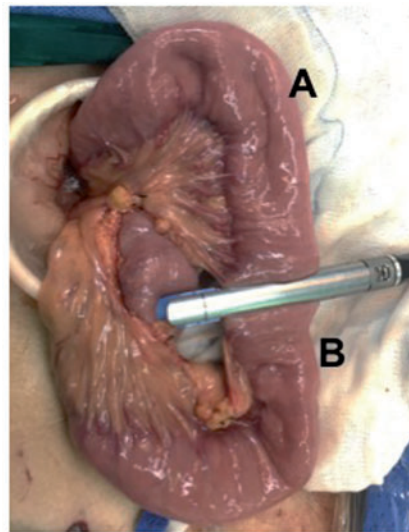


Figure 2. The jejunal pouch (A) constructed via making a side-to-side anastomosis by using a linear stapler.

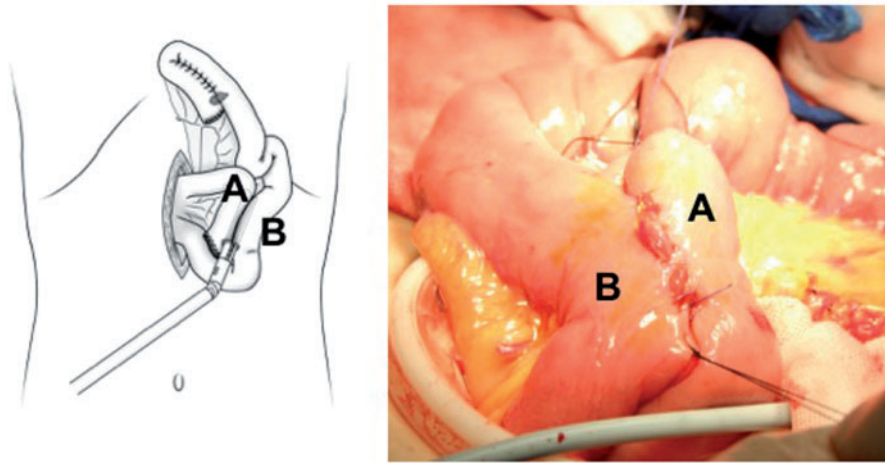


Figure 3. A side-to-side anastomosis between the proximal (A) and the distal jejunum (B) made by using a linear stapler. The entry hole was closed with 3-0 sutures.

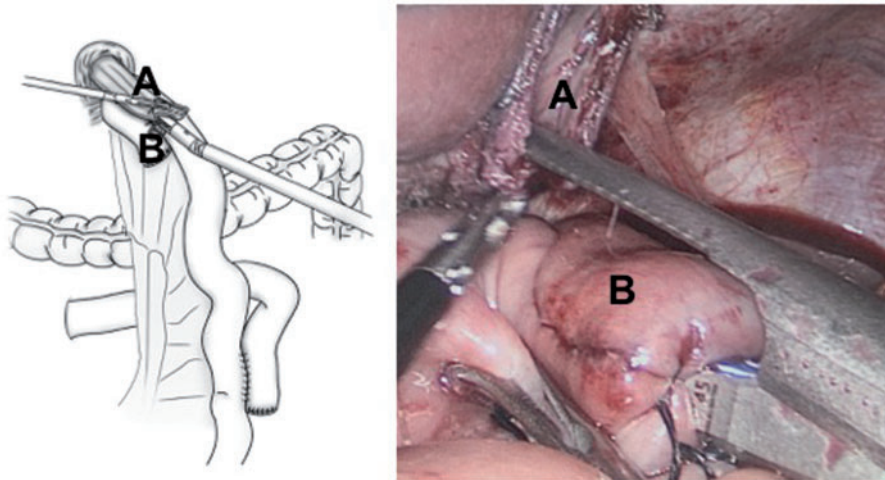


Figure 4. A side-to-side anastomosis between the esophagus (A) and the jejunal pouch (B). This anastomosis was performed by using a linear stapler.

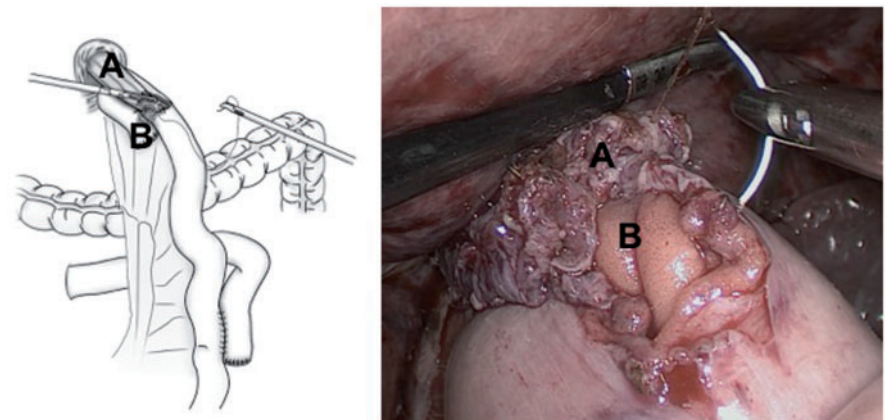


Figure 5. The entry hole between the esophagus (A) and the jejunal pouch (B). It was closed by using the knotless tissue control device.



