Roux-en-Y Reconstruction Following Distal Gastrectomy Reduced Endoscopic Reflux Esophagitis in Older Adults: Propensity Score-Matching Analysis

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Objective: This study aimed to examine the functional outcomes of Roux-en-Y (RY) and Billroth I (BI) reconstruction methods following distal gastrectomy in patients ages ≥75 years with gastric cancer.

Summary of background data: RY and BI reconstructions are commonly performed after distal gastrectomy. However, no study has compared the 2 procedures in older adults.

Methods: We identified older patients who underwent RY (n = 103) or BI (n = 71) reconstruction following distal gastrectomy from 2011 to 2018 in our database. Patients in the RY and BI groups were matched by propensity scores, and each group included 62 patients. We compared short-term surgical outcomes and clinical findings at 1 year postoperatively. Additionally, risk factors for endoscopic reflux esophagitis following distal gastrectomy were evaluated.

Results: Reflux esophagitis, bile reflux, and remnant gastritis were significantly less frequent in RY reconstruction than in BI reconstruction. Moreover, both BI reconstruction and preoperative hiatus hernias were independent risk factors for postoperative endoscopic reflux esophagitis. Although the incidence of postoperative surgical complications following RY and BI was similar, RY was found to cause delayed gastric emptying more frequently than BI.

Conclusion: RY reconstruction is a favorable procedure to prevent reflux esophagitis in older patients, particularly in those with hiatal hernia.
The main reconstructions performed following distal gastrectomy (DG) are Roux-en-Y (RY), Billroth I (BI), and Billroth II reconstructions.1–3 However, Billroth II reconstruction often causes bile reflux.1,2 BI reconstruction has been considered physiologically optimal because foods pass from the stomach to the duodenum as before. However, BI reconstruction can similarly cause bile reflux and inflammation into the esophageal or gastric mucosa.1,2,4–12 Bile reflux is involved in esophagitis, which is associated with esophagogastric junction cancer.13 Although RY reconstruction can prevent bile reflux, it causes delayed gastric emptying (DGE) or Roux stasis.6,9,14,15 RY and BI reconstructions had equivalent surgical outcomes and postoperative quality of life in randomized controlled trials and a meta-analysis.2,16,17 However, reflux esophagitis and remnant gastritis occur more frequently in BI than in RY reconstruction.1,2,4–9 Hiatus hernia causes reflux esophagitis18,19 and is common in older adults, especially in older women who have not undergone gastrectomy.20,21 Therefore, reflux esophagitis is more prevalent in older patients with hiatus hernia. Previous comparable studies of the reconstruction methods following DG were conducted among patients with a mean or median age ranging from 50 to 60 years.1–12,15 However, no studies have compared these reconstruction methods in older adults following DG. The Japan Gerontological Society and the Japan Geriatrics Society have recommended redefining the elderly as those aged 75 years and older.22 Therefore, we aimed to compare the functional outcomes of RY and BI reconstructions after DG in patients aged ≥75 years with gastric cancer.

Materials and Methods

Patient selection

We identified 421 patients who underwent DG in our database of gastric cancer from 2011 to 2018. Of these, we excluded 230 patients aged <75 years, 12 who had stage IV disease, 4 who underwent double tract reconstruction, and 1 with severe preoperative hiatal hernia and esophagitis. Of the remaining 174 patients, 103 and 71 had undergone RY and BI reconstructions, respectively.

Propensity score matching by a logistic regression model was conducted to minimize the bias between the RY and BI groups. Propensity scores were calculated with the following items: age, sex, body mass index, the Charlson Comorbidity Index, tumor location, and pathologic stage determined by the American Joint Committee on Cancer staging.23 Patients from the 2 groups were individually matched using statistical software, as noted below. As shown in a flow chart (Fig. 1), 62 patients who underwent RY and BI reconstructions were each matched.

Ethical approval and informed consent

This study was conducted according to the Declaration of Helsinki principles and was approved by the Institutional Review Board of the Japanese Red Cross Musashino Hospital. The requirement for written informed consent was waived because of the retrospective design; however, the study’s protocol was displayed for patients on our hospital website (https://www.musashino.jrc.or.jp/clinical/index.html; in Japanese).

