Surgical Endoscopy (2019) 33:520–527
https://doi.org/10.1007/s00464-018-6326-6

Outcome of endoscopic small-bore naso-jejunal tube stenting in early postoperative jejunal limb obstruction after gastrectomy

Chadin Tharavej[1] · Worawit Kattipatanapong[1] · Suppaut Pungpapong[1] · Suthep Udomsawaengsup[1] · Krit Kitisin[1] · Patpong Navicharern[1]

Received: 5 May 2018 / Accepted: 6 July 2018 / Published online: 12 July 2018

Abstract

Background Early postoperative jejunal limb obstruction is a rare complication following gastric surgery with jejunal reconstruction. The condition is mainly attributed to kinking of the jejunal limbs, gastrojejunal or jejunojejunal anastomosis. There has been currently limited information regarding the safety and efficacy of endoscopic treatment in patients with early postoperative jejunal obstruction. We aimed to investigate outcome of endoscopic small-bore naso-jejunal (N-J) tube stenting across the obstructed segment in patients with uncomplicated early postoperative partial jejunal limb obstruction.

Methods All patients diagnosed of jejunal limb obstruction within 8 weeks after gastric-related surgery were reviewed. Patients with malignant obstruction, complete closed loop obstruction, sepsis, instability, intestinal strangulation, or perforation were excluded. All patients underwent endoscopic dekinking and stenting for 2 weeks with an N-J tube using 16-French single lumen plastic nasogastric tube across the obstruction segment after failed conservative therapy. Successful N-J tube placement across the obstruction point was confirmed by contrast study. Complications, technical, and clinical success were evaluated.

Results Twenty-one patients met the criteria. The primary operations were 7 partial gastrectomies with Billroth-II reconstruction, 7 total or partial gastrectomies with Roux-en-Y reconstruction and 4 Whipple's operations, 2 bypass procedures, and 1 proximal gastrectomy. Most common site of obstruction was jejunojejunal anastomosis and gastrojejunal anastomosis following Roux-en-Y and Billroth-II reconstruction, respectively. Endoscopic N-J tube placement was technically successful in 20 out of 21 patients (95%). One patient had aspirated pneumonia. There was no procedure-related mortality. After N-J tube removal, clinical success was demonstrated in 19 out of 20 patients (95%) at the median duration of 6 months. One patient underwent reoperation due to repeated tube dislodgement.

Conclusions Endoscopic stenting with a 16-F naso-jejunal tube across the angulated segment is safe and effective for treatment of patients with uncomplicated early postoperative partial jejunal limb obstruction following gastric surgery with jejunal reconstruction.

Keywords Afferent limb obstruction · Efferent limb obstruction · Postgastrectomy syndrome · Jejunal limb obstruction · Endoscopic naso-jejunal tube placement

Mechanical obstruction of the constructed jejunal limbs is a rare complication of gastric surgery with jejunal reconstruction. Its incidence ranges from 0.2 to 1.7% [1–3] after gastrectomy, Whipple's operation, and gastrojejunal bypass surgery. The most common type of mechanical obstruction is afferent limb obstruction (ALO, or biliopancreatic limb obstruction). Efferent limb obstruction (ELO, or enteric limb obstruction) and Roux limb obstruction (RLO, or obstruction of an enteric jejunal segment proximal to the jejunojejunostomy after Roux-en-Y reconstruction) are extremely rare. The etiology includes kinking, adhesions, internal herniation, volvulus, stenosis, inflammation, enterolith, and recurrent cancer [3–7]. Kinking and internal herniation are among the major causes during the early postoperative period [3] and recurrent cancer is predominant in the late postoperative phase [5]. This condition should be kept in

✉ Chadin Tharavej
chadin@gmail.com

[1] Department of Surgery, Faculty of Medicine, Chulalongkorn University and King Chulalongkorn Memorial Hospital, 1873 Rama 4 rd., Bangkok 10330, Thailand

mind when patients complain of epigastric pain relieved by massive bilious vomiting following gastric surgery. Late diagnosis and treatment may result in catastrophic complications including intestinal strangulation, perforation, and proximal anastomotic leakage particularly in the case of complete ALO [1, 3].

