



Pure natural orifice transluminal endoscopic surgery (NOTES) nonstenting endoscopic gastroenterostomy: first human clinical experience

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EUS-guided gastroenterostomy (EUS-GE) is a novel approach for the treatment of gastric-outlet obstruction.¹⁻³ This technique uses lumen-apposing metal stents to create a bypass between the stomach and the small bowel distal to the obstruction. This method is typically used for gastric-outlet obstruction resulting from an obstructing malignancy and has not been used for gastric-outlet obstruction resulting from benign disease.^{4,5} We present an unusual case of benign gastric-outlet obstruction in which routine medical treatment failed to relieve the obstruction, and a pure natural orifice transluminal endoscopic surgery

(NOTES) nonstenting endoscopic gastroenterostomy was performed successfully.

A 15-year-old boy was transferred to our hospital for intermittent vomiting due to gastric-outlet obstruction. Upper-GI contrast imaging revealed gastric retention and duodenal dilation due to an obstruction in the third portion of the duodenum (Fig. 1A). Abdominal CT showed a 20.5° angle between the superior mesenteric artery (SMA) and the abdominal aorta (Fig. 1B) such that the third portion of the duodenum was compressed between the aorta and the overlying SMA (Fig. 1C). SMA

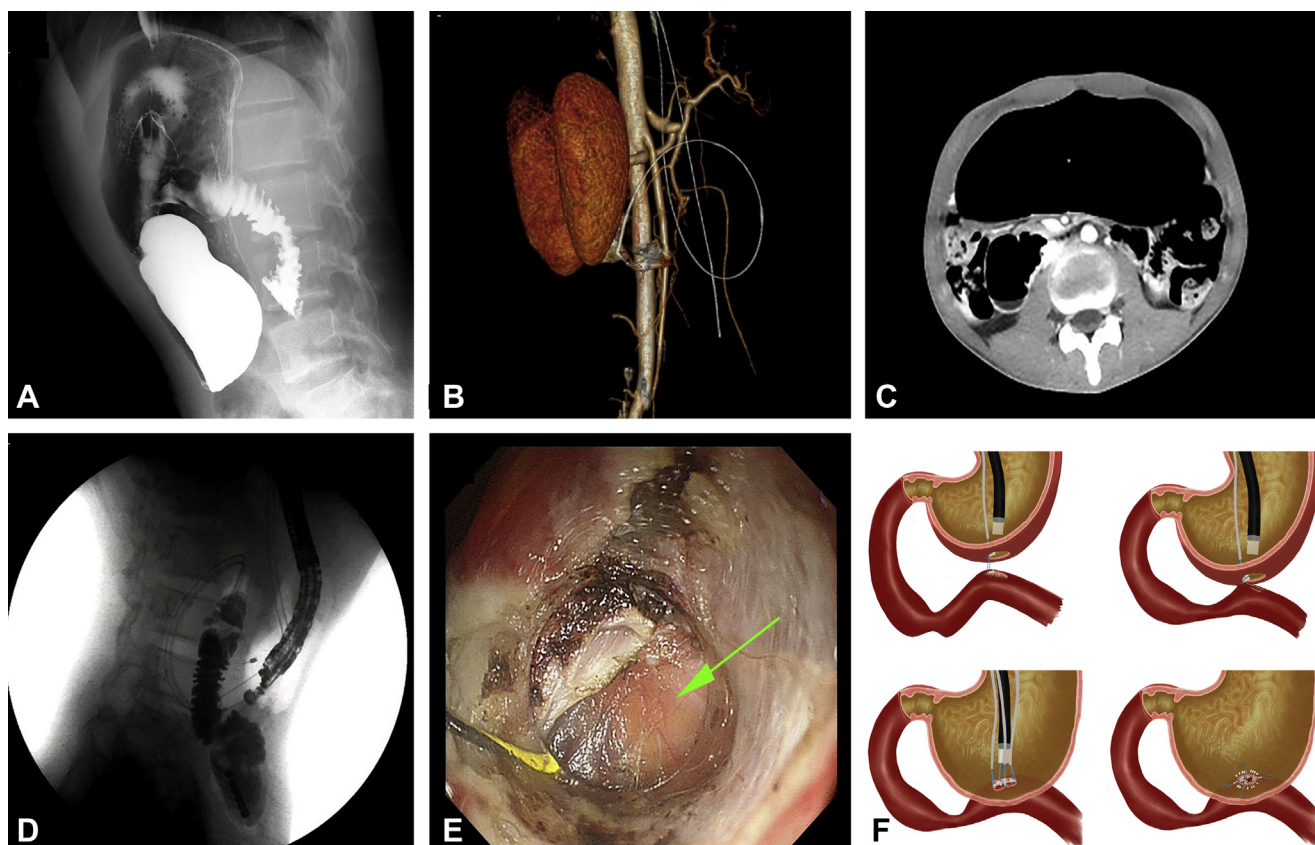


Figure 1. **A**, Upper-GI contrast image showing gastric retention, duodenal dilation, and an obstruction in the third portion of the duodenum. **B**, CT view of abdomen showing a 20.5° angle between the SMA and the abdominal aorta. **C**, Third portion of the duodenum compressed between the aorta and overlying SMA. **D**, EUS-guided puncture. **E**, Excised gastric wall along the guidewire (*arrow*, jejunum). **F**, Kissing suturing method.