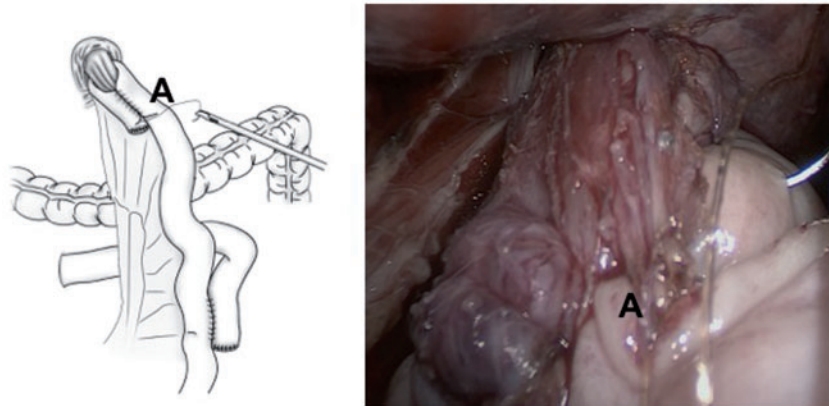


Figure 6. The anti-reflux fix (A) made via attaching the two sides of the jejunal pouch together using 3-0 sutures.

was the strength of the attachment—strong enough to reduce reflux but not too strong to make the anastomosis too narrow.

### Post-operative management

After the procedure of jejunal pouch-esophageal anti-reflux anastomosis, the patients recovered remarkably well. They tolerated a liquid diet by post-operative Day 2 or 3 and were discharged on post-operative Day 5 or 6. Post-operative digestive tract imaging showed that the anastomosis worked well. After 6 months of follow-up, none of these seven patients complained of any reflux syndrome (acid reflux, heartburn, etc.).

### Discussion

In patients undergoing total gastrectomy, end-to-side anastomosis between the esophagus and the jejunum is commonly used by surgeons. However, it is a difficult procedure, even for experienced surgeons; reflux symptoms and abdominal pain are the main complaints during follow-up. Roux stasis syndrome and reflux disease are serious problems after Roux-en-Y esophagojejunostomy [13]. Although an uncut Roux-en-Y procedure has been reported to prevent Roux stasis syndrome after total gastrectomy, it has not been widely adopted by surgeons because of its high risk of severe reflux disease after recanalization [14].

More than 70 procedures have been developed to reduce patients' complaints and to improve quality of life after total gastrectomy [15]. Creating a jejunal pouch has been reported to have advantages for the functional capacity of the gastric substitute [16–18]. However, J-pouch creation is still associated with serious reflux symptoms after total gastrectomy. We attempted to suture the lateral sides of the jejunal pouch to bundle the anastomosis between the jejunal pouch and the esophagus. Similar to the mechanism of fundoplication in the treatment of gastroesophageal reflux disease, we believe this suture operation can also control the reflux from the jejunal pouch into the esophagus, which is caused by the loss of the stomach cardia. In our first seven patients, no patients complained of symptoms related to reflux during 6 months of follow-up post operation. This implies that our method might control reflux symptoms from the jejunal pouch-esophagus anastomosis. In our opinion, the reflux-control function may be related to the papillary-like structure formed, as shown in Figure 7.

However, this method still needs additional cases to demonstrate its effectiveness in controlling reflux symptoms.

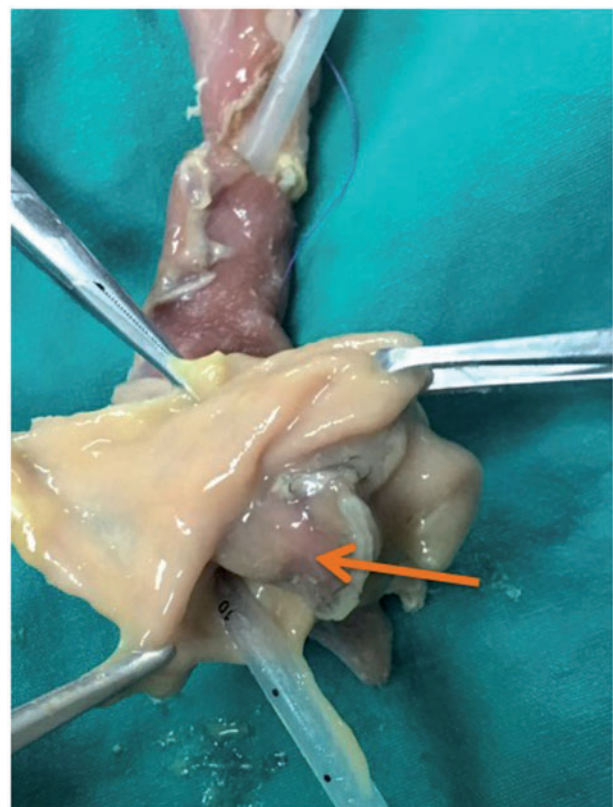


Figure 7. The papillary-like structure (as the arrow shows) was constructed via the jejunal pouch-esophageal anti-reflux anastomosis to control the reflux.

After this technique has been proven, only experienced surgeons should attempt to perform it. If too many tissues from the jejunal pouch are bundled, it may cause anastomotic narrowing. One limitation of our study is that long-term follow-up is still needed.

### Conclusions

Jejunal pouch-esophagus anti-reflux anastomosis can control reflux symptoms effectively. It may be considered an option at the time of surgery to improve quality of life after total gastrectomy.

Conflict of interest statement: none declared.

## Acknowledgements

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