Surgery remains a standard of care in this condition [1–3, 7]. Nevertheless, some of them are still unfit to undergo reoperation. Recently, a few successful endoscopic treatments have been reported, including endoscopic decompression, repositioning [8], and metal [9] and double-pigtail stent placement [10]. However, the treatment outcome of endoscopic small-bore naso-jejunal (N-J) tube stenting across the occlusion segment in patients with partial jejunal limb obstruction during the early postoperative period of gastric-related surgery is less known.

The aim of this study was to evaluate the safety, and efficacy of endoscopic small-bore N-J tube stenting in patients with uncomplicated early postoperative partial jejunal limb obstruction after gastric surgery with jejunal reconstruction.

Materials and methods

Patients

The medical records of patients diagnosed as having jejunal limb obstruction within 8 weeks after gastric-related surgery between August 2001 and July 2017 at King Chulalongkorn Memorial Hospital were reviewed. Some of the patients underwent initial operation in another hospital and were referred to our clinic. In our practice, stable patients with abnormal upper gastrointestinal (GI) symptoms that were suspicious of early postoperative jejunal limb obstruction underwent upper GI (UGI) study, upper endoscopy, and computed tomography (CT). These symptoms included at least one of the following abnormalities: (1) epigastrium pain or fullness or early satiety, (2) nausea or vomiting, (3) naso-enteric tube drainage volume of > 500 ml/day after 1 week of operation, and (4) inability to tolerate regular diet after 2 weeks of uneventful operation. Patients with evidence of cancer recurrence, complete afferent limb obstruction, volvulus, internal herniation, closed loop obstruction, early postoperative distal small bowel obstruction, gastroparesis, intestinal strangulation, peritonitis, sepsis, or instability were ineligible for endoscopic treatment and excluded from the study. Only patients with uncomplicated obstruction and confirmed diagnosis of partial jejunal limb obstruction of < 8 weeks after gastric-related surgery with jejunal reconstruction who underwent endoscopic small-bore N-J tube stenting were included in the final analysis. Demographic data, primary disease, primary operation, type of reconstruction, location of obstruction, and treatment information in individual patients were obtained.

This study was approved by Institutional Review Board of Chulalongkorn University. The risks and benefits of the procedure were presented to the patients and written informed consent was obtained prior to providing the treatment.

Endoscopic small-bore naso-jejunal (N-J) tube stenting (Fig. 1)

In our center, endoscopic N-J tube placement across the obstruction point was attempted in all the non-complicated patients who were diagnosed as having early postoperative partial jejunal limb obstruction with failed conservative treatment. Nil per mouth and nasogastric tube drainage for 2 weeks were initially provided to the patients as conservative method. Surgical intervention was offered in patients who were ineligible for or had failed endoscopic treatment. All the procedures were performed under general anesthesia and fluoroscopic monitoring with the patients in the supine position.

Standard UGI endoscopic examination is performed. Intraluminal acute angulation or kinking of the intestinal segment is identified. Endoscopic dekinking is attempted by gentle passage of the endoscope tip across the angulated segment, navigated using fluoroscopy and contrast study (Fig. 1A). Prolonged attempts were needed in some cases until the intraluminal intestinal segment distal to the obstruction point is endoscopically identified. Once the tip of the endoscope is located distal to the kinking segment, a Savary-Gilliard guidewire is placed through-the-scope, across the angulated point. The endoscope is then totally withdrawn, leaving the guidewire in place (Fig. 1B). An N-J tube was threaded over the guidewire across the obstructed segment by using a 16-French single lumen plastic nasogastric tube (125 cm in length) (Fig. 2). In case of high degree of angulation, a soft guidewire was initially cannulated through-the-scope across the acute angulation segment. The endoscope was then advanced over the soft guidewire passing across the kinking area. A soft wire is replaced with a Savary-Gilliard guidewire, and an N-J tube is then placed over it. Successful N-J tube placement across the obstruction point is confirmed by using tube contrast study (Fig. 1C). The N-J tube was left in place for 14 days.

Outcome evaluation

All the patients had a minimum follow-up duration of 3 months and underwent UGI study at a median duration of 1 week after N-J tube removal (Fig. 1D). They were interviewed and evaluated regarding their upper GI symptoms and diet. Technical and, clinical success, and complications of endoscopic treatments were evaluated.

