

# A Novel Technique of Anti-reflux Esophagogastrostomy Following Left Thoracoabdominal Esophagectomy for Carcinoma of the Esophagogastric Junction

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**Abstract** We developed an anti-reflux technique of intrathoracic esophagogastrostomy, based on the “Kamikawa procedure” or “Double flap technique”, which is sometimes used in Japan after open proximal gastrectomy for early upper gastric cancer. We applied this technique to four patients with tumors of the esophagogastric junction. All four patients underwent lower esophagectomy and proximal gastrectomy via a left thoraco-abdominal approach. This procedure includes four steps. Firstly, “double door” seromuscular flaps were created at the anterior wall of the gastric tube. Secondly, the inferior end of the mucosal “window” was opened. Thirdly, suturing was performed between the esophagus and the gastric mucosal “window”. Finally, the anastomosis was covered by the seromuscular flaps. No patient experienced post-operative morbidity, or suffered from reflux, even in the Trendelenburg position, dysphagia, or belching. Although this procedure has only been applied to a limited number of patients, we consider that this anastomosis surgical technique is a promising approach to the prevention of reflux after esophagogastrostomy.

## Introduction

Esophagogastrostomy is a frequently used reconstructive method following esophagectomy or resection of the esophagogastric junction. Although it is a safe and straightforward procedure, it can sometimes be accompanied by reflux of gastric or bile acid [1].

This study was based on the report which was presented to the ISDE (International Society for Disease of the Esophagus) in Vancouver, Canada, September 22–24, 2014.

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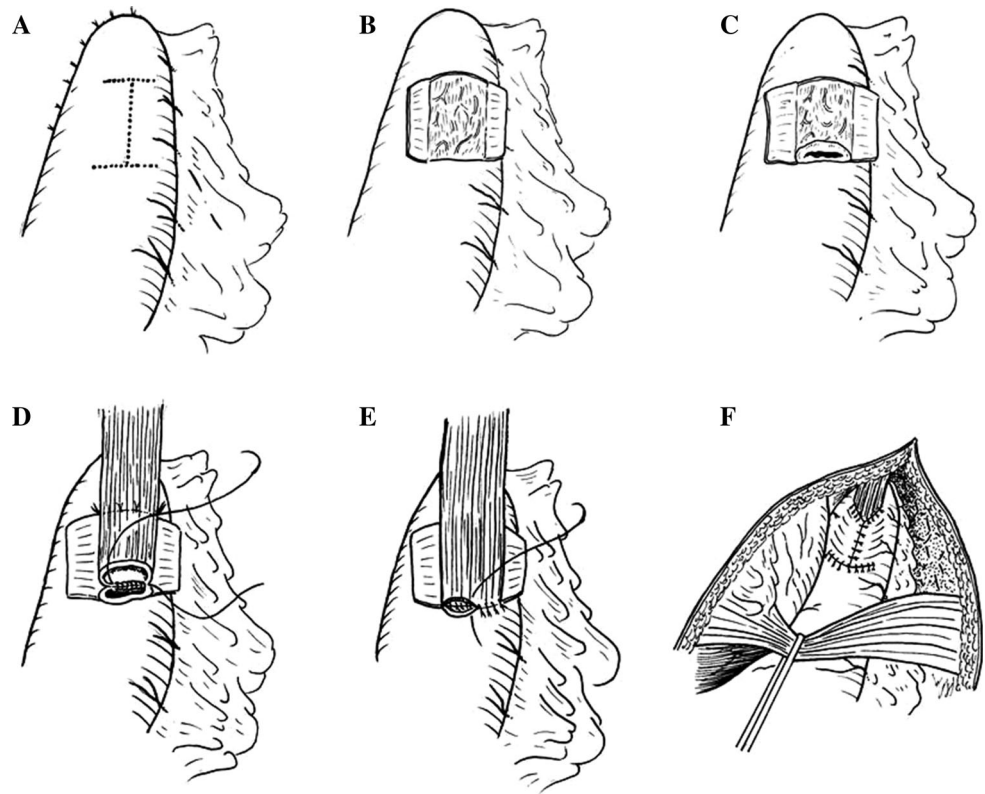
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This report presents a novel technique of intrathoracic esophagogastrostomy that is designed to prevent this reflux. It is based on an anti-reflux anastomosis, known as the “Kamikawa procedure” or “Double flap technique”, which is sometimes used in Japan after open proximal gastrectomy for early upper gastric cancer [2, 3]. We applied this technique to four patients who were diagnosed with tumors of the esophagogastric junction (three adenocarcinomas and one squamous cell carcinoma).

## Surgical techniques

Between December 2013 and May 2014, all four patients underwent lower esophagectomy and proximal gastrectomy via a left thoraco-abdominal approach which comprises a left 6th intercostal thoracotomy and oblique laparotomy via a continuous incision in the right semi-lateral position. Before cutting the proximal end of the esophagus, the point 5 cm above the planned cut end must be marked because the esophagus shrinks after resection. The cardia of the

**Fig. 1** Schema of anastomotic procedures. **a** “Double flap”, 2.5 cm × 3.5 cm (width × height). **b** Creation of the mucosal “window” is complete. **c** Creation of an opening at the inferior edge of the window. **d** The esophagus is fixed to the superior edge of the window and sutured to the posterior wall. **e** Suturing of the anterior wall. **f** After the anastomosis has been covered by seromuscular flaps



stomach is resected by a linear stapler. It is important to create a wide gastric tube because a narrow gastric remnant may cause insufficiency of blood flow at the tip of a gastric tube after making the seromuscular flaps.

