ABSTRACT

Purpose: Completion total gastrectomy (CTG) for remnant gastric cancer (RGC) is a technically demanding procedure and associated with increased morbidity. The present study aimed to evaluate postoperative complications and their risk factors following surgery for RGC after initial partial gastrectomy due to gastric cancer excluding peptic ulcer.

Materials and Methods: We retrospectively reviewed the data of 107 patients who had previously undergone an initial gastric cancer surgery and subsequently underwent CTG for RGC between March 2002 and December 2020. The postoperative complications were graded using the Clavien-Dindo classification. Logistic regression analyses were used to determine the risk factors for complications.

Results: Postoperative complications occurred in 34.6% (37/107) of the patients. Intra-abdominal abscess was the most common complication. The significant risk factors for overall complications were multi-visceral resections, longer operation time, and high estimated blood loss in the univariate analysis. The independent risk factors were multi-visceral resection (odds ratio [OR], 2.832; 95% confidence interval [CI], 1.094–7.333; P=0.032) and longer operation time (OR, 1.005; 95% CI, 1.001–1.011; P=0.036) in the multivariate analysis. Previous reconstruction type, minimally invasive approach, and current stage were not associated with the overall complications.

Conclusions: Multi-visceral resection and long operation time were significant risk factors for the occurrence of complications following CTG rather than the RGC stage or surgical approach. When multi-visceral resection is required, a more meticulous surgical procedure is warranted to improve the postoperative complications during CTG for RGC after an initial gastric cancer surgery.

Keywords: Morbidity; Stomach neoplasm; Gastrectomy; Gastric stump
INTRODUCTION

Patients who have undergone gastric resection for any cause have a higher risk of developing malignancy in the remnant stomach [1-3]. Previously, remnant gastric cancer (RGC) was commonly diagnosed in patients who underwent gastric resection for peptic ulcer disease. Recently, the surgical indications for peptic ulcer surgery are limited owing to the improved response to medical treatment; consequently, the incidence of RGC following peptic ulcer surgery has decreased. By contrast, the incidence of RGC is increasing among long-term survivors following gastric resection for early-stage gastric cancer (EGC) as detected during the national screening program [4-6].

Completion total gastrectomy (CTG) and lymph node dissection are the standard treatments for resectable RGC as well as primary disease [7]. CTG is correlated with a high risk of complications due to the formation of adhesions after surgery and altered gastrointestinal tract anatomy. In particular, lymph node dissection during initial gastric resection for cancer can cause profound adhesions between the remnant stomach and surrounding organs, such as the pancreas, spleen, liver, and transverse colon, with its mesentery [8,9].

Several risk factors for the occurrence of complications of CTG as treatment for RGC have been reported, regardless of the initial disease status [8]. However, as the indication for initial partial gastrectomy has changed from peptic ulcer disease to EGC, re-evaluation of the complications and their risk factors is warranted to identify new information. Moreover, the effect of minimally invasive surgery (MIS) for CTG should be evaluated as this procedure has become a popular surgical approach.

In this study, we aimed to analyze the postoperative complications and their risk factors following CTG for RGC after previous gastrectomy for cancer, excluding peptic ulcer, to improve the postoperative surgical outcomes.

MATERIALS AND METHODS

Study design and patients

Among 157 patients who underwent CTG between March 2002 and February 2021, 107 who had previously undergone distal gastrectomy as initial treatment for cancer were included. In the present study, RGC was defined as a newly detected cancer located in the remaining stomach, despite the time interval.

Data on the demographic features, details of the initial gastrectomy (approach and anastomosis type, extent of lymph node dissection, and stage), and the interval between the initial gastrectomy and CTG were collected. Comorbidity was calculated using the Charlson comorbidity index (CCI) scale, and the severity of comorbidity was categorized as low grade (CCI scores ≤2) or high grade (CCI scores >2).

The clinicopathological features of RGC (tumor histologic type, tumor location, tumor size, and stage) and surgical details of CTG (approach, combined resected organs, extent of lymph node dissection, operation time, and estimated blood loss) were reviewed. The main location of RGC was classified into the gastrointestinal anastomosis and remnant stomach. The histologic type was classified into two groups: differentiated (papillary, well-differentiated, and moderately...
differentiated tubular adenocarcinoma) or undifferentiated (poorly differentiated, mucinous tubular adenocarcinoma, and signet ring cell carcinoma). Gastric cancer staging was based on the 8th edition of the International Union for Cancer Control/American Joint Committee on Cancer [10]. All study patients underwent CTG with Roux-en-Y esophagojejunostomy.