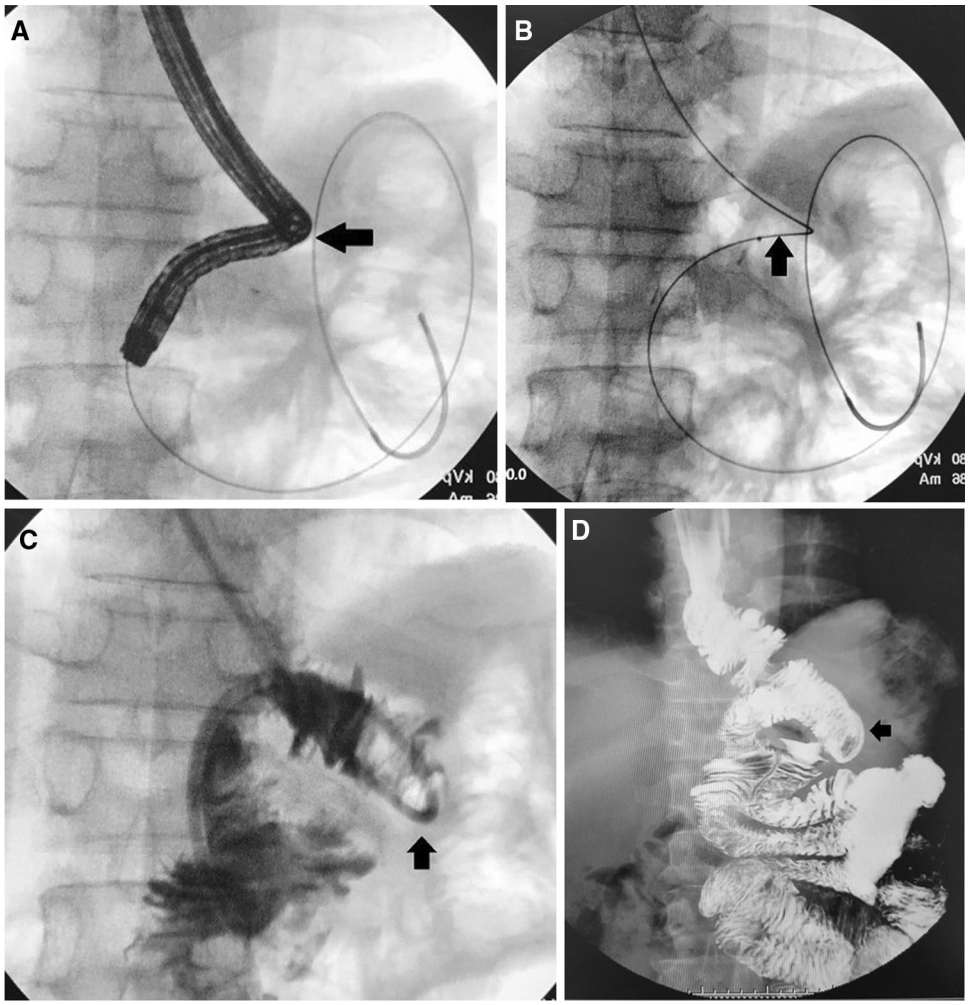

Fig. 1 **A**–**D** Endoscopic nasojejunal (N-J) tube placement in a patient with efferent limb obstruction after D2 total gastrectomy with Roux-en-Y reconstruction is illustrated. **A** Endoscopic dekinking of the acute angulated jejunal segment (black arrow) is shown. **B** A Savary-Gilliard guidewire is placed across the obstructed jejunal segment (black arrow). **C** A technical success of N-J tube placement across the kinking point (black arrow) is demonstrated by tube contrast study. **D** An UGI study at 1 week after N-J tube removal demonstrates free flow of contrast medium to the caudal intestine representing a clinical success

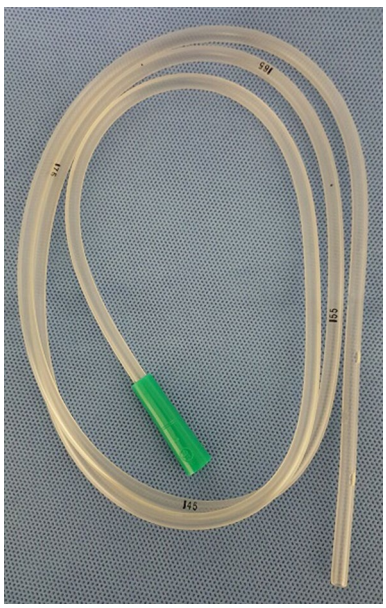

Fig. 2 A standard 16-French single lumen plastic nasogastric tube (125 cm in length) used for stenting the kinking segment

Definition

Jejunal limb obstruction was defined as all the following criteria: (1) abnormal UGI symptoms, (2) intraluminal mechanical obstruction (luminal closure, acute angulation, or kinking) identified using endoscopic examination [11] (Fig. 3) corresponding to the imaging studies [limitation of contrast passage across the obstructed segment in the UGI study or abnormal dilation of the duodenum on CT scan (Figs. 4, 5)].

