

Internal hernia after laparoscopic gastric resection with antecolic Roux-en-Y reconstruction for gastric cancer

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Abstract

Background To decrease the incidence of internal hernia after laparoscopic gastric bypass, current recommendations include closure of mesenteric defects. Laparoscopic gastric resection is used increasingly for the treatment of gastric cancer, but the incidence of internal hernia in the treated patients has not been studied.

Methods This study retrospectively reviewed 173 patients who underwent laparoscopic resection for gastric cancer at one institution, including distal and total gastric resections with antecolic Roux-en-Y reconstruction.

Results An internal hernia occurred in 4 (7%) of 58 patients whose jejunojejunal mesenteric defect was not closed a mean of 326 days after surgery. All the patients underwent reoperation with reduction and repair of the hernia. In 115 subsequent cases, with closure of the mesenteric defect, internal hernias did not occur (0/115 cases; $p < 0.05$).

Conclusion Based on the current recommendations for patients undergoing bariatric surgery, closure of this potential hernia defect is mandatory after laparoscopic gastrectomy with a Roux-en-Y reconstruction for gastric cancer.

Keywords Internal hernia · Laparoscopic gastrectomy · Laparoscopically assisted distal gastrectomy · Laparoscopically assisted total gastrectomy · Roux-en-Y reconstruction

Laparoscopic gastrectomy for gastric cancer is performed widely not only in Asia (Japan and Korea) but also in Western countries, with numerous clinical series being reported [1–3]. Roux-en-Y reconstruction is the standard method of reconstruction after laparoscopic distal or total gastrectomy [4–6].

Laparoscopic Roux-en-Y gastric bypass (RYGBP) currently is the most commonly performed bariatric procedure worldwide [7]. For several years, internal hernia has been recognized as a potential complication of RYGBP, with an incidence of 1% to 5% in open surgery [8]. It is suggested that because it induces fewer postoperative adhesions, the laparoscopic approach is associated with an increased risk of early postoperative or long-term internal hernia [7–9]. This is a matter of concern because these hernias can present dramatically as an acute intestinal obstruction with necrosis of bowel segments, especially when diagnosis with prompt surgical intervention is delayed [10].

However, a search of the literature using <http://www.PubMed.gov> with the keywords “laparoscopic gastrectomy,” “gastric cancer,” and “internal hernia” performed 4 January 2011 found no reports of internal hernia associated with Roux-en-Y reconstruction after laparoscopic gastrectomy for cancer. We report our experience with internal hernia since the introduction of laparoscopic gastrectomy with antecolic Roux-en-Y reconstruction, placing special emphasis on the clinical presentation and approaches to reduce this problem in the field of laparoscopic gastric cancer surgery.

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Patients and methods

Patients

Patients with gastric cancer who underwent laparoscopically assisted distal gastrectomy (LADG) or laparoscopically assisted total gastrectomy (LATG) at Jichi Medical University Hospital were reviewed retrospectively after institutional review board approval. The indications for laparoscopic gastrectomy included T1 or T2 (muscularis layer) gastric cancer, no bulky lymph node metastases, and no significant comorbidities.

Laparoscopic gastrectomy

Five ports (three 12-mm and two 5-mm ports) were placed, and a flexible laparoscope was introduced through the infraumbilical port with the patient under general anesthesia and carbon dioxide (CO₂) pneumoperitoneum established. Laparoscopic mobilization of the stomach and lymph node dissection was performed. The duodenum was divided distal to the pylorus with a linear stapler (Ethicon Endo-Surgery, Puerto Rico).

Next, the stomach was divided with linear staplers (LADG), or the esophagus was transected (LATG), followed by a routine regional lymph node dissection. The specimen was retrieved through a 4-cm incision in the left upper quadrant. On the distal side 20 cm distal to the ligament of Treitz, the mesentery of the jejunum was divided for a distance of 10 cm. The jejunum then was divided with a linear stapler (Ethicon).

LADG

The distal jejunum was brought up to the remnant stomach in an antecolic fashion. The greater curvature of the stomach was anastomosed to the jejunum side-to-side with a stapler (Ethicon). The site of entry for the linear stapler then was closed using a linear stapler.

LATG

After division of the esophagus using the Endo-GIA Universal (60-3.5) stapler (Covidien, Mansfield MA, USA), a transorally inserted anvil (OrVil; Covidien) was used for the intracorporeal esophagojejunal anastomosis (DSTEEA 25; Covidien). The jejunum was brought up in an antecolic fashion, and the esophagojejuno anastomosis was performed using the double-stapling technique. A circular stapler (EEA) was inserted through the 4-cm minilaparotomy under pneumoperitoneum. The jejunal stump then was closed intracorporeally using a stapler.