The postoperative complications were defined as any adverse outcome occurring within one month after surgery and graded using the Clavien-Dindo classification [11]. Pancreatic fistula was defined as a drain output with an amylase level of >3 times the upper limit of normal serum amylase level and was associated with clinical significance [12]. Grade IIIa or higher complications, requiring additional intervention or surgery, were regarded as major complications. The risk factors were analyzed by comparing patients with and without complications.

All study procedures were performed in accordance with the principles of the 1964 Declaration of Helsinki. This study was reviewed and approved by the Institutional Review Board of the National Cancer Center, Korea (NCC 2021-0310).

**Statistical analysis**

Categorical variables were expressed as frequencies with percentages. Continuous variables were expressed as means with standard deviations. To analyze the relevant factors between the groups with and without complications, significant differences in categorical data and continuous variables were examined using Pearson’s \( \chi^2 \) test and Student’s t-test or Mann-Whitney U test, respectively. Logistic regression analyses were performed to determine the factors that independently contributed to the occurrence of complications, and the values of these variables were expressed as odds ratios (ORs) with their corresponding 95% confidence intervals (CIs). Only variables with a P-value of less than 0.10 in the univariate analysis were included in the multivariate analysis. A P-value of <0.05 was considered significant. Data were analyzed using Systat R version 13.0 (Systat Software Inc., San Jose, CA, USA).

**Informed consent statement**

The requirement for obtaining informed consent was waived because of the retrospective study design.

**RESULTS**

**Patients’ demographic characteristics**

The patients’ baseline characteristics are summarized in Table 1. Most patients had previously undergone open distal gastrectomy (82/107, 76.6%). Billroth II anastomosis (80/107, 74.8%) was more frequently performed compared with Billroth I (27/107, 25.2%), and Roux-en Y reconstruction was not identified. The mean time interval between the previous gastrectomy and the development of RGC was 101.4±96.7 months (range:6–488 months). The time intervals between previous gastrectomy and the development of RGC were within 5 years and after 5 years in 47.7% and 52.3% of the patients, respectively. The tumor was located more frequently in the remnant stomach (75/107, 70.8%) than in the anastomosis site (31/107, 29.2%). Undifferentiated tumors (56/107, 52.3%) were more common than differentiated tumors (51/107, 47.7%). Open CTG was performed in 95 patients (88.8%), and splenectomy frequently performed during CTG (30/107, 28.0%), followed by colon resection (14/107, 13.1%). 51.5% of the patients had pStage 1 disease (52/101). The mean operative time was 246.6 minutes, and the volume of estimated blood loss was 304.3 mL.
| Variables                              | Value (n=107)             |
|----------------------------------------|---------------------------|
| **Sex**                                |                           |
| Male                                   | 87 (81.3)                 |
| Female                                 | 20 (18.7)                 |
| **Age (yr)**                           | 64.1±10.7                 |
| **BMI (kg/m**^2**)                     | 21.6±3.1                  |
| **Comorbidity**                        |                           |
| Low CCI                                | 78 (72.9)                 |
| High CCI                               | 29 (27.1)                 |
| **Previous approach**                  |                           |
| Laparoscopy                            | 24 (22.4)                 |
| Open                                   | 82 (76.6)                 |
| Robot assisted                         | 1 (0.9)                   |
| **Previous anastomosis**               |                           |
| Billroth I                             | 27 (25.2)                 |
| Billroth II                            | 80 (74.8)                 |
| **Previous LN dissection**             |                           |
| Unknown                                | 33 (30.8)                 |
| ≥D1                                    | 17 (15.9)                 |
| ≥D2                                    | 57 (53.3)                 |
| **Previous T classification**          |                           |
| Unknown                                | 22 (20.6)                 |
| T1                                     | 40 (37.4)                 |
| T2                                     | 12 (11.2)                 |
| T3                                     | 17 (15.9)                 |
| T4a                                    | 16 (15.0)                 |
| **Previous N classification**          |                           |
| Unknown                                | 22 (20.6)                 |
| N0                                     | 64 (59.8)                 |
| N1                                     | 8 (7.5)                   |
| N2                                     | 6 (5.6)                   |
| N3a                                    | 7 (6.5)                   |
| **Previous TNM stage**                 |                           |
| Unknown                                | 22 (20.6)                 |
| Stage 1                                | 48 (44.9)                 |
| Stage 2                                | 23 (21.5)                 |
| Stage 3                                | 14 (13.1)                 |
| **Time interval (mon)**                |                           |
| ≤5 yr                                  | 51 (47.7)                 |
| >5 yr                                  | 56 (52.3)                 |
| **Tumor location**                     |                           |
| Anastomotic site                       | 31 (29.2)                 |
| Remnant stomach                        | 75 (70.8)                 |
| **Histology**                          |                           |
| differentiated                         | 51 (47.7)                 |
| Undifferentiated                       | 56 (52.3)                 |
| **Current approach**                   |                           |
| Laparoscopy                            | 12 (11.2)                 |
| Open conversion from laparoscopy       | 3 (2.8)                   |
| Open                                   | 92 (86.0)                 |
| **Current LN dissection**              |                           |
| Unknown                                | 1 (0.9)                   |
| ≥D1                                    | 31 (29.0)                 |
| ≥D2                                    | 75 (70.1)                 |
| **Combined resection**                 |                           |
| No                                     | 71 (66.4)                 |
| Yes                                    | 36 (33.6)                 |
| Spleen                                 | 30 (28.0)                 |
| Pancreas                               | 12 (11.2)                 |
| Colon                                  | 14 (13.1)                 |
| Liver                                  | 5 (4.7)                   |