Gastroparesis was defined as all the following criteria: (1) abnormal UGI symptoms, (2) limitation of contrast outflow from the stomach to the intestinal segment demonstrated by UGI study, (3) no endoscopic evidence of intraluminal mechanical obstruction, and (4) limitation of contrast outflow from the stomach to the caudal intestine despite retaining N-J tube across the gastric outflow as shown in Fig. 6.

Technical success of endoscopic N-J tube placement was defined as successful endoscopic insertion of an N-J tube across the obstructed intestinal segment demonstrated by a contrast study.

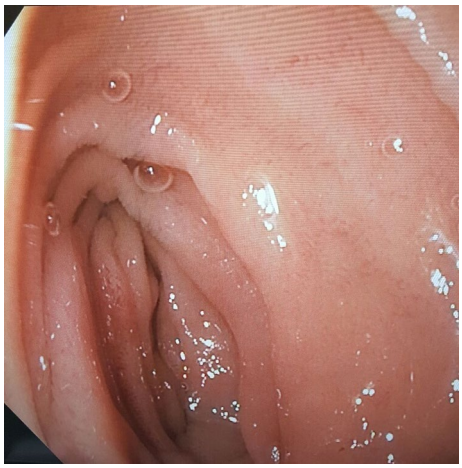

Fig. 3 Endoscopic finding of intraluminal mechanical obstruction reveals luminal closure of a jejunal segment

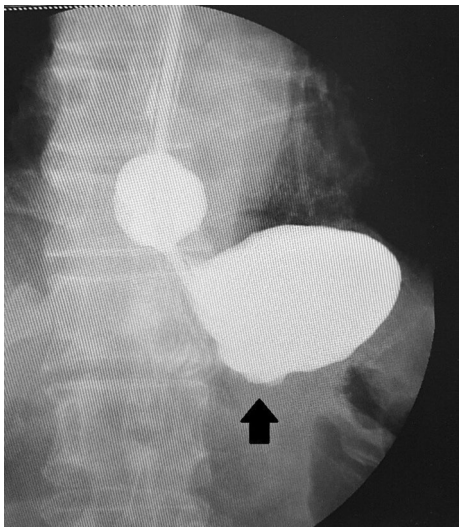

Fig. 4 An UGI study in a patient undergoing D2 subtotal gastrectomy with Roux-en-Y reconstruction demonstrates the obstruction site at gastrojejunal anastomosis. There was no contrast medium passing across the obstruction point (black arrow) compatible with the endoscopic finding of obstruction at gastrojejunal anastomosis

Clinical success of endoscopic N-J tube placement was defined when immediate resolution of abnormal UGI symptoms with resumption of regular diet and jejunal obstruction were clinically and radiologically evident, respectively, without requiring any re-intervention therapy for at least 3 months after N-J tube removal.

Statistical analysis

The data are expressed as numbers, and median with the ranges in parentheses.

Fig. 5 A CT scan on the sixth postoperative day of a patients undergoing gastrectomy with Billroth II reconstruction demonstrates a dilated loop of duodenum with valvulae conniventes projecting toward the lumen (key board sign) compatible with diagnosis of afferent limb obstruction

