

Successful Endoscopic Treatment of Post-esophagectomy Refractory Reflux Using OverStitch: The First Clinical Case

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ABSTRACT

AIMS: The reflux of duodeno-gastric contents into the remnant esophagus (gastric tube-esophageal reflux: GTER) is a significant issue in long-term esophageal cancer survivors after radical esophagectomy. We attempted endoscopic valve (funnel) creation for prevention for GTER using OverStitch endoscopic suturing system.

METHODS: The OverStitch was mounted onto a standard double-channel endoscope. Under general anesthesia, the funnel creation was attempted by placing semi-full thickness sutures on the gastric wall, at 3 cm distal to the primary esophago-gastric anastomosis. The post-operative outcomes were also evaluated.

RESULTS: In total, 4 sutures were needed and the operating time was 62 minutes without complication. The endoscopic and swallowing studies, as well as pH profile, were all improved postoperatively. The patient's quality of life was dramatically improved with complete disappearance of night-time reflux in spine position.

CONCLUSIONS: Endoscopic antireflux funnel creation was feasible and safe. This procedure may become a useful treatment for patients with severe GTER after esophagectomy.

KEYWORDS: Refractory-reflux, endoscopy, reflux esophagitis, endoscopic surgery, post-esophagectomy, OverStitch

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Introduction

Esophageal cancer is still one of the most aggressive malignancies; however, its prognosis after radical esophagectomy has been dramatically improved with recent advancement in perioperative multidisciplinary therapy.^{1,2} Subsequently, chronic postoperative complications which may lead to poor quality of life (QOL) have become clinical issues. The reflux of duodeno-gastric contents into the remnant esophagus (gastric tube-esophageal reflux: GTER) is one of those issues in long-term cancer survivors. The GTER not only causes deterioration of QOL but also leads to serious consequences such as pneumonia; however, a fundamental and truly effective treatment for GTER has not been reported.^{3–5}

The OverStitch Endoscopic Suturing System (Apollo Endosurgery, Austin, TX, USA) has been widely used for various procedures such as closure of fistulas and revision of gastrojejunal anastomosis after bariatric surgery.^{6,7} We previously reported its use in endoscopic endoluminal antireflux valve

(funnel) creation procedure in animal models and indicated its feasibility, safety, and potential effectiveness for GTER.⁸ In this short communication, we describe our “first in human” experience with endoscopic antireflux funnel procedure using OverStitch.

Case Report

The patient was 69-year-old male cancer survivor, who underwent radical subtotal esophagectomy with intrathoracic anastomosis at his age of 59. No recurrence was observed more than 10 years, but severe GTER episodes were seen more than 3 times in a week. He was otherwise healthy, but his body weight remained less than 60 kg and he could never sleep in supine position for years. Repeated medical treatments and daily life guidance resulted in only partial effect. Endoscopic funnel creation was offered as an alternative to the patient with full explanation of its potential advantages and risks. Prior to the