Operative procedures

We incised the stomach at about 3 cm length from the cardia, so that enough proximal margin was secured for the tumor localized in the middle or the lower portion. Surgeons selected BI reconstruction when they confirmed a remnant stomach of adequate size and no anastomotic tension. Otherwise, we selected RY reconstruction. In the case of distal subtotal gastrectomy, double tract reconstruction was performed. In BI reconstruction, we performed an extracorporeal gastroduodenostomy using a circular stapler of 28 mm in diameter. In RY reconstruction, we divided the jejunum at approximately 20 to 30 cm from the duodenoojunal flexure and made a Roux limb with a length of approximately 20 to 30 cm.11 We performed gastrojejunostomy or jejunojejunostomy using 60-mm–long and 45-mm–long linear staplers, respectively. Antiperistaltic anastomosis was performed on both sides, and the Roux limb was anastomosed in the antecolic route. We excluded patients with severe hiatal hernias; therefore, no patients underwent hiatal hernia repair. A certified surgeon conducted all reconstructions as an operator or instructive assistant.

Outcomes of interest

The following surgical outcomes were investigated: time of operation, estimated blood loss, postopera-
421 patients underwent distal gastrectomy in our institution between 2011 and 2018

230 patients <75 years
12 patients with stage IV disease
4 patients underwent double tract reconstruction
1 patient with severe hiatal hernia before surgery

174 older patients (age >75 years) underwent distal gastrectomy

71 patients underwent RY
103 patients underwent BI

62 patients underwent RY
62 patients underwent BI

Propensity score matching

Fig. 1 Flow chart of patient selection.

Intergroup differences were not observed in the background of patients after matching (Table 1).
Although the RY group had a significantly longer operation time than the BI group, blood loss volume and postoperative recovery course were comparable between both groups (Table 2). The proximal margin was significantly longer in the BI group than in the RY group (Table 2). The total postoperative complications related to the remnant stomach were similar between the RY and BI groups (Table 2). However, DGE occurred only in the RY group, with 3 of 5 patients needing drainage with a nasogastric tube, whereas no patient had DGE in the BI group.

Clinical findings at 1 year postoperatively were evaluated in 48 and 43 patients in the RY and BI groups, respectively (Table 3). Thirty-three patients could not be followed up for 1 year because of recurrent disease (n = 12), treatment for other malignancies or severe diseases (n = 4), death from other diseases (n = 6) or from complications after gastrectomy (n = 1), and not visiting our hospital (n = 10). Regarding the RGB scores, remnant gastritis, bile reflux, and reflux esophagitis were significantly less frequent in the RY group than in the BI group. The incidence of endoscopic hiatus hernia was comparable between groups both preoperatively and postoperatively; however, the prevalence was significantly higher postoperatively. No patients developed preoperative reflux esophagitis. The incidence of GERD-related symptoms and dumping syndrome was not significantly different between the 2 groups, and the relative values of hemoglobin, serum albumin, vitamin B12 levels, and body weight were comparable between both groups. Two patients who underwent RY took iron for anemia at 1 year postoperatively, whereas 6 received postoperative adjuvant chemotherapy in both groups.

Risk factors for postoperative endoscopic reflux esophagitis are shown in Table 4. Although both BI reconstruction and preoperative hiatus hernia were independent risk factors, postoperative hiatus her-
nia did not show a significant association with endoscopic reflux esophagitis. Moreover, bile reflux, remnant gastritis, and residual food showed no significant association with postoperative endoscopic reflux esophagitis.

Discussion and Conclusion

We demonstrated that RY reconstruction reduced reflux esophagitis and remnant gastritis, which are probably caused by bile reflux in older patients.