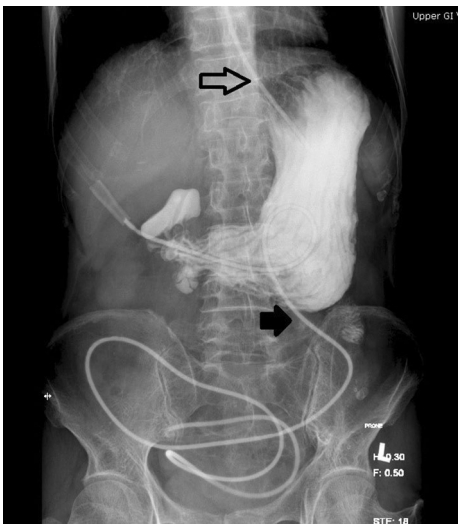

Fig. 6 An UGI study via NG tube (open arrow) at 2 weeks after truncal vagotomy and loop gastrojejunostomy (G-J) in a patient diagnosed of chronic peptic stricture of the first part of the duodenum reveals the limitation of contrast medium passing across G-J despite patent anastomosis demonstrated by endoscopy and gastro-enteric tube stenting (black arrow). These findings are compatible with the diagnosis of gastroparesis. Patients with these findings were excluded from the study

Results

From August 2001 to July 2017, 21 patients were diagnosed as having early postoperative jejunal limb obstruction at King Chulalongkorn Memorial Hospital.

Demographic data, primary diseases and types of operation are summarized in Table 1. Two patients who were diagnosed of having superior mesenteric artery syndrome and caustic stricture of the gastric antrum presenting with gastric outlet obstruction underwent nasogastric tube decompression at 4 and 3 weeks, respectively, before the primary operation. Apart from jejunal limb obstruction, the postoperative course of all the patients was uneventful, except that of one patient with controlled leakage of pancreaticojejunostomy after Whipple operation. No postoperative bleeding, reoperation, or postoperative mortality was reported.

Presenting symptoms, locations, and types of jejunal limb obstruction after primary operation are shown in Table 2.

Endoscopic N-J tube insertion across the obstructed intestinal segment was attempted in all the 21 patients who had failed conservative treatment with nil per mouth and 2-week gastric tube decompression. The median interval between onset of abnormal UGI symptom and endoscopic N-J tube placement was 13 days (7–19 days) and the median duration of the endoscopic procedure was 45 min (30–120 min). Technical success was achieved in 20 (95%) of 21 patients. One technical failure was reported in a patient with a small Petersen hernia with partial ALO. Due to the small size of hernia, CT scan was unable to diagnose. Immediate reoperation with hernia reduction and defect closure was successfully performed in the same setting as planned after a brief period of unsuccessful non-aggressive endoscopic attempts.

The N-J tube was left in place for a median duration of 15 days (12–20 days). No procedure-related mortality was reported. One patient had a mild form of aspirated pneumonia, and 2 patients had an inadvertent tube dislodgement that required re-insertion. Of the 2 patients who underwent endoscopic tube re-insertion, one ultimately attained clinical

Table 1 Demographic data, primary disease, and surgical treatment

Parameter	Value (total $n=21$)
Gender (M:F)	11:10
Median age (years)	62 (23–82)
Primary disease ($n=21$)	
– Gastric cancer	9
– Complicated peptic ulcer disease	3
– Other gastric tumors	3
– Periampullary cancer	4
– Superior mesenteric artery syndrome	1
– Corrosive gastric outlet stricture	1
Primary operation ($n=21$)	
– Total:subtotal D2 gastrectomy	1:8
– Truncal vagotomy + antrectomy	2
– Proximal gastrectomy	1
– Subtotal gastrectomy + colectomy	1
– Hemi gastrectomy + distal pancreatectomy + colectomy + splenectomy	1
– Total gastrectomy + distal pancreatectomy + colectomy + splenectomy	1
– Whipple operation	4
– Laparoscopic duodeno-jejunostomy	1
– Open gastrojejunostomy	1
Reconstruction ($n=21$)	
Following gastrectomy ($n=15$)	
– Roux-en-Y esophago-jejunostomy	2
– Roux-en-Y gastrojejunostomy	5
– Billroth II + Braun anastomosis	2
– Billroth II	5
– Jejunal interposition (Merendino operation)	1
Following Whipple operation ($n=4$)	
– Child reconstruction	1
– Child + Braun anastomosis	3
Bypass procedure ($n=2$)	
– Side to side 2nd part duodenum with loop jejunum	1
– Loop gastrojejunostomy	1

Table 2 Characteristics, location, and type of obstruction of patients with early postoperative jejunal limb obstruction ($n=21$)