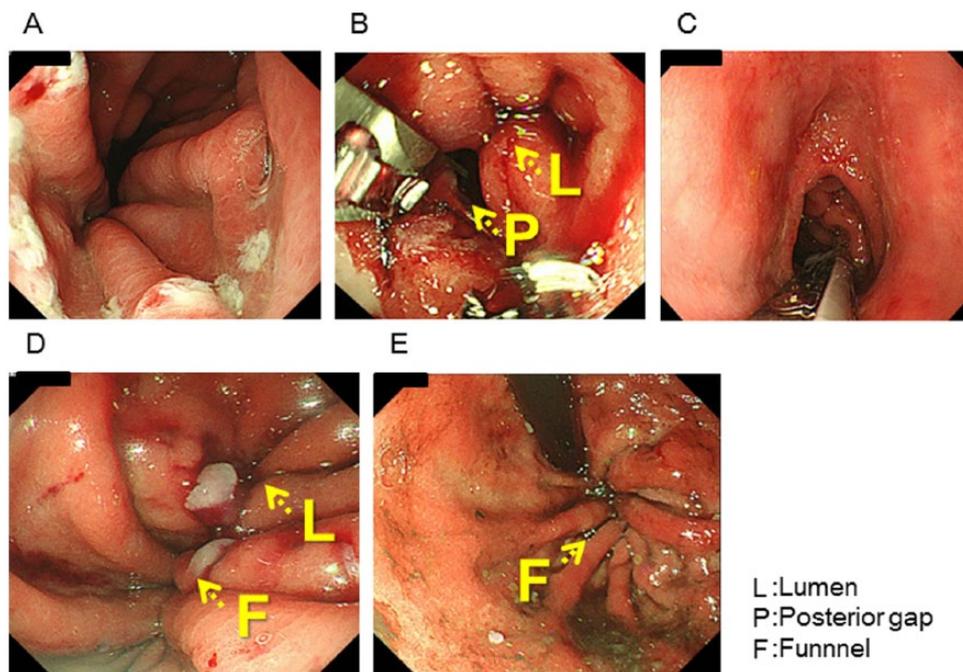


Figure 1. (A) Three suturing sites in the gastric tube were marked. (B) Two semi-full-thickness sutures were placed and tied with a cinching device at 3-o'clock and 9-o'clock directions, respectively. Then, a small posterior gap was closed using 2 additional sutures. (C) A capsule-based reflux testing system was placed. After the procedure, the (D) front and (E) reverse image.

procedure, we intensively evaluated the severity of reflux by esophagography using water-soluble contrast medium (Gastrografin; Bayer, Leverkusen, Germany), as well as pH monitoring using wireless pH-metry (Bravo Reflux Capsule; Given Imaging, Israel) which was placed in the remnant esophagus. The procedure was approved by institutional review board and committee of highly advanced medical treatment. A written informed consent was obtained.

The technical details of our procedure were described elsewhere.⁸ OverStitch (Apollo Endosurgery) Suturing System was mounted onto the tip of a double-channel flexible endoscope (GIF-T240; Olympus Medical Systems, Tokyo, Japan). Under general anesthesia with endotracheal intubation, a short endoscopic overtube (6C23A; Top Corp., Tokyo, Japan) was placed in the remnant esophagus to facilitate both atraumatic passage of the endoscope with suturing devices and to prevent aspiration pneumonia. Carbon dioxide insufflation was used to distend the gastric tube. First, we marked 3 suturing sites in the gastric tube (anterior, greater curvature, and posterior) using argon plasma coagulation, approximately 3 cm distal to the original anastomosis. After submucosal saline injection in a standard fashion, the gastric mucosa was semi-circumferentially incised to expose the muscle layer in between anterior and posterior suturing sites (Figure 1A). Next, the exposed muscle layer was grasped using a dedicated anchoring device (Tissue Helix; Apollo Endosurgery). Two semi-full-thickness sutures were placed using OverStitch and tied with a cinching device (Suture Cinch; Apollo Endosurgery) at 3-o'clock and 9-o'clock directions, respectively. Then, a small posterior gap was closed using 2 additional sutures (Figure 1B). After the procedure, a capsule-based reflux testing

system (Bravo Reflux Capsule; Medtronic, Dublin, Ireland) was placed above the prior anastomosis (Figure 1C). We evaluated the following items, ie, feasibility, safety, effectiveness, durability, and patient's QOL.

At first, we assessed feasibility and safety of this procedure. The funnel was successfully created with our technique using OverStitch (Figure 1D and E). The total suturing time was 62 minutes. The blood loss was negligible. The patient could resume solid food on postoperative day1 (POD 1) and discharged on POD 3. No perioperative complication was encountered.