Table 2  Short-term surgical outcomes

|                     | RY (n = 62) | BI (n = 62) | P value |
|---------------------|-------------|-------------|---------|
| Operating time, min | 233 (113–366) | 175 (90–340) | <0.01   |
| Estimated blood loss, mL | 150 (0–1680) | 160 (10–1130) | 0.47    |
| Proximal margin in resected specimen, median (range) | 28 (6–110) | 40 (5–120) | <0.01   |
| Time to flatus, median (range), postoperative day | 2 (1–6) | 2 (1–4) | 0.22    |
| Initiation of solid food, median (range), postoperative day | 4 (3–13) | 4 (3–5) | 0.96    |
| Postoperative hospital stay, median (range), d | 9 (7–41) | 9 (7–24) | 0.67    |
| Mortality, n (%) | 0 (0) | 0 (0) | 1.00    |
| Complications related to remnant stomach, n (%) | 5 (8) | 3 (6) | 0.72    |
| Leakage | 0 (0) | 0 (0) | 1.00    |
| Anastomotic bleeding | 0 (0) | 2 (3) | 0.50    |
| Delayed gastric emptying | 5 (8) | 0 (0) | 0.06    |
| Necrosis of remnant stomach | 0 (0) | 1 (2) | 1.00    |
| Other surgical complications, n (%) | 4 (6) | 5 (8) | 1.00    |
| Reoperation within 90 d, n (%) | 0 (0) | 1 (2) | 1.00    |
| Readmission within 90 d, n (%) | 2 (3) | 0 (0) | 0.50    |

Table 3  Clinical findings of patients followed up at 1 year postoperatively

|                     | RY (n = 48) | BI (n = 43) | P value |
|---------------------|-------------|-------------|---------|
| Preoperative endoscopic findings, n (%) | | | |
| Reflux esophagitis grades A–D | 0 (0) | 0 (0) | 1.00    |
| Hiatus hernia | 12 (25) | 13 (30) | 0.58    |
| Postoperative endoscopic findings, n (%) | | | |
| Reflux esophagitis | 1 (2) | 7 (16) | 0.02    |
| A | 1 (2) | 5 (12) | |
| B | 0 (0) | 2 (5) | |
| C or D | 0 (0) | 0 (0) | |
| Hiatus hernia | 31 (65) | 27 (63) | 0.86    |
| Amount of residual food | | | |
| 0 | 26 (54) | 35 (81) | 0.56    |
| 1 | 6 (13) | 5 (12) | |
| 2 | 6 (13) | 5 (12) | |
| 3 | 10 (21) | 7 (16) | |
| 4 | 0 (0) | 0 (0) | |
| Extent of remnant gastritis | | | |
| 0 | 14 (29) | 2 (5) | <0.01   |
| 1 | 17 (35) | 7 (16) | |
| 2 | 11 (23) | 24 (56) | |
| 3 | 6 (13) | 19 (44) | |
| Bile reflux | 5 (10) | 29 (67) | <0.01   |
| Clinical symptoms, n (%) | | | |
| Dumping | 1 (2) | 3 (7) | 0.34    |
| GERD-related | 10 (21) | 8 (19) | 0.83    |
| Relative value of body weight, median (range), % | 90 (77–110) | 90 (79–102) | 0.87    |
| Hemoglobin, median (range), g/dL | 12.3 (7.0–15.7) | 12.5 (9.3–16.1) | 0.14    |
| Serum albumin, median (range), g/dL | 4.0 (3.0–4.7) | 4.1 (2.2–4.6) | 0.63    |
| Vitamin B12, median (range), pg/mL | 364 (123–1370) | 342 (158–763) | 0.21    |

*Based on the Residue, Gastritis, and Bile (RGB) classification.
The findings of this study are similar to those of previous reports showing that RY reduced endoscopic remnant gastritis and bile reflux. Therefore, these findings are likely to be common in both older and young patients. The incidence of grade A or higher reflux esophagitis was 0 to 17% in RY and 5% to 30% in BI reconstruction for patients of all ages at 1 year postoperatively. Some reports have shown a significant decrease in reflux esophagitis after RY reconstruction. Another study on BI reconstruction showed the involvement of a smaller remnant stomach with reflux esophagitis. BI reconstruction was only performed when the remnant stomach was large enough to reach the duodenum without tension in this study. Therefore, the remnant stomach's size might not affect the increasing incidence of reflux esophagitis after BI reconstruction.