Parameters	Value
Presenting symptoms	
– Vomiting	16 (76%)
– Gastric tube drainage > 500 ml/day after 1 week of surgery	5
Median duration from surgery to onset of abnormal GI symptom	13 (3–28) days
No. of patients diagnosed at the same admission of surgery	19 (90%)
Location of obstruction	Type of obstruction (*n*)
– Following Roux-en-Y reconstruction ($n=7$)	
– Gastro-jejunal anastomosis	3 (RLO = 3)
– Jejuno-jejunal (J-J) anastomosis	3 (ELO = 3)
– Biliopancreatic limb 10 cm proximal to J-J (Petersen hernia)	1 (ALO = 1)
– Following Billroth II with Braun ($n=2$)	
– Jejuno-jejunal anastomosis	2 (ELO = 1, ALO = 1)
– Following Billroth II ($n=5$)	
– Gastro-jejunal anastomosis	5 (ALO = 3, ELO = 2)
– Following Whipple with Braun ($n=3$)	
– Jejuno-jejunal anastomosis	3 (ALO = 2, ELO = 1)
– Following Whipple without Braun ($n=1$)	
– Gastro-jejunal anastomosis	1 (ALO = 1)
– Following bypass operation ($n=2$)	
– Duodeno-jejunal anastomosis	1 (ALO = 1)
– Gastro-jejunal anastomosis	1 (ELO = 1)
– Following proximal gastrectomy (Merendino, $n=1$)	
– Jejuno-gastric anastomosis (JG)	1 (JG = 1)

RLO Roux limb obstruction, *ELO* efferent limb obstruction, *ALO* afferent limb obstruction, *Braun* side-to-side jejunojejunostomy, *Merendino* proximal gastrectomy with jejunal segment interposition

successful, but the other, who had caustic stricture of the gastric antrum, required reoperation because of tube re-dislodgement a few days later. No serious complications, such as perforation, bleeding, intestinal strangulation, or anastomotic break down had been reported after the procedure. The clinical success rate was 95% (19/20 patients) at a median duration of 6 months after tube removal.

Discussion

Jejunal limb obstruction is a mechanical obstruction of the constructed jejunal segment after gastric surgery with jejunal reconstruction. This condition can be further classified according to the site, severity, timing, and type of obstruction. The most common site of occlusion is at or near the stoma, which is usually caused by kinking, twisting, or recurrent cancer [3, 5, 10]. Obstruction of non-stoma site commonly results from internal herniation and volvulus [1, 7]. Obstruction severity can be classified into mild, moderate, and severe forms [12]. Mild obstruction usually results from edema of the stoma and can be resolved by proximal decompression. Moderate degree of obstruction represents the high grade partial occlusion which is occasionally manifested by sudden massive bilious vomiting with immediate abdominal pain relief. Both surgical and non-surgical treatments have been recommended in patients with moderate obstruction. Emergency surgical intervention is usually inevitable in patients with severe obstruction, including complete closed loop obstruction, strangulation, necrosis, or perforation. The timing of obstruction after operation can be divided into the early and late phase. Early postoperative obstruction, defined as < 2 weeks after surgery, frequently results from kinking, twisting, or internal herniation, and commonly require surgical intervention [2, 3, 8, 13, 14]. Conversely, late obstruction is usually caused by recurrent cancer, radiation enteritis, and stricture, which can be preferably managed by non-operative treatment, including metal stent placement, balloon dilatation, and some percutaneous methods [4, 5]. In our study, the median duration between the primary surgery and onset of abnormal UGI symptom was 13 days (3–28 days); however, the definite diagnosis of mechanical obstruction was usually confirmed a few weeks later. Regarding the type of the obstruction, this condition can be classified as ALO, ELO, and RLO. Reports in

the literatures are usually focused on the management of ALO [1–7]. The information of ELO and RLO are scarce [8–10].

ALO is a rare complication after gastrectomy with Billroth II or Roux-en-Y reconstruction, Whipple operation with conventional reconstruction (Child's), and side-to-side bypass gastrojejunostomy. Its incidence ranges from 0.2 to 1.7% [1–3]. Diagnosis of ALO includes clinical findings, imaging studies, and endoscopic examination [4, 11]. The common symptoms are epigastric pain, nausea, and vomiting. Elevation of serum bilirubin and amylase levels is common. Non-filling or retention of contrast medium for > 60 min in a UGI study is suggestive of ALO [11]. However, these findings can be found in up to 20% of patients without afferent limb occlusion [4]. CT scan is currently the most accurate imaging study for diagnosing ALO, and its classic finding is a dilated duodenal loop with valvulae conniventes projecting toward the lumen (keyboard sign, Fig. 5) [4]. In addition, CT may suggest information regarding the cause of obstruction and presence of complication. The site of obstruction and mechanical obstruction can be evaluated and confirmed using endoscopic examination [11]. Delayed diagnosis and treatment of this condition confer risks of fatal complications, including strangulation, necrosis, perforation, and proximal anastomosis leakage [1, 3]. A mortality rate of up to 60% (3/5 patients) has been previously reported [15]. Treatment usually depends on the severity and cause of the obstruction. Blouhos et al. [4] recommended surgical intervention in patients with ALO caused by a benign condition and non-operative treatment in those with unresectable cancers.

