

ORIGINAL ARTICLE

Afferent loop obstruction following laparoscopic distal gastrectomy with Billroth-II gastrojejunostomy

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Purpose: Afferent loop (A-loop) obstruction is an uncommon postgastrectomy complication following Billroth-II (B-II) or Roux-en-Y reconstruction. Moreover, its development after laparoscopic gastrectomy has not been reported. Here we report 4 cases of A-loop obstructions after laparoscopic distal gastrectomy (LDG) with B-II reconstruction. **Methods:** Among the 396 patients who underwent LDG with a B-II anastomosis between April 2004 and December 2011, 4 patients had A-loop obstruction. Their data were obtained from a prospectively maintained institutional database and analyzed for outcomes. **Results:** Four patients (1.01%) developed A-loop obstruction. All were male, and their median age was 52 years (range, 30 to 73 years). The interval between the initial gastrectomies and the operation for A-loop obstruction ranged from 4 to 540 days (median, 33 days). All 4 patients had symptoms of vomiting and abdominal pain and were diagnosed by abdominal computed tomographic (CT) scan. The causes of the A-loop obstructions were adhesions (2 cases) and internal herniations (2 cases) that were treated with Braun anastomoses and reduction of the herniated small bowels, respectively. All patients recovered following the emergency operations. **Conclusion:** A-loop obstruction is a rare but serious complication following laparoscopic and open gastrectomy. It should be considered when a patient complains of continuous abdominal pain and/or vomiting after LDG with B-II reconstruction. Prompt CT scan may play an important role in diagnosis and treatment.

Key Words: Afferent loop obstruction, Billroth-II operation, Laparoscopy, Ileus

INTRODUCTION

The incidence of afferent loop (A-loop) obstruction after Billroth-II (B-II) distal gastrectomy has been reported to be 0.3–1.0% [1]. It may be caused by adhesions, kinking, stenosis or internal herniation after open or laparoscopic gastrectomy. A-loop obstruction develops acutely, and its onset can be early or late postoperatively [2]. In some pa-

tients, the condition can be rapidly complicated by the development of duodenal stump leakage or perforation followed by peritonitis and can result in sepsis [3,4]. Therefore, early diagnosis and immediate surgical therapy are mandatory to decrease the high mortality rate associated with this complication. Making this diagnosis is important not only for open gastrectomy but also for laparoscopic gastrectomy. While a number of laparoscopic

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gastrectomies have been markedly increased, there is no effort to evaluate characteristics of A-loop obstruction following laparoscopic distal gastrectomy (LDG) with a B-II anastomosis. The aim of this study was to elucidate the causes and treatment of A-loop obstruction after LDG with B-II reconstruction for gastric cancer.

METHODS

We retrospectively reviewed a surgical database of 396 gastric cancer patients who underwent LDG with a B-II anastomosis between April 2004 and December 2011. We evaluated the patients' clinicopathologic characteristics and operative findings. The anastomoses were performed by either extracorporeal or intracorporeal methods that were described previously [5]. All anastomoses were performed in the B-II gastrojejunostomy, antecolic and antiperistaltic fashion with 10–15 cm of the usual length of the afferent limb.

RESULTS

Of the 396 patients, 4 (1.01%) developed A-loop obstruction (Table 1). The median age of the patients, each of whom was male, was 45 years old (range, 30 to 73 years). Two of the four patients had advanced gastric cancer, and the remaining two were in the early stage of the disease. All patients had undergone curative resection of their gas-

tric cancer. One patient underwent extracorporeal anastomosis, and the other three underwent intracorporeal anastomoses. All patients were symptomatic with abdominal pain with or without nausea, vomiting and fever. A definitive diagnosis was made by computed tomographic (CT) scan in all cases. The serum amylase level was elevated in two patients, but the serum total bilirubin level did not increase in all patients. The cause of the A-loop obstruction was an adhesion around the afferent limb side of the gastrojejunostomy in cases 1 and 2 (Fig. 1A, B) and internal herniation in the other two patients (Fig. 1C). The internal herniation occurred at the mesenteric gap between the mesocolon and gastrojejunostomy anastomosis. The intervals between the initial gastric resections and the diagnosis of A-loop obstruction ranged from 4 to 540 days. All patients underwent emergency operations before the development of complications such as duodenal stump leakage or peritonitis. The two patients with adhesions underwent adhesiolysis with a Braun anastomosis to avoid rupture of the dilated afferent limb. Two patients with internal herniation underwent reduction of the herniated small bowel into normal position, one via a laparoscopic method and the other via open method. None of the patients died due to the A-loop obstruction, and all four patients are still alive with no evidence of recurrence through the follow-up periods (median, 37 months; range, 18 to 51 months).