Postoperative reflux esophagitis was associated with both BI reconstruction and preoperative hiatus hernia. However, postoperative hiatus hernia showed no significant association with endoscopic reflux esophagitis. Hiatus hernia is involved in the relaxation of the lower esophageal sphincter and the delayed clearance of esophageal acid in patients who have not undergone gastrectomy. Hiatus hernia is considered a risk factor for reflux esophagitis in patients without gastrectomy. Severe chalasis of the lower esophageal sphincter after DG may occur in patients with preoperative hernia; therefore, RY reconstruction would be a good method in such patients to prevent reflux esophagitis. RY reconstruction may be required more frequently after DG because the incidence of preoperative hiatus hernia is likely to be greater in older patients than in the young population.

A study on bilirubin monitoring in the esophagus after DG showed increased duration of bile reflux following BI reconstruction compared with that following RY reconstruction. Therefore, bile reflux is considered an important cause of reflux esophagitis after DG. However, its macroscopic detection in the esophagus is difficult in endoscopic examinations. Similarly, it causes mucosal inflammation in remnant gastritis, however, bile reflux into the remnant stomach or remnant gastritis did not significantly relate to reflux esophagitis in the present study.

We found that the GERD-related symptoms at 1 year postoperatively were similar between the RY and BI groups, contrary to other studies that found these symptoms significantly reduced following RY. In patients who did not undergo gas-

**Table 4 Risk factors for postoperative endoscopic reflux esophagitis**

|                          | Yes (n = 8) | No (n = 83) | P value | OR   | 95% CI   | P value |
|--------------------------|------------|-------------|---------|------|----------|---------|
| Baseline characteristics |            |             |         |      |          |         |
| Male, n (%)              | 6 (75)     | 52 (63)     | 0.71    |      |          |         |
| Age, median, y           | 78         | 79          | 0.98    |      |          |         |
| Body mass index, median, kg/m² | 23.6       | 21.8        | 0.11    |      |          |         |
| Charlson Comorbidity Index, median | 3          | 2           | 0.53    |      |          |         |
| Smoking history, n (%)   | 5 (63)     | 48 (58)     | 1.00    |      |          |         |
| Alcohol drinking, n (%)  | 5 (63)     | 43 (52)     | 0.72    |      |          |         |
| Tumor location (the middle portion of stomach), n (%) | 2 (25) | 36 (43) | 0.46 | | | |
| Operative factors        |            |             |         |      |          |         |
| Open approach, n (%)     | 5 (63)     | 48 (58)     | 1.00    |      |          |         |
| D1/1+, n (%)             | 7 (88)     | 62 (75)     | 0.67    |      |          |         |
| BI, n (%)                | 7 (88)     | 36 (43)     | 0.02    | 9.8  | (1.1–89.4) | 0.04   |
| Proximal margin, median, mm | 33         | 31          | 0.56    |      |          |         |
| Postoperative distal gastric emptying, n (%) | 0 (0) | 4 (5) | 1.00 | | | |
| Relative body weight at 1 y, median, % | 90 | 91 | 0.48 | | | |
| Endoscopic findings, n (%) |            |             |         |      |          |         |
| Preoperative hiatus hernia | 6 (75) | 19 (22) | <0.01 | 10.8 | (1.9–61.5) | <0.01 |
| Postoperative hiatus hernia | 7 (88) | 51 (61) | 0.25 | | | |
| Residual food            | 4 (50)     | 32 (39)     | 0.71    |      |          |         |
| Remnant gastritis        | 8 (100)    | 68 (82)     | 0.34    |      |          |         |
| Bile reflex              | 5 (63)     | 29 (35)     | 0.14    |      |          |         |

95% CI, 95% confidence interval; OR, odds ratio.
trectomy, GERD-related symptoms showed no correlation with the severity of reflux esophagitis.²⁹ Older patients with severe GERD commonly had atypical or mild symptoms, whereas those patients with mild reflux esophagitis complained of heart-burn more frequently than young patients.³⁰,³¹ GERD-related complaints were less reliable than endoscopic findings, particularly in elderly patients. These might be reasons for the divergence between the endoscopic findings and GERD-related symptoms in this study.