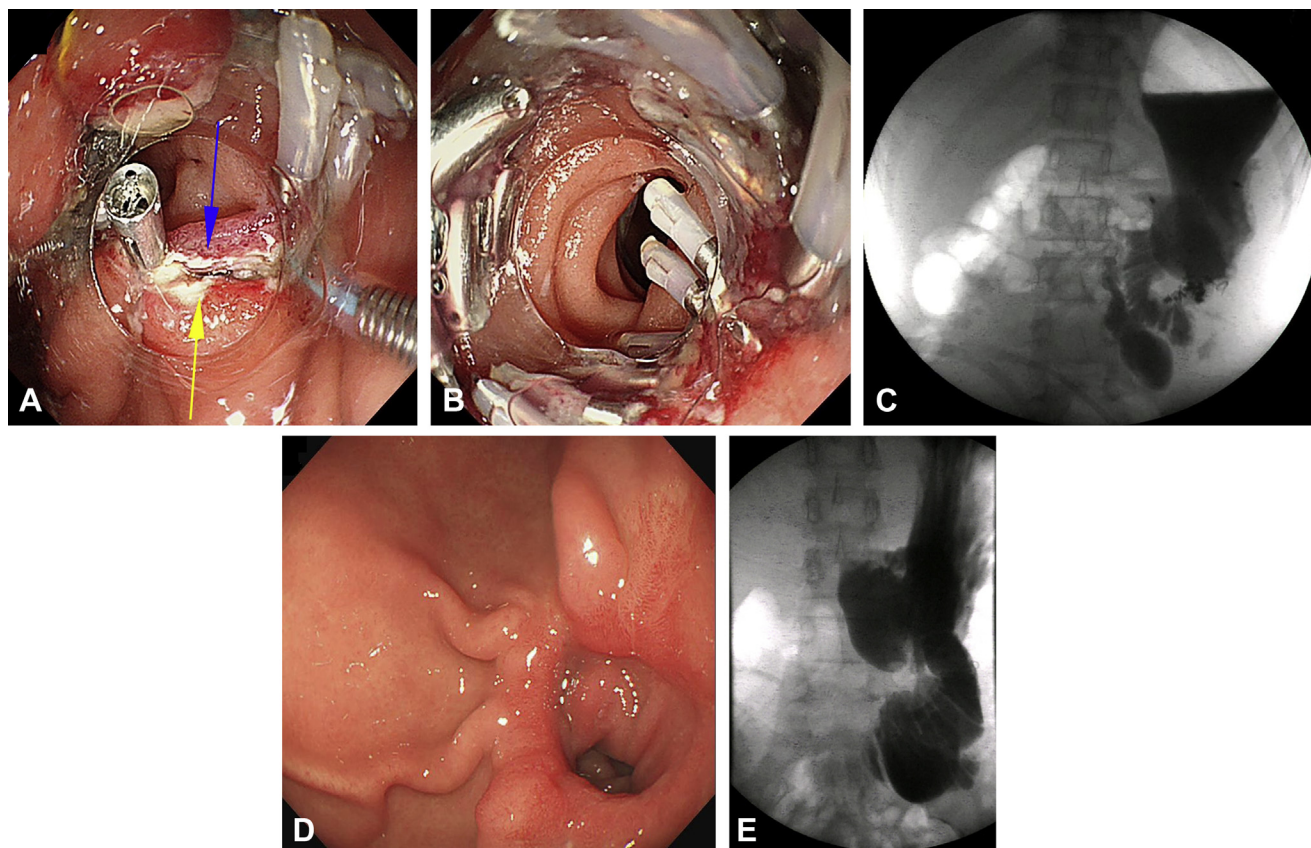


Figure 2. **A**, Kissing suturing for GI anastomoses (*yellow arrow*, gastric mucosa; *blue arrow*, intestinal mucosa). **B**, Endoscopic view of GI anastomosis. **C**, Upper-GI contrast image on postoperative day 3. **D**, Endoscopic view and **E**, iohexol contrast image 5 months postoperatively.

syndrome was diagnosed. After multidisciplinary team discussion, we performed pure NOTES nonstenting endoscopic gastroenterostomy. Informed consent was obtained from the parents after explaining standard of care alternatives and novel nature of the procedure, and IRB approval was obtained from the institution to submit this manuscript for publication.

Endoscopic-guided intubation by use of a double-balloon type intestinal obstruction catheter (Sumitomo Bakelite, Tokyo, Japan) was performed 1 day before the NOTES procedure. Saline solution was used to wash the stomach, and high-level sterilization of the endoscope was done with oxarline solution. In the main procedure, under fluoroscopic monitoring, the balloon was inflated with iohexol contrast solution. An EUS endoscope was passed into the stomach and was used to identify the inflated balloon. A 19-gauge needle was then used to puncture the balloon under EUS guidance (Fig. 1D). A guidewire was passed downstream into the jejunum through the 19-gauge needle under fluoroscopic guidance. The EUS endoscope was withdrawn, leaving the guidewire in the jejunum. Then a gastroscope with a transparent cap was inserted into the stomach, and the gastric mucosa was incised around the guidewire. A 2-cm full-thickness incision was made on

the stomach wall with a hook knife, allowing access into the abdominal cavity. An insulated tip knife was used to remove visceral fat along the guidewire (Fig. 1E). The jejunum was found by following the guidewire, and a 2-cm incision was made in the jejunum wall with the hook knife and the insulated tip knife. The jejunum was then dragged toward the stomach with a snare and rat-toothed forceps. Next, the kissing suturing method was used to anastomose the jejunum and stomach (Fig. 1F). A single-channel endoscope was used to perform the procedure. A