Table 1. Characteristics of patients with afferent loop obstructions following laparoscopic distal gastrectomy with Billroth-II reconstruction

Series	Sex/age	Stage (UICC 7th)	Cause	Interval (day)	Symptoms	Serum amylase (IU/L) ^{a)}	Total bilirubin (mg/dL) ^{b)}	Diagnostic tool	Surgical procedure
1	Male/35	T1aN0M0	Omental adhesion	12	Abdominal pain, vomiting, fever	60	1.0	CT	Adhesiotomy and Braun
2	Male/30	T4aN0M0	Omental adhesion	4	Abdominal pain	790	No f/u	CT	Adhesiotomy and Braun
3	Male/73	T1aN0M0	Internal herniation	53	Abdominal pain	197	0.72	CT	Reduction (laparoscopy)
4	Male/69	T2N0M0	Internal herniation	540	Abdominal pain	107	0.57	CT	Reduction (open)

UICC, Union for International Cancer Control; CT, computed tomography.

^{a)}Normal range, 37 to 160 IU/L. ^{b)}Normal range, 0.2 to 1.2 mg/dL.

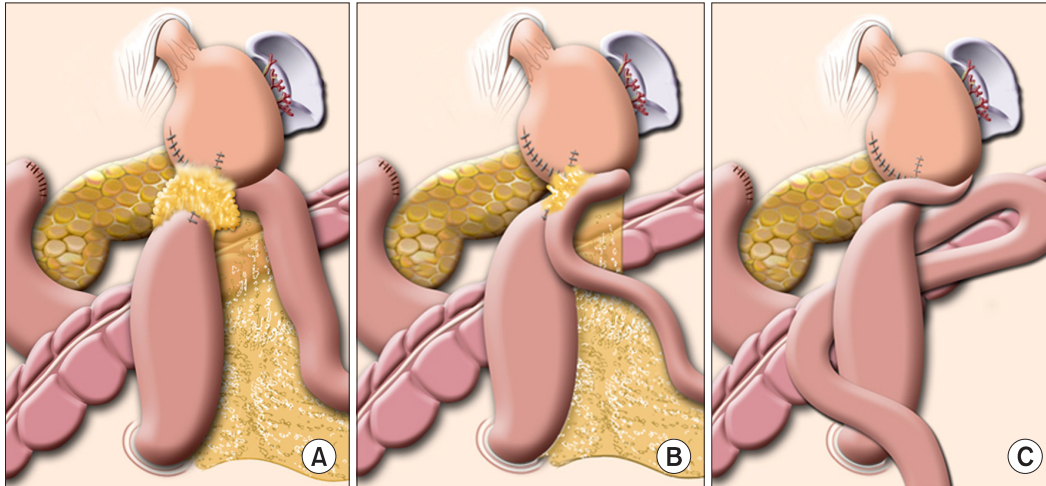


Fig. 1. (A) Illustration of afferent obstruction in case 1. (B) Illustration of afferent obstruction in case 2. (C) Illustration of internal herniation in cases 3 and 4.