Early postoperative complications were not significantly different in randomized controlled trials and some retrospective studies comparing RY and BI reconstruction.¹²,⁶,⁸,³² However, 2 studies comparing the procedures revealed that RY reconstruction had a significantly higher incidence of DGE, bowel obstruction, internal herniation, and intra-abdominal abscess than BI reconstruction.¹⁵,³³ Although a previous study has reported a 21% incidence of DGE after RY,⁶ it was the most common complication in this study. We diagnosed DGE based on symptoms requiring fasting in patients without gastrointestinal stenosis. However, various definitions of DGE have been proposed, and many of them included the late removal of the nasogastric tube or a postponement of initiating diet.³⁴ Therefore, a comparison between studies is difficult. A retrospective study showed that isoperistaltic gastrojejunostomy in RY reconstruction, higher body mass index, and tumors located in the lower third of the stomach were risk factors for DGE after DG.¹³,¹⁴ Antiperistaltic gastrojejunostomy in RY did not prevent DGE in the present study. Patients with DGE recovered within 1 month after gastrectomy, and no patients needed temporary stent placement or reoperation in this study.

Our study has some limitations. (1) This study was retrospective, although data were collected prospectively. Moreover, we did not use internationally validated questionnaires to investigate clinical symptoms or quality of life. (2) BI reconstruction was selected only in cases with no anastomotic tension. This selection could have potentially created a bias and influenced our results, although the tumor location was matched to minimize the bias. As mentioned above, a larger remnant stomach was more effective to prevent reflux esophagitis in a published study.²⁶ However, 4 cases of distal subtotal gastrectomy were excluded from the analysis because of double tract reconstruction. Based on our operation records in the matched groups, the stomach was divided at about 3 cm length from the cardia, except in the cases of 3 patients, where the length was unrecorded. Therefore, the remnant stomach size did not differ considerably in the matched cases. In fact, the proximal margin was shorter in the RY group, including more tumors located in the middle portion than in the BI group. Additionally, the tumor location and the length of proximal margin were not associated with endoscopic reflux esophagitis in the present study. (3) Reflux into the esophagus was not assessed by pH monitoring. (4) The number of patients who developed postoperative reflux esophagitis was too low to demonstrate the significance of other risk factors.

In older patients who underwent DG for gastric cancer, RY was a more favorable reconstruction procedure than BI, resulting in decreased postoperative endoscopic reflux esophagitis, bile reflux, and remnant gastritis. Similarly, it was a better procedure for patients with hiatus hernia, which was a risk factor for endoscopic reflux esophagitis after DG. However, GERD-related symptoms were not different between the groups, and DGE was the most common postoperative complication in older patients following RY.

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References

1. Kim CH, Song KY, Park CH, Seo YJ, Park SM, Kim JJ. A comparison of outcomes of three reconstruction methods after laparoscopic distal gastrectomy. J Gastric Cancer 2015;15(1):46–52
2. Lee MS, Ahn SH, Lee JH, Park DJ, Lee HJ, Kim HH et al. What is the best reconstruction method after distal gastrectomy for gastric cancer? Surg Endosc 2012;26(6):1539–1547
3. Smolskas E, Lunevicius R, Samalavicius NE. Quality of life after subtotal gastrectomy for gastric cancer: does restoration method matter?–a retrospective cohort study. Ann Med Surg (Lond) 2015;4(4):371–375
4. Fukuwara K, Osugi H, Takada N, Takemura M, Higashino M, Kinoshita H. Reconstructive procedure after distal gastrectomy for gastric cancer that best prevents duodenogastric reflux. World J Surg 2002;26(12):1452–1457
5. Shinoto K, Ochiai T, Suzuki T, Okazumi S, Ozaki M. Effectiveness of Roux-en-Y reconstruction after distal gastrectomy based on an assessment of biliary kinetics. Surg Today 2003;33(3):169–177