(continued to the next page)
The details of postoperative complications are listed in Table 2. The complications rate was 34.6% (37/107), of which intra-abdominal abscess was the most common complication (19/107, 17.8%).

| Variables | Value (n=107) |
|-----------|--------------|
| Reason for combined resection | |
| LN dissection | 27 (25.2) |
| Direct invasion | 16 (15.0) |
| Adhesion | 1 (0.9) |
| Tumor size (cm)† | 4.2±2.4 |
| Retrieved LN‡ | 11.4±11.3 |
| T classification | |
| T0 | 2 (1.9) |
| T1 | 38 (35.5) |
| T2 | 19 (17.8) |
| T3 | 19 (17.8) |
| T4 | 29 (27.1) |
| N classification‡ | |
| N0 | 79 (78.2) |
| N1 | 11 (10.9) |
| N2 | 9 (8.9) |
| N3 | 2 (2.0) |
| M classification | |
| M0 | 101 (94.4) |
| M1 (peritoneal metastasis) | 6 (5.6) |
| pStage | |
| 1 | 52 (51.5) |
| 2 | 25 (24.8) |
| 3 | 18 (17.8) |
| 4 | 6 (5.9) |
| Operation time (min) | 246.6±96.2 |
| EBL (ml) | 304.3±344.4 |
| Postoperative hospital stay (day) | 14.6±12.8 |
| Values are presented as mean ± standard deviation or number (%). |
| BMI = body mass index; CCI = Charlson comorbidity index; LN = lymph node; T = tumor; N = node; M = metastasis; EBL = estimated blood loss. |
| *Tumor location was unknown in 1 patient; †No residual tumors were detected in 5 patients; ‡No lymph nodes were retrieved in 6 patients. |

Table 2. Postoperative complications

| Variables | Value (n=107) |
|-----------|--------------|
| Complication | |
| No | 70 (65.4) |
| Yes | 37 (34.6) |
| Intra-abdominal abscess | 19 (17.8) |
| Anastomotic leakage | 9 (8.4) |
| Anastomotic stricture | 3 (2.8) |
| Postoperative bleeding | 1 (0.9) |
| Pancreatic fistula | 1 (0.9) |
| Colon fistula | 1 (0.9) |
| Pneumonia | 5 (4.7) |
| Stroke | 1 (0.9) |
| Wound problem | 3 (2.8) |
| Clavien-Dindo classification | |
| II | 10 (9.3) |
| IIIA | 22 (20.6) |
| IIIB | 4 (3.7) |
| IVA | 1 (0.9) |
| Values are presented as number (%). |

Postoperative complications

The details of postoperative complications are listed in Table 2. The complications rate was 34.6% (37/107), of which intra-abdominal abscess was the most common complication (19/107, 17.8%).
The major complications (Clavien–Dindo grade III or higher) occurred in 25.2% (27/107). There was no mortality case.