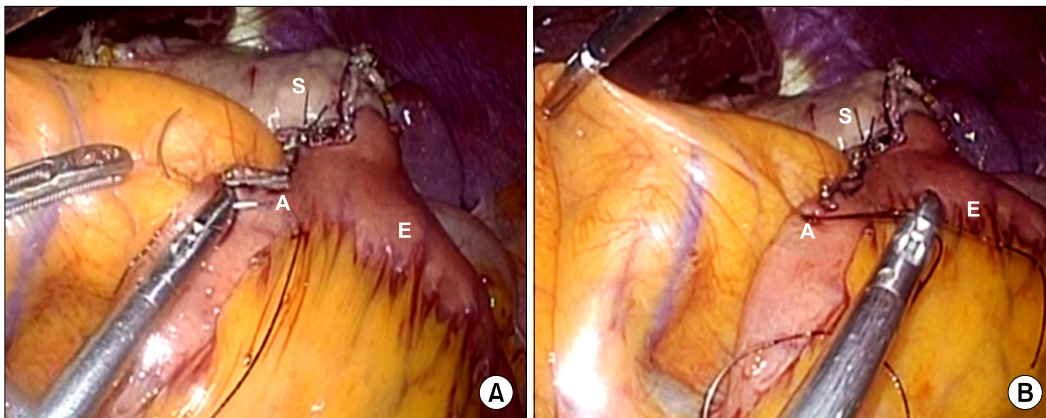


Fig. 2. (A) Stitch between the afferent limb and transverse mesocolon. (B) Closure of mesenteric gap following Billroth-II gastrojejunostomy. S, remnant stomach; A, afferent limb; E, efferent limb.

DISCUSSION

According to a nation-wide survey by the Korean Gastric Cancer Association, the proportion of early gastric cancer (EGC) in Korea increased from 47.4% in 2004 to 57.7% in 2009 due to the development of diagnostic instruments as well as increased use of mass and individual screening. Additionally, the use of LDG for EGC has been increasing significantly [6,7]. In terms of anastomoses, the Billroth I anastomosis is increasingly performed, but the B-II remains one of the main reconstructive options following distal gastrectomy for gastric cancer. The proportions of the reconstruction types following distal gas-

trectomy in 2009 were 63.4%, 33.1% and 3.3% for B-I, B-II and R-Y, respectively [6,7]. A-loop obstruction is a possible and important complication following LDG despite its rarity. This report has meaningful value in terms of the incidence of A-loop obstruction in LDG with B-II because the number of laparoscopic gastrectomies has increased and will continue to do so.

A-loop obstruction occurred in 0.3-1.0% as a result of partial or complete obstruction of the afferent limb following B-II or R-Y anastomosis and may be due to adhesions, kinking, internal herniation or stenosis caused by inflammatory changes or malignancy [1,8]. Because of the relatively low incidence of A-loop obstruction, routine

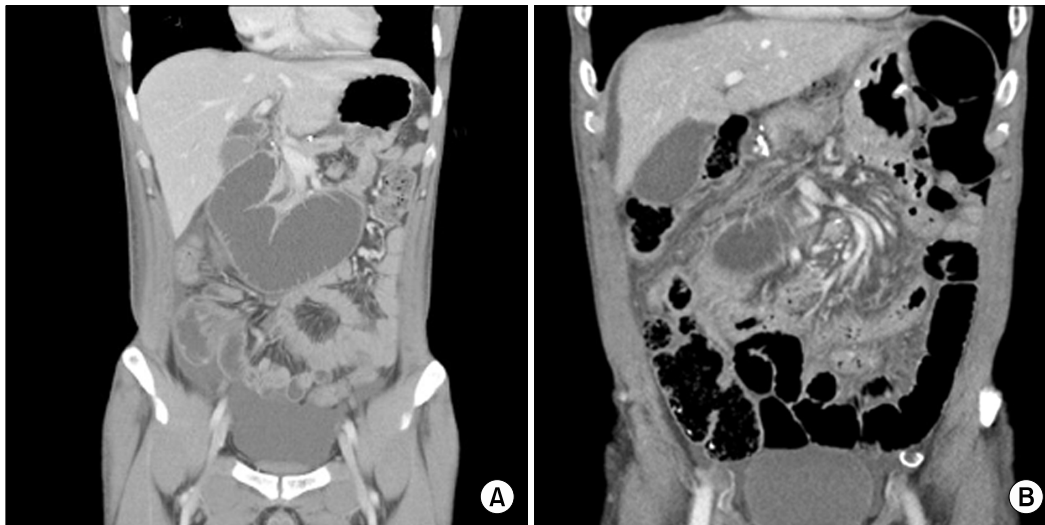


Fig. 3. (A) Markedly dilated duodenal c-loop. (B) A whirling appearance of the mesenteric vessels, suggestive of internal herniation through Petersen's space.

Braun anastomosis for prevention of A-loop obstruction is controversial. We performed it selectively, not in a routine manner.

In our series, the incidence of A-loop obstruction following LDG was similar with previously reported open surgery. We cannot find definite differences between open and laparoscopic gastrectomy regarding the cause of A-loop obstruction. However, there were several specific predisposing factors in A-loop obstruction following LDG such as partial omentectomy and antecolic anastomosis, as found through review of our series. In patient 1, who underwent an extracorporeal anastomosis, an adhesion developed around the proximal afferent limb with remnant omentum (Fig. 1A). Because partial omentectomies were widely performed with laparoscopic gastrectomy, this type of case was not reported in the open surgical group. The other three cases underwent intracorporeal anastomoses; the obstruction in case 2 was caused by an adhesion (Fig. 1B), and the other two were caused by internal herniations (Fig. 1C).

Internal herniation through the jejunal mesenteric gap is a specific morbidity associated with Roux-en-Y reconstruction. This hernia causes twisting of the jejunojejunostomy, thereby causing afferent loop obstruction [1]. To prevent internal herniation, these mesenteric gaps and defects should be tightly closed with stitches. Internal her-

niation at Petersen's space has also been recognized as a cause of afferent loop obstruction after B-II gastrectomy. In our series, two of the four patients with afferent loop obstructions developed obstructions by this type of internal herniation at the mesenteric gap in the region of the gastrojejunostomy. Therefore, placing a routine stitch to close the mesenteric gap between the afferent limb and mesocolon is recommended to prevent internal herniation (Fig. 2).

The intervals between the initial and emergency operations for A-loop obstructions in our series ranged from 4 days to 1.5 years. In our series, adhesions tended to develop early (between 4 and 12 days); otherwise, internal herniation caused late onset of A-loop obstruction (between 53 and 540 days). In the literature, the interval ranges from 3 months and 14 years, regardless of cause [9-11]. Hence, this complication can occur at any time during the post-operative period.

The clinical diagnosis of afferent loop obstruction can be difficult because the symptoms are nonspecific. The usual symptoms are abdominal pain, nausea and vomiting, which occur commonly in any case of small bowel obstruction. Vomitus not containing bile, which suggests complete obstruction of the afferent limb, may be helpful to distinguish between A-loop obstruction and ordinary small bowel obstruction. Stagnation of pancreatic and bile

juice in the distended duodenum may lead to elevation of the serum amylase level, which is a frequent finding with acute pancreatitis and can result in an erroneous diagnosis [12]. Elevated serum amylase was observed in only 1 case in this series. Jaundice due to A-loop obstruction is rare. Plain abdominal radiography is not helpful for making the diagnosis because the afferent jejunal limb is fluid-filled and gasless. In case 1 of this series, the patient suffered from abdominal pain and vomiting. However, plain abdominal X-ray showed no definite dilatation of the duodenal c-loop. We therefore treated him using routine conservative treatments of nasogastric tube decompression with fluid and electrolyte supplement. Verification by CT scan was delayed until his symptoms were aggravated. Although a gastrograffin meal series may suggest the diagnosis because of poor filling or nonfilling of the afferent jejunal limb, CT scan is the most useful imaging modality for diagnosing A-loop obstruction. Characteristically, the dilated afferent limb is found in the midabdomen (Fig. 3A), and it is typically located in the horizontal part of the duodenum, placed between the aorta and the superior mesenteric vessels and displacing these vessels ventrally. In the case of internal herniation, a whirling appearance of the mesenteric vessels can typically be observed (Fig. 3B).

The treatment of choice for A-loop obstructions depends on the cause of obstruction and the length of the afferent limb. A Braun anastomosis is the treatment of choice in cases of severe adhesions and for manual reduction of the herniated small bowel with closure of the mesenteric gap in cases of internal herniation. However, percutaneous transhepatic metal stents with a double-pigtail catheter or endoscopic management can be performed in cases of A-loop obstructions due to cancer recurrence or pancreatitis [13-15]. In our results, there were no candidates for these alternative methods. The reported mortality rate associated with A-loop obstructions is high (30-60%) [4,16]. Most of these high mortality rates were reported before the development of CT scan or ultrasonography. Delayed diagnosis of afferent loop obstruction may lead to severe complications including duodenal stump leakage and perforation or necrosis of the entire afferent limb, resulting in sepsis and death. In our series, there were no deaths because of our prompt surgical treatment follow-

ing early diagnosis of the disease by CT scan.

In conclusion, as in an open B-II gastrectomy, the incidence of afferent loop obstruction following LDG with B-II reconstruction was quite low, at 1.01% in our series. When a patient develops progressive abdominal pain and vomiting after LDG with B-II reconstruction with non-specific findings on plain radiographs with or without an elevated serum amylase, abdominal CT scan should be performed immediately to prevent further disease progression.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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