6. Ishikawa M, Kitayama J, Kaizaki S, Nakayama H, Ishigami H, Fuji S et al. Prospective randomized trial comparing Billroth I and Roux-en-Y procedures after distal gastrectomy for gastric carcinoma. World J Surg 2005;29(11):1415–1420

7. Nunobe S, Okaro A, Sasaki M, Saka M, Fukagawa T, Katai H et al. Billroth I versus Roux-en-Y reconstructions: a quality-of-life survey at 5 years. Int J Clin Oncol 2007;12(6):433–439

8. Kojima K, Yamada H, Inokuchi M, Kawano T, Sugihara K. A comparison of Roux-en-Y and Billroth-I reconstruction after laparoscopy-assisted distal gastrectomy. Ann Surg 2008;247(6):962–967

9. Namikawa T, Kitagawa H, Okabayashi T, Kubayashi M, Hanazaki K. Roux-en-Y reconstruction is superior to Billroth I reconstruction in reducing reflux esophagitis after distal gastrectomy: special relationship with the angle of his. World J Surg 2010;34(5):1022–1027

10. Hirao M, Takiguchi S, Imamura H, Yamamoto K, Kurokawa Y, Fujita J et al. Comparison of Billroth I and Roux-en-Y reconstruction after distal gastrectomy for gastric cancer: one-year postoperative effects assessed by a multi-institutional RCT. Ann Surg Oncol 2013;20(5):1591–1597

11. Inokuchi M, Kojima K, Yamada H, Kato K, Hayashi M, Motoyama K et al. Long-term outcomes of Roux-en-Y and Billroth-I reconstruction after laparoscopic distal gastrectomy. Gastric Cancer 2013;16(1):67–73

12. Okuno K, Nakagawa K, Kojima K, Kanemoto E, Gokita K, Taniko Y et al. Long-term functional outcomes of Roux-en-Y versus Billroth I reconstructions after laparoscopic distal gastrectomy for gastric cancer: a propensity-score matching analysis. Surg Endosc 2018;32(11):4465–4471

13. McQuaid KR, Laine L, Fennerty MB, Souza R, Spechler SJ. Systematic review: the role of bile acids in the pathogenesis of gastro-oesophageal reflux disease and related neoplasia. Aliment Pharmacol Ther 2011;34(2):146–165

14. Matsumoto S, Wakatsuki K, Migita K, Ito M, Nakade H, Kunishige T et al. Predictive factors for delayed gastric emptying after distal gastrectomy with Roux-en-Y reconstruction. Am J Surg 2018;208(6):1086–1090

15. Nakaniishi K, Kanda M, Ito S, Mochizuki Y, Teramoto H, Ishigure K et al. Propensity-score-matched analysis of a multi-institutional dataset to compare postoperative complications between Billroth I and Roux-en-Y reconstructions after distal gastrectomy. Gastric Cancer 2020;23(4):734–745

16. Takiguchi S, Yamamoto K, Hirao M, Imamura H, Fujita J, Yano M et al. A comparison of postoperative quality of life and dysfunction after Billroth I and Roux-en-Y reconstruction following distal gastrectomy for gastric cancer: results from a multi-institutional RCT. Gastric Cancer 2012;15(2):198–205

17. Xiong JJ, Altaf K, Javed MA, Nunes QM, Huang W, Mai G et al. Roux-en-Y versus Billroth I reconstruction after distal gastrectomy for gastric cancer: a meta-analysis. World J Gastroenterol 2013;19(7):1124–1134

18. Amano K, Adachi K, Katsube T, Watanabe M, Kinoshita Y. Role of hiatus hernia and gastric mucosal atrophy in the development of reflux esophagitis in the elderly. J Gastroenterol Hepatol 2001;16(2):132–136