transparent cap was attached to the end of the endoscope to provide a constant view during the procedure. A nylon loop was fixed on the transparent cap attached to the endoscope, passed to the site of incision, and placed into the incision. A clip was used to fix 1 side of the nylon loop to 1 edge of the full-thickness incision of the wall of the jejunum. A second clip was then used to anchor the same nylon loop to the same edge of the incision of the full-thickness wall of the stomach. The nylon loop was then ligated, fixing the stomach and jejunum wall together. This procedure was then repeated to fix the 4 sites of circular incision of the jejunum and stomach wall together. Clips were then used to ensure complete closure of the incision (Fig. 2A; Video 1, available online at www.VideoGIE.org).

The procedure time was 3 hours and 19 minutes. During the operation, no significant bleeding or any other adverse events occurred. After construction, the endoscope was able to pass freely through the anastomosis (Fig. 2B). The patient received prophylactic antibiotics for 5 days after successful completion of the procedure. Upper-GI contrast imaging confirmed that contrast material passed through the anastomosis smoothly on postoperative day 3 (Fig. 2C). He started eating 3 days after the procedure and gained 2 kg weight in 2 weeks. Endoscopy and iohexol contrast imaging 5 months later showed a smooth anastomosis without any stenosis and complete recovery (Figs. 2D and E). No adverse events were noted during the 5 months of the follow-up period.

We successfully performed endoscopic gastroenterostomy with results similar to those usually obtained by surgery. This case suggests that that pure NOTES nonstenting endoscopic gastroenterostomy is a possible alternative for the treatment of patients with benign gastric-outlet obstruction. Further validation is needed to confirm the safety and efficacy of this approach.

DISCLOSURE

All authors disclosed no financial relationships relevant to this publication.

Abbreviations: NOTES, natural orifice transluminal endoscopic surgery; SMA, superior mesenteric artery.

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