Despite the evidences of efficacy of prophylactic Braun anastomosis against ALO [3, 16], 3 out of 5 patients with adding Braun anastomosis in our series had postoperative ALO (Table 2). All 3 patients had a point of obstruction at jejunojejunostomy (J-J) and underwent successful endoscopic treatment. We assume that improper placement of a side to side J-J results in twist of the anastomosis leading to a complicated obstruction. Endoscopic N-J tube insertion was more complicated in patients with J-J obstruction. Complete mapping of all sites and types of the occlusion by endoscopic examination, UGI study, and CT scan is crucial for planning the placement of the small-bore N-J tube stenting. To prevent the twist of the jejunojejunal anastomosis, a precise placement of side-to-side J-J should be obtained.

ELO is an extremely rare condition following gastric surgery, similar to ALO. Its incidence has never been studied. Kinking, internal herniation, adhesive band, intussusception, and recurrent cancer have been reported as a cause of occlusion. The clinical manifestations are non-specific and indistinguishable from those of ALO. Owing to the rarity of the condition, treatment has been poorly defined. A few cases with successful treatment have been reported, including endoscopic double-pigtail stent placement [10], and endoscopic stent insertion [9]. Similar to that of ELO, evidence regarding RLO has been limited. Successful endoscopic repositioning in a patient with Roux limb kinking 10 days after total gastrectomy with Roux-en-Y esophagojejunal reconstruction has been reported [8]. There are 8 patients with ELO and 3 patients with RLO in our series and all of them except one patient with ELO are cured by endoscopic small-bore N-J tube stenting. In addition, seven out of 8 patients with ELO who had tube placed into the efferent limb were fed via the tube commencing on the day after the procedure.

In order to successfully place an N-J tube across the occlusion, passage of an endoscope across the kinking point is the key maneuver. There are several methods that we used to pass an endoscope across the obstruction. In mild degree of kink, an endoscope can be gradually advanced passing the kinking segment under endoscopic visualization by keeping the long axis of the endoscope perpendicular to the circular mucosal fold, valvulae conniventes, of the affected intestine. In moderate degree of angulation, the tip of endoscope is gently advanced across the kink navigated by contrast study via through-the-scope catheter. In case of acute angulation, endoscopic cannulation of a soft wire into the stenotic lumen of the affected segment is attempted until it passes across the kink demonstrated on fluoroscopy. The endoscope is then further advanced over the wire across the angulation. A 16 French nasogastric tube is placed over Savary-Gilliard wire. Intraluminal oil lubrication of the tube facilitates the placement.

Of the 21 patients in our series, 20 (95%) patients had technical success and 19 of these 20 (95%) patients with technical success had clinical success. One patient with small Petersen hernia who failed endoscopic treatment underwent successful surgical hernia reduction. A clinical failure was demonstrated in one patient with corrosive stricture of the gastric antrum who underwent loop gastrojejunal bypass surgery. The reason for failure was repeated inadvertent tube dislodgement resulting from recurred vomiting. Our findings demonstrated a low complication rate. Only one patient had mild aspirated pneumonia during the endoscopic procedure and was cured ultimately by intravenous antibiotics. All the patients were slightly annoyed by the nasal tube, but none requested for tube removal. As our patients mainly underwent non-operative treatment, we could not identify the definite causes of obstruction. According to the previous data, we assumed that obstructions in our patients may result from benign lesions, including kinking or twisting of the jejunal segment close to the anastomosis. We advocate this treatment as an alternative option in patients with non-complicated, early postoperative partial jejunal limb obstruction close to the anastomosis. Patients with complications, closed

loop obstruction, volvulus or internal herniation should undergo immediate surgical treatment.