**Comparison of the clinicopathological characteristics according to the presence of overall complication**

The clinicopathological features were compared based on the patients’ complication (Table 3). The presence of combined resected organs, longer operative time, and higher volume of blood loss were significantly related to the occurrence of complications. However, previous operation-related factors (previous approach, anastomosis type, extent of lymph node dissection, and stage), current approach for CTG, tumor location, tumor size, extent of lymph node dissection, and T and N classifications were not markedly different between the two groups.

**Table 3. Comparison of the clinicopathological characteristics according to the presence of overall complication**

| Variables                      | Without complication (n=70) | With complications (n=37) | P-value |
|--------------------------------|----------------------------|---------------------------|---------|
| Sex                            |                            |                           | 0.828   |
| Male                           | 56 (80.0)                  | 31 (83.8)                 |         |
| Female                         | 14 (20.0)                  | 6 (16.2)                  |         |
| Age                            | 64.1±11.0                  | 64.2±10.2                 | 0.952   |
| BMI                            | 21.5±3.2                   | 21.8±2.9                  | 0.653   |
| Comorbidity                    |                            |                           | 0.112   |
| Low CCI                        | 55 (78.6)                  | 23 (62.2)                 |         |
| High CCI                       | 15 (21.4)                  | 14 (37.8)                 |         |
| Previous approach              |                            |                           | 0.654   |
| Laparoscopy                    | 14 (20.0)                  | 10 (27.0)                 |         |
| Open                           | 55 (78.6)                  | 27 (73.0)                 |         |
| Robot assisted                 | 1 (1.4)                    | 0 (0.0)                   |         |
| Previous anastomosis           |                            |                           | 0.939   |
| Billroth I                     | 17 (24.3)                  | 10 (27.0)                 |         |
| Billroth II                    | 53 (75.7)                  | 27 (73.0)                 |         |
| Previous LN dissection*        |                            |                           | 0.897   |
| D1+                            | 11 (21.6)                  | 6 (26.1)                  |         |
| ≥D2                            | 40 (78.4)                  | 17 (73.9)                 |         |
| Previous T classification†     |                            |                           | 0.971   |
| T1                             | 27 (45.8)                  | 13 (50.0)                 |         |
| T2                             | 8 (13.6)                   | 4 (15.4)                  |         |
| T3                             | 12 (20.3)                  | 5 (19.2)                  |         |
| T4a                            | 12 (20.3)                  | 4 (15.4)                  |         |
| Previous N classification†     |                            |                           | 0.074   |
| N0                             | 45 (76.3)                  | 19 (73.1)                 |         |
| N1                             | 3 (5.1)                    | 5 (19.2)                  |         |
| N2                             | 4 (6.8)                    | 2 (7.7)                   |         |
| N3                             | 7 (11.9)                   | 0 (0.0)                   |         |
| Time interval (mon)            | 93.2±91.5                  | 116.9±100.2               | 0.229   |
| Tumor location†                |                            |                           | 0.204   |
| Anastomosis                    | 23 (32.9)                  | 8 (22.2)                  |         |
| Remnant stomach                | 47 (67.1)                  | 28 (77.8)                 |         |
| Histology                      |                            |                           | 0.956   |
| Differentiated                 | 34 (48.6)                  | 17 (45.9)                 |         |
| Undifferentiated               | 36 (51.4)                  | 20 (54.1)                 |         |
| Current approach               |                            |                           | 0.748   |
| Laparoscopy                    | 7 (10.0)                   | 5 (13.5)                  |         |
| Open                           | 63 (90.0)                  | 32 (86.5)                 |         |
| Current LN dissection          |                            |                           | 0.299   |
| D1+                            | 23 (33.3)                  | 8 (21.6)                  |         |
| D2                             | 46 (66.7)                  | 29 (78.4)                 |         |
| Retrieved LN                   | 11.2±11.0                  | 11.8±11.4                 | 0.777   |
| Combined resection             |                            |                           | 0.002   |
| No                             | 54 (77.1)                  | 17 (45.9)                 |         |
| Yes                            | 16 (22.9)                  | 20 (54.1)                 |         |