We next conducted morphological evaluation using Gastrografin which was infused into the anal side of the funnel through the endoscopy. The angle at which the contrast medium overflowed beyond the funnel was fluoroscopically measured and recorded as the "reflux angle." Although the "reflux angle" was $+30^\circ$ (head-up) before funnel creation, this decreased $< -20^\circ$ (head-down) immediately after the procedure (Figure 2A and B). At 1 month postoperatively, a trivial reflux of Gastrografin over the funnel at -20° , but most of the contrast medium remained on the anal side of the funnel. At 12 months after procedure, the trace amount of reflux flow was observed at 0° (Figure 2C).

Third, we conducted functional evaluation using a continuous pH monitoring immediately after the procedure till discharge. Before the procedure, a significant drop in pH was measured in all day regardless of the patient's position. Immediately after funnel creation (POD 1), a little pH drop was seen. However, no further pH drop was observed even during sleep and meal on POD 2 (Figure 2D).

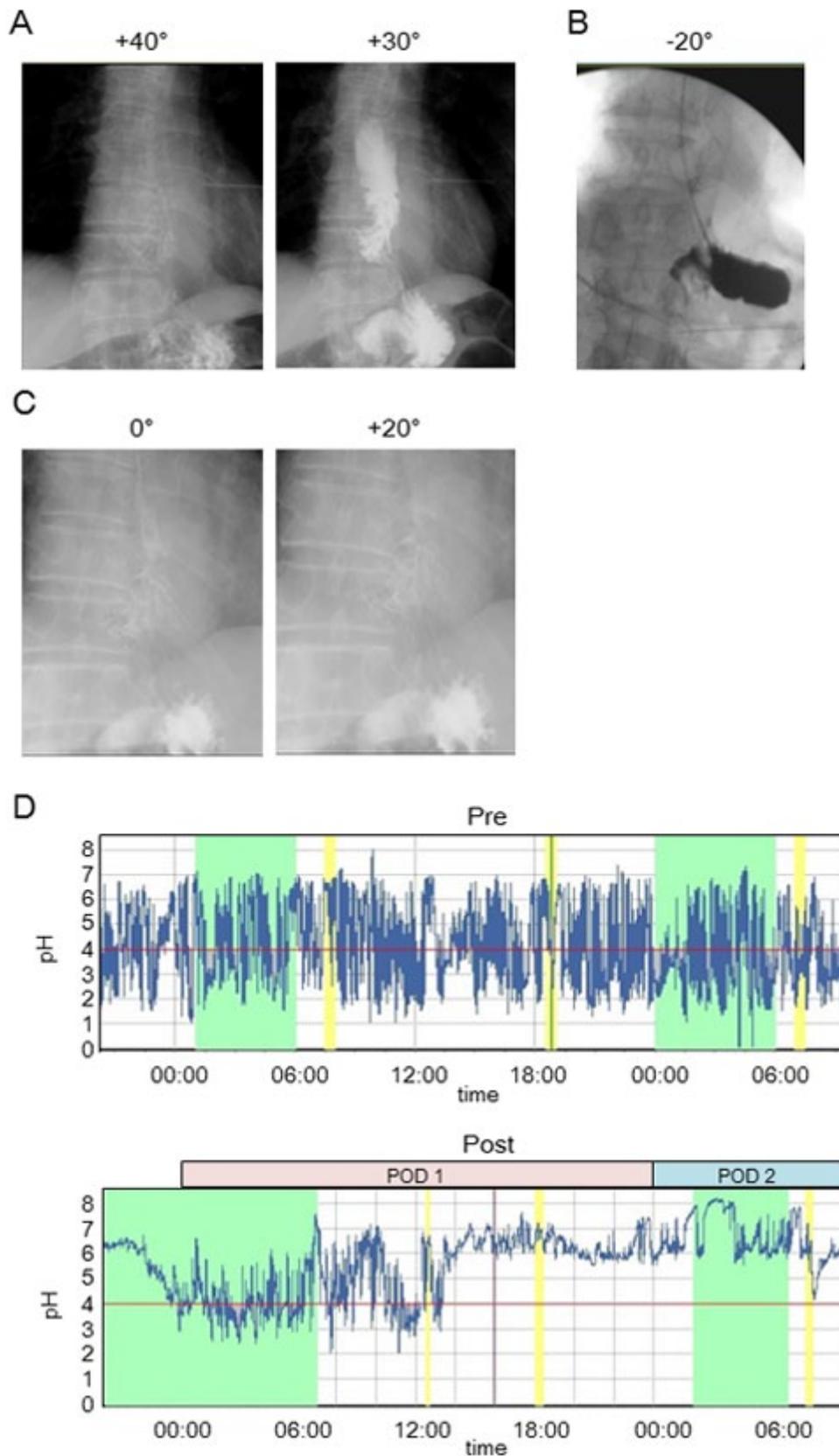


Figure 2. Morphological evaluation using Gastrografin (A) before and (B) after funnel creation. (C) No reflux on Gastrografin study 12 months postoperatively. (D) Marked improvement in postoperative pH profile compared with preoperative data.

We further assessed durability of the funnel by performing follow-up endoscopy at 1 week and at 1, 2, 3, 6, 9, and 12 months after the procedure. It revealed that all sutures

were still in situ and the funnel remained intact even 12 months after procedure (Figure 3A). Diffuse esophagitis, which was observed preoperatively, resolved partially in