### Making a “double flap” on a gastric tube (video 1)

After removal of the tumor, “double door” seromuscular flaps were created at the anterior wall of the gastric tube. The dimensions of the “door” were 2.5 cm × 3.5 cm (width x height) (Fig. 1a). The mucosal “window” should be positioned 3–4 cm below the tip of the gastric tube and near the greater curvature to ensure the preservation of blood flow. Using electric cautery, the submucosal layer was cautiously detached and exposed the mucosa, which resulted in the creation of the seromuscular flaps (Fig. 1b). After the creation of the “double flap” was complete, the inferior end of the mucosal “window” was opened (Fig. 1c) and a gastric tube was passed through the hiatus.

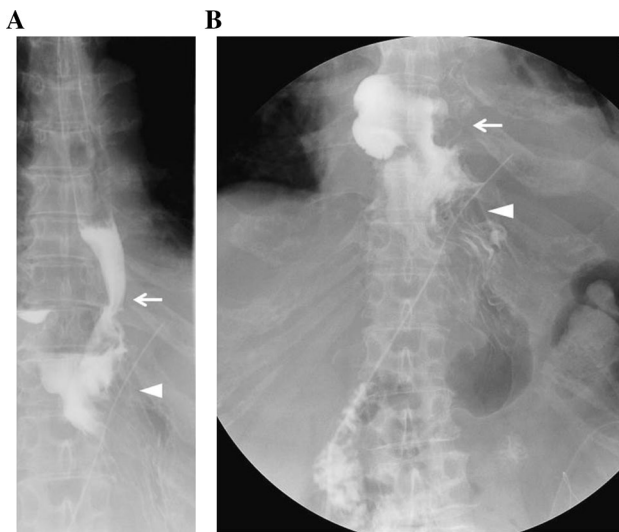
### Anastomosis in the thorax (video 2 and 3)

Firstly, the esophagus at the previously marked point 5 cm above the cut end was fixed to the superior end of the mucosal “window” using three or four stitches. Secondly,

continuous suturing was performed between the posterior wall of the esophagus and the superior opening of the mucosa on the gastric tube (Fig. 1d). Thirdly, interrupted layer-to-layer sutures were placed between the anterior wall of the esophagus and the inferior opening of the mucosa (Fig. 1e). Finally, the anastomosis was covered by the seromuscular flaps (Fig. 1f). The inferior ends of both sides of the seromuscular flaps were fixed in position, slightly below the inferior end of the mucosal “window”. This allowed the anastomosis to be fully covered by the flaps. Both side ends of flaps were upwardly sutured in the midst of the window. Near the superior end of the “window”, it is not necessary to join both ends of the flaps when the tension between the flaps becomes strong. After completion of the anastomosis, a gastric tube was fixed firmly to the hiatus. Pyloroplasty was not additionally performed in any of our cases.

### Results

None of the four patients experienced any post-operative morbidity, including anastomotic leakage or stricture, and none suffered from reflux, dysphagia, or belching. On the 7th post-operative day, swallowed contrast media showed that there was no regurgitation into the esophagus when the patients lay down or even when they were placed in the



**Fig. 2** Contrast media swallow test. **a** Contrast media have passed smoothly through the anastomosis. (Patient in upright position). **b** Contrast media were not regurgitated into the esophagus. (Patient in the Trendelenburg position). *Arrow* the anastomosis. *Arrowhead* the hiatus

Trendelenburg position (Fig. 2a, b). Six months after surgery, no patient suffered from reflux and dysphagia, underwent endoscopic dilatation of their anastomosis, or required anti-acid drugs including proton-pump inhibitor in outpatient clinics.

## Discussion

Although we performed this procedure for only four patients, we feel this new anastomotic technique of esophagogastrostomy has the potential to improve post-operative symptoms of reflux. There are several reports including those by Dr. Aly et al. regarding anti-reflux esophagogastrostomy [4, 5]. He and his colleagues performed a randomized trial comparing the standard anastomotic procedure and their anti-reflux one. Although the outcomes of their subjects were very good, the incidence of leakage was relatively high 4/29 (14 %). In this study, we chose the “Kamikawa” procedure not only because

Nishizaki et al. reported that this procedure had low incidences of leakage (0/15, 0 %) and stenosis (1/15, 7 %) in proximal gastrectomy for early upper gastric cancer [3], but also due to our familiarity with this procedure. Although there was concern about blood flow to the gastric tube and its flaps, we did not experience any ischemic change in the gastric tube or its flaps. The site of the “double flaps” on the gastric tube was considered very important to avoid insufficient blood flow.

This procedure has several drawbacks. Firstly, the proximal esophagus needs to be 5 cm in length to perform the anastomosis. Therefore, it cannot be used in cases where the tumor is located in the upper esophagus. Secondly, this procedure is relatively time-consuming; it takes about 50 min, including making the “double door” on the gastric tube. Thirdly, all of our procedures were performed in open thoracotomy. We should improve our techniques to be adjusted for thoracoscopic surgery.

In conclusion, by applying this novel anastomotic procedure to esophagogastrostomy, reflux of gastric or bile acid could be prevented following resection of the esophagogastric junction.

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