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In the multivariable Cox regression analysis, presence of combined resected organs (OR, 2.832; 95% CI, 1.094–7.333; P=0.032) and longer operation time (OR, 1.005; 95% CI, 1.001–1.011; P=0.036) were the significant factors for overall complications (Table 4).

### DISCUSSION

In this study, we evaluated the incidence of postoperative morbidity and its risk factors following CTG for RGC. The overall complication rate was 34.6%. Multi-visceral resection and longer operation time were the significant factors for postoperative complications.

It has been reported that the overall complication rate of CTG for RGC was 10%–44.8% [13-15], while the mortality rate was 0%–13.7% [16-18]. In the present study, the mortality rate was 0%, but the complication rate was relatively high at 34.6%. The higher complication...
The rate reported in this study is due to the fact that only patients who underwent partial gastric surgery for gastric cancer were included, excluding those with peptic ulcer disease [19,20]. Our results indicate that the surgical approach used after initial gastric cancer surgery is more difficult than that used after initial peptic ulcer surgery.

As the indication of partial gastrectomy changed from peptic ulcer disease to gastric cancer due to the improvement in treatment response among peptic ulcer disease patients and the well-organized screening program for gastric cancer, re-evaluation of the complications and their risk factors of CTG is warranted to improve the surgical outcomes [21]. To the best of our knowledge, our study was the first report dealing RGC patients who underwent initial cancer surgery, excluding those with peptic ulcer disease.

Initial gastric cancer surgery is quite different from peptic ulcer surgery. Simple partial gastrectomy and gastrojejunostomy without lymph node dissection are performed in most patients with peptic ulcer disease. However, perigastric and extragastric lymph node dissection are indispensable in the initial cancer surgery. Moreover, several options for the reconstruction of the remnant stomach to the duodenum and jejunum are more sophisticated. Therefore, adhesion to the surrounding organs, such as the liver, pancreas, and transverse colon, was profound after the initial gastric cancer surgery. Adhesiolysis and removal of the remaining stomach and lymph nodes are technically demanding [15,20]. These differences were supposed to be the main reason for the high rate of postoperative complications in this study after initial gastric cancer surgery compared with peptic ulcer gastrectomy [19].

In this study, the risk factors for the occurrence of complications were determined as combined organ resection and longer operation time rather than RGC stage or surgical approach, which were comparable to the reports of previous studies [8,9,22]. Since most of the patients were diagnosed with RGC at an early stage through postoperative surveillance or screening endoscopy, the risk factors of CTG were related to reoperation itself rather than the current tumor stage and surgical approach, which was similar to the results of another study [8].

Previous studies reported that the rates of anastomotic leakage (3.8%–10.9%) and pulmonary complication (4%–8.6%) were relatively high in patients who underwent CTG [14,23,24]. On the contrary, intra-abdominal abscess was the most common (17.8%, 19/107), followed by anastomotic leakage (8.4%, 9/107) among complications in the present study. Compared with other studies, it was difficult to determine why intra-abdominal abscess is more common than anastomotic leakage.

Initial laparoscopic surgery might be related to a lower rate of open conversion for CTG owing to less adhesions [25,26]. However, Son et al. [20] reported that previous laparoscopic surgery did not reduce adhesions to the operative bed or anastomotic site. This study showed that the previous surgical approach did not affect the incidence of CTG complications.

Owing to the advances in laparoscopic instruments and the accumulated experience of surgeons, the rate of MIS for RGC is increasing. Several studies reported that MIS for RGC showed similar volume of blood loss, complication rate, number of retrieved lymph nodes, and pathologic findings and favorable overall survival compared with open surgery [14,20,26]. However, the open conversion rate from laparoscopy was also relatively high (25%–47%) due to the formation of adhesions from previous surgery. As MIS remains technically challenging, the selection of a surgical approach for CTG should be carefully considered.
This study has some limitations, including its small, retrospective, single-center design. Only a few patients underwent initial and laparoscopic CTG for RGC after partial gastric cancer surgery. In the era of MIS, the role of this type of surgery should be evaluated to determine whether it can improve the surgical outcomes compared with conventional open surgery.