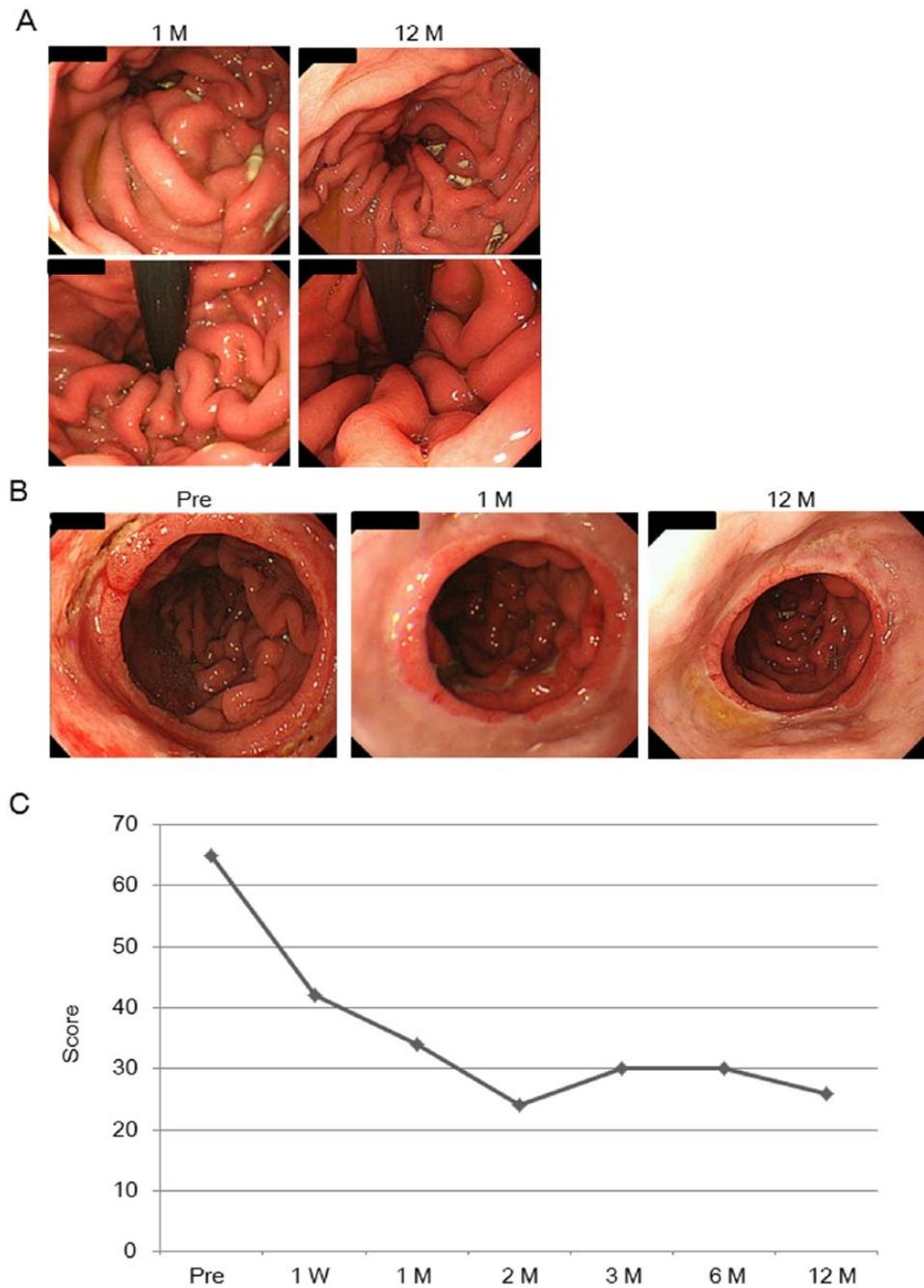


Figure 3. (A) The funnel observed 1 and 12 months postoperatively, showing its durability. (B) Rapid and persistent improvement in endoscopic findings and (C) DAUGS20 scores.

1 month postoperatively and further improved in 12 months (Figure 3B).

We last assessed patient's QOL using Dysfunction after Upper Gastrointestinal Surgery (DAUGS) 20 scoring system before and 1 week, 1, 2, 3, 6, 9, and 12 months after funnel creation. The total score before funnel creation was 65 points, but it improved to 26 points at 12 months after procedure (Figure 3C). The patient could sleep in supine position without GTER.

Discussion

In this study, we attempted endoscopic funnel creation using OverStitch in a long-term cancer survivor with severe GTER

disease. The possible complications of this procedure are pharyngeal and laryngeal laceration, aspiration pneumonia, gastric mucosal bleeding, gastric perforation and lumen, and stenosis. The authors believe, however, that most of these complications can be controlled immediately using OverStitch endoscopically. In the functional assessment, the postoperative pH profile was improved dramatically compared with preoperative data, showing less than 5% of fraction time pH <4 on POD 2. In morphological assessment, GTER was not observed even in -20° after creating funnel, although it was seen even in "head-up" position ($+30^\circ$) before procedure. At 1 month after procedure, the postoperative edema on the gastric mucosa was