The limitation of our study is the small number of patients resulting from the rarity of the condition, and its retrospective nature. In conclusion, endoscopic stenting with a 16-F naso-jejunal tube across the obstructed intestinal segment for 2 weeks is a safe and an effective treatment option in patients with non-complicated, early postoperative partial jejunal limb obstruction after gastric surgery with jejunal reconstruction.

Compliance with ethical standards

Disclosures Drs. Chadin Tharavej, Worawit Kattipatanapong, Suppaut Pungpapong, Suthep Udomsawaengsup, Krit Kitisin, and Patpong Navicharern have no conflicts of interest or financial ties to disclose.

References

1. Aoki M, Saka M, Morita S, Fukagawa T, Katai H (2010) Afferent loop obstruction after distal gastrectomy with Roux-en-Y reconstruction. World J Surg 34:2389–2392
2. Kim DJ, Lee JH, Kim W (2013) Afferent loop obstruction following laparoscopic distal gastrectomy with Billroth-II gastrojejunostomy. J Korean Surg Soc 84:281–286
3. Nageswaran H, Belgaumkar A, Kumar R, Riga A, Menezes N, Worthington T, Karanjia ND (2015) Acute afferent loop syndrome in the early postoperative period following pancreaticoduodenectomy. Ann R Coll Surg Engl 97:349–353
4. Blouhos K, Boulas KA, Tsalis K, Hatzigeorgiadis A (2015) Management of afferent loop obstruction: reoperation or endoscopic and percutaneous interventions? World J Gastrointest Surg 7:190–195
5. Pannala R, Brandabur JJ, Gan SI, Gluck M, Irani S, Patterson DJ, Ross AS, Dorer R, Traverso LW, Picozzi VJ, Kozarek RA (2011) Afferent limb syndrome and delayed GI problems after pancreaticoduodenectomy for pancreatic cancer: single-center, 14-year experience. Gastrointest Endosc 74:295–302
6. Sarli L, Iusco D, Violi V, Roncoroni L (2003) Enterolith ileus complicating afferent loop syndrome simulating acute pancreatitis. Int Surg 88:129–132
7. Katagiri H, Tahara K, Yoshikawa K, Lefor AK, Kubota T, Mizokami K (2016) Afferent loop syndrome after Roux-en-Y total gastrectomy caused by volvulus of the Roux-limb. Case Rep Surg 2016:4930354
8. Higashizono K, Aikou S, Yagi K, Mori K, Yamashita H, Nomura S, Seto Y (2016) Early endoscopic management for early bowel obstruction after gastrectomy: a case report. Surg Case Rep 2::35
9. Cha RR, Lee SS, Kim H, Kim HJ, Kim TH, Jung WT, Lee OJ, Bae KS, Jeong SH, Ha CY (2015) Management of post-gastrectomy anastomosis site obstruction with a self-expandable metallic stent. World J Gastroenterol 21:5110–5114
10. Lee WY, Moon JS (2013) Endoscopic treatment of efferent loop syndrome with insertion of double pigtail stent. World J Gastroenterol 19:7209–7212
11. Wise SW (2000) Case 24: afferent loop syndrome. Radiology 216:142–145
12. Simon MM (1956) Obstruction of the proximal jejunal loop following gastrectomy; mechanism and prevention. Am J Surg 91:423–430
13. Sugimachi K, Korenaga D, Tomikawa M, Ikeda Y, Tsukamoto S, Kawasaki K, Yamamura S, Takenaka K (2008) Factors influencing the development of small intestinal obstruction following gastrectomy for early gastric cancer. Hepatogastroenterology 55:496–499
14. Hoya Y, Mitsumori N, Yanaga K (2009) The advantages and disadvantages of a Roux-en-Y reconstruction after a distal gastrectomy for gastric cancer. Surg Today 39:647–651
15. Quinn WF, Gifford JH (1950) The syndrome of proximal jejunal loop obstruction following anterior gastric resection. Calif Med 72:18–21 (**illust**)
16. Kakaei F, Beheshtirouy S, Nejatollahi SM, Rashidi I, Asvadi T, Habibzadeh A, Oliaei-Motlagh M (2015) Effects of adding Braun jejunojejunostomy to standard Whipple procedure on reduction of afferent loop syndrome—a randomized clinical trial. Can J Surg 58:383–388