19. Murao T, Sakurai K, Mihara S, Marubayashi T, Murakami Y, Sasaki Y. Lifestyle change influences on GERD in Japan: a study of participants in a health examination program. Dig Dis Sci 2011;56(10):2857–2864

20. Loffeld RJ, van der Putten AB. Newly developing hiatus hernia: a survey in patients undergoing upper gastrointestinal endoscopy. J Gastroenterol Hepatol 2002;17(5):542–544

21. Manes G, Pieramico O, Umino G, Mosca S, de Nucci G, Balzano A et al. Relationship of sliding hiatus hernia to gastroesophageal reflux disease: a possible role for Helicobacter pylori infection? Dig Dis Sci 2003;48(2):303–307

22. Ouchi Y, Rakugi H, Arai H, Akishita M, Ito H, Toba K et al. Redefining the elderly as aged 75 years and older: proposal from the Joint Committee of Japan Gerontological Society and the Japan Geriatrics Society. Geriatr Gerontol Int 2017;17(7):1045–1047

23. In H, Solsky I, Palis B, Langdon-Embry M, Ajani J, Sano T. Validation of the 8th Edition of the AJCC TNM Staging System for Gastric Cancer using the National Cancer Database. Ann Surg Oncol 2017;24(12):3683–3691

24. Kubo M, Sasaki M, Gotoda T, Ono H, Fujiyoshi M, Saito D et al. Endoscopic evaluation of the remnant stomach after gastrectomy: proposal for a new classification. Gastric Cancer 2002;5(2):83–89

25. Lundell LR, Dent J, Bennett JR, Blum AL, Armstrong D, Galmiche JP et al. Endoscopic assessment of oesophagitis: clinical and functional correlates and further validation of the Los Angeles classification. Gut 1999;45(2):172–180

26. Nomura E, Lee SW, Tanioka T, Fujii S et al. Newly developing hiatus hernia: a survey in patients undergoing upper gastrointestinal endoscopy. J Gastroenterol Hepatol 2008;23(1):169–177

27. Emerenziani S, Habib FI, Ribolzi M, Caviglia R, Guarino MP, Petitti T et al. Effect of hiatal hernia on proximal oesophageal acid clearance in gastro-oesophageal reflux disease patients. Aliment Pharmacol Ther 2006;23(6):751–757

28. Kahrilas PJ, Shi G, Manka M, Joehl RJ. Increased frequency of transient lower oesophageal sphincter relaxation induced by gastric distention in reflux patients with hiatal hernia. Gastroenterology 2000;118(4):688–695

29. Okamoto K, Iwakiri R, Mori M, Hara M, Oda K, Danjo A et al. Clinical symptoms in endoscopic reflux esophagitis: evaluation in 8031 adult subjects. Dig Dis Sci 2003;48(12):2237–2241
30. Kurin M, Fass R. Management of gastroesophageal reflux disease in the elderly patient. *Drugs Aging* 2019;36(12):1073–1081

31. Furuta K, Kushiyama Y, Kawashima K, Shibagaki K, Komazawa Y, Fujishiro H et al. Comparisons of symptoms reported by elderly and non-elderly patients with GERD. *J Gastroenterol* 2012;47(2):144–149

32. Imamura H, Takiguchi S, Yamamoto K, Hirao M, Fujita J, Miyashiro I et al. Morbidity and mortality results from a prospective randomized controlled trial comparing Billroth I and Roux-en-Y reconstructive procedures after distal gastrectomy for gastric cancer. *World J Surg* 2012;36(3):632–637

33. Kumagai K, Hiki N, Nunobe S, Jiang X, Kubota T, Aikou S et al. Different features of complications with Billroth-I and Roux-en-Y reconstruction after laparoscopy-assisted distal gastrectomy. *J Gastrointest Surg* 2011;15(12):2145–2152

34. Panwar R, Pal S. The International Study Group of Pancreatic Surgery definition of delayed gastric emptying and the effects of various surgical modifications on the occurrence of delayed gastric emptying after pancreatoduodenectomy. *Hepatobiliary Pancreat Dis Int* 2017;16(4):353–363