improved; therefore, the lumen became slightly enlarged, resulting in trivial reflux over the funnel at -20° . However, even 12 months after the procedure, the antireflux funnel was still functional in supine position. These improvements were also confirmed endoscopically. Still, the authors believe that the improvement in patient's QOL, especially disappearance of his sleeping disorder, must be a best fruit of this new procedure.

This study has several limitations. First, this is the case report with only one patient. Further patient accumulation is absolutely required. Second, the operating time was long. Although our team repeatedly practiced using animal models, the anatomical difference between porcine and human subjects, eg, thickened gastric folds with inflammation in human, was considered partially responsible for lengthy procedure. Third, the long-term effectiveness and durability of the funnel need to be addressed. Although we routinely perform endoscopy to evaluate the funnel, longer follow-up is necessary to conclude that the funnel is truly durable.

In summary, endoscopic antireflux funnel creation using OverStitch was feasible and safe in a human subject. This procedure may become a useful treatment option for patients with severe GTER after esophagectomy.

Author Contributions

HN conceived and designed the experiments, analyzed the data, wrote the first draft of the manuscript. MY and YY

conceived and designed the experiments, analyzed the data, agree with manuscript results and conclusions. TK, SH, KM, RK, YM, TM, TT, YK, HM, ST, MM, and YD agree with manuscript results and conclusions. KN conceived and designed the experiments, analyzed the data, agree with manuscript results and conclusions, jointly developed the structure and arguments for the paper, made critical revisions, and approved final version.

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