In conclusion, the complication rate of CTG for RGC after partial gastric cancer surgery is relatively high. The primary risk factors were multi-visceral resection and longer operative time rather than tumor stage and surgical approach. Hence, surgical strategies considering these factors are warranted to improve the outcomes of CTG for RGC.

REFERENCES

1. Han WH, Eom BW, Yoon HM, Kim YW, Kook MC, Ryu KW. The different clinicopathological features of remnant gastric cancer depending on initial disease of partial gastrectomy. Cancers (Basel) 2020;12:2847.

2. Toftgaard C. Gastric cancer after peptic ulcer surgery. A historic prospective cohort investigation. Ann Surg 1989;210:159-164.

3. Hosokawa O, Kaizaki Y, Watanabe K, Hattori M, Douden K, Hayashi H, et al. Endoscopic surveillance for gastric remnant cancer after early cancer surgery. Endoscopy 2002;34:469-473.

4. Jun JK, Choi KS, Lee HY, Suh M, Park B, Song SH, et al. Effectiveness of the Korean National Cancer Screening Program in reducing gastric cancer mortality. Gastroenterology 2017;152:1319-1328.e7.

5. Information Committee of the Korean Gastric Cancer Association. Korean Gastric Cancer Association-led nationwide survey on surgically treated gastric cancers in 2019. J Gastric Cancer 2021;21:221-235.

6. Sowa M, Onoda N, Nakanishi I, Maeda K, Yoshikawa K, Kato Y, et al. Early stage carcinoma of the gastric remnant in Japan. Anticancer Res 1993;13:1835-1838.

7. Guideline Committee of the Korean Gastric Cancer Association (KGCA), Development Working Group & Review Panel. Korean practice guideline for gastric cancer 2018: an evidence-based, multi-disciplinary approach. J Gastric Cancer 2019;19:1-48.

8. Kwon IG, Cho I, Choi YY, Hyung WJ, Kim CB, Noh SH. Risk factors for complications during surgical treatment of remnant gastric cancer. Gastric Cancer 2015;18:390-396.

9. Ahn HS, Kim JW, Yoo MW, Park DJ, Lee HJ, Lee KU, et al. Clinicopathological features and surgical outcomes of patients with remnant gastric cancer after a distal gastrectomy. Ann Surg Oncol 2008;15:1632-1639.

10. Brierley JD, Gospodarowicz MK, Wittekind C. TNM Classification of Malignant Tumours. Hoboken (NJ): John Wiley & Sons; 2017.

11. Clavien PA, Barkun J, de Oliveira ML, Vauthey JN, Dindo D, Schulick RD, et al. The Clavien-Dindo classification of surgical complications: five-year experience. Ann Surg 2009;250:187-196.

12. Bassi C, Marchegiani G, Dervenis C, Sarr M, Abu Hilal M, Adham M, et al. The 2016 update of the International Study Group (ISGPF) definition and grading of postoperative pancreatic fistula: 11 years after. Surgery 2017;161:584-591.

13. Ohira M, Toyokawa T, Sakurai K, Kubo N, Tanaka H, Muguruma K, et al. Current status in remnant gastric cancer after distal gastrectomy. World J Gastroenterol 2016;22:2424-2433.

14. Kwon IG, Cho I, Guner A, Choi YY, Shin HB, Kim HI, et al. Minimally invasive surgery for remnant gastric cancer: a comparison with open surgery. Surg Endosc 2014;28:2452-2458.
15. Nagai E, Nakata K, Ohuchida K, Miyasaka Y, Shimizu S, Tanaka M. Laparoscopic total gastrectomy for remnant gastric cancer: feasibility study. Surg Endosc 2014;28:289-296.

16. Shimada H, Fukagawa T, Haga Y, Oba K. Does remnant gastric cancer really differ from primary gastric cancer? A systematic review of the literature by the Task Force of Japanese Gastric Cancer Association. Gastric Cancer 2016;19:339