LADG and LATG

The jejunojejunostomy was fashioned using a hand-sewing technique through the minilaparotomy in a conventional fashion under direct vision.

Internal hernias

In the first 58 patients we report, the jejunojejunal mesenteric defect was not closed during the procedure. An internal audit of these patients showed that internal hernia complicated the postoperative course of three patients. The surgical practice then was changed to include routine closure of the defect. After the change in practice, an internal hernia developed in one more patient from the initial group of 58 patients.

All the patients underwent routine computed tomography (CT) scan 6 months postoperatively as part of the routine evaluation. Patients who underwent reoperation due to symptoms and CT findings consistent with internal hernia were reviewed. The mesenteric defect usually was closed under laparoscopic vision using a 3-0 absorbable suture (Vicryl; Ethicon) and sometimes under direct vision in the case of thin patients, at the discretion of the operating surgeon. The patients who experienced internal hernia were reviewed in two groups. The no-closure group (initial 58 patients) was compared with the group that underwent routine closure of the mesenteric defect (subsequent 115 patients).

Results

In this study, 173 patients were reviewed from 2008 to 2010. The no-closure group included 58 patients (38 LADG and 20 LATG), and the closure group included 115 patients (91 LADG and 24 LATG). Internal hernia occurred only for 4 (7%) of the 58 patients in the no-closure group. The mean observation period was 719 days in the no-closure group. The mean time to diagnosis of internal hernia was 326 days (Table 1).

All the internal hernia patients presented with colicky pain. The radiologic findings were abnormal for all the patients, with dilation of the small bowel, remnant stomach, or both and a visible transition point (Fig. 1), or twisted appearance of the mesentery and its vessels, suggesting a volvulus (Fig. 2). Emergency surgical treatment comprising reduction of the hernia and closure of the mesenteric defect was performed in an open fashion due to the dilated intestine and the surgeon's preference. No adhesions were noted at reoperation for any of the patients (Fig. 3).

All hernias were located at the jejunojejunal mesenteric defect. No internal hernias were found at "Petersen's

Table 1 Incidence of internal hernia after laparoscopic gastric resection with a Roux-en-Y reconstruction

No-closure group	LADG (<i>n</i> = 38)	LATG (<i>n</i> = 20)	Total (<i>n</i> = 58)
Observation period (days)	704 ± 75	748 ± 103	719 ± 88
Internal hernia: cases (%)	2 (5)	2 (10)	4 (7) ^a
Time to hernia (days)	402	250	326
Closure ^b group	LADG (<i>n</i> = 91)	LATG (<i>n</i> = 24)	Total (<i>n</i> = 115)
Observation period (days)	271 ± 161	298 ± 186	277 ± 166
Internal hernia (cases)	0	0	0 ^a

LADG laparoscopic assisted distal gastrectomy, LATG laparoscopically assisted total gastrectomy

^a Chi-square analysis shows a *p* value of 0.004 for the comparison of the no-closure and closure groups

^b Closure of the jejunojejunal mesenteric defect



Fig. 1 Plain computed tomography (CT) scan performed 534 days after laparoscopically assisted distal gastrectomy (LADG) showing a dilated duodenum (D) and remnant stomach (S). The *arrowhead* shows the area of the caliber change

window,” which is the space between the Roux limb and the transverse mesocolon. No further cases of internal hernia were recorded after the surgical practice was changed to include routine closure of the mesenteric defects.

No severe complications occurred after LADG. One patient in the closure group required reoperation due to leakage after LATD. This series had no mortality or recurrence cases.

Discussion

Laparoscopic surgery generally is associated with several advantages over the open approach to the same procedure,

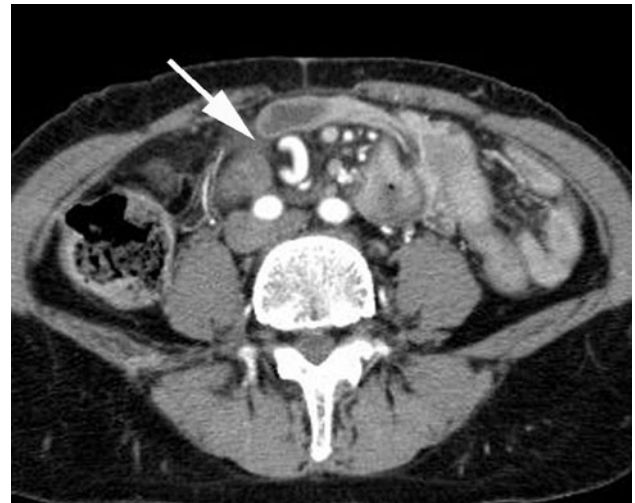


Fig. 2 Early phase of an enhanced computed tomography (CT) scan showing twisting of the mesenteric artery (*arrow*) in a patient 269 days after laparoscopically assisted distal gastrectomy (LADG)

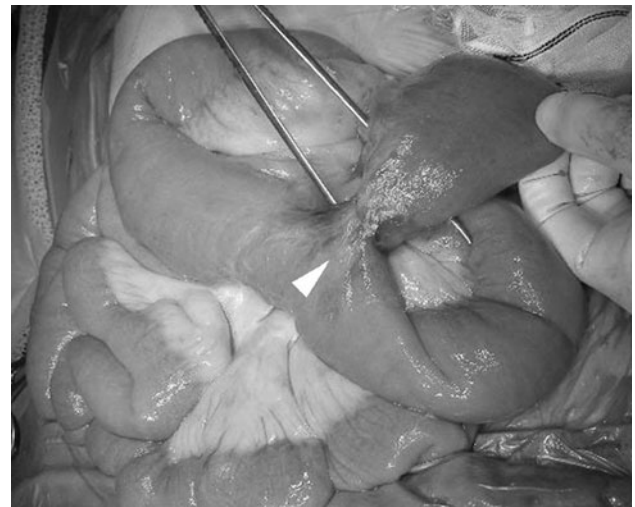


Fig. 3 Operative findings after reduction of the internal hernia at the jejunojejunal mesenteric defect. The *arrow* shows the area of the anastomosis with minimal ischemic changes. There were no adhesions

such as reduction in postoperative pain and earlier resumption of normal activities. Several randomized controlled studies of LADG show further benefits including less bleeding and improved quality of life compared with a conventional open distal gastrectomy [1, 2, 11].

In light of these data, many surgeons are performing or investigating LADG. Roux-en-Y reconstruction after LADG has the potential advantages of a lower incidence of reflux esophagitis, fewer postoperative complications, and better quality of life than the Billroth I method of reconstruction [4, 5, 12].

The LATG procedure remains technically challenging, and the operative technique has not been standardized [13]. The incidence of postoperative complications is reported to be higher than with distal gastrectomy, and the safe performance of the esophagojejunostomy remains the key issue [14]. Transoral introduction of the anvil head of the circular stapler is a recent promising innovation [15]. Recent reports suggest that the complication rates are similar to those for open surgery and that the operating time is longer but with less blood loss [6]. The indications for LATG may expand, with Roux-en-Y reconstruction as the standard method after LATG.

Laparoscopic RYGBP reportedly has a higher rate of postoperative internal hernia than open bypass surgery because of fewer adhesions. Iannelli et al. [7] reviewed 26 studies with a total of 11,918 patients to determine the incidence of internal hernia after laparoscopic RYGBP for morbid obesity. These authors reported 300 cases of internal hernia (2.5%) occurring after laparoscopic RYGBP, with a bowel resection rate of 5% and a mortality rate of 1.2% in internal hernia cases.

Internal hernias are potentially dangerous due to the risk of intestinal strangulation [10]. The retrocolic route in laparoscopic RYGBP has three potential sites for internal hernia, namely, the transverse colon mesentery, Petersen's space, and the enteroenterostomy site [9]. Recently, many authors prefer the antecolic route for the Roux limb, which reduces the potential sites for hernia from three to two and encloses the mesenteric defect after a laparoscopic RYGBP. Paroz et al. [8] recommended routine closure of all mesenteric defects using a running nonabsorbable suture to prevent internal hernia after laparoscopic RYGBP (internal hernia ratio: 1.3% absorbable to 5.6% nonabsorbable; $p = 0.03$).

This is the first report of internal hernia in patients undergoing laparoscopic gastrectomy with a Roux-en-Y reconstruction for gastric cancer. No patients in this series had an internal hernia at Petersen's space, but closure might be needed at that location as well. It appears from the current series that closure of the jejunojunal mesenteric defect may be very important in reducing the incidence of internal hernia.

The use of a nonabsorbable running suture for closure of the mesenteric defect may be indicated according to the report of Paroz et al. [8]. The use of laparoscopic gastrectomy followed by Roux-en-Y reconstruction for the treatment of gastric cancer is increasing rapidly and probably will continue to increase into the future. Closure of the mesenteric defects (jejunojejunal defect and Petersen's space) is recommended for these patients, consistent with the recommendations for laparoscopic RYGBP with an antecolic Roux-en-Y reconstruction, to minimize the incidence of internal hernia.

Disclosures Drs. Yoshinori Hosoya, Alan Lefor, Takashi Ui, Hidenori Haruta, Kentaro Kurashina, Shin Saito, Toru Zuiki, Naohiro Sata, and Yoshikazu Yasuda have no conflicts of interest or financial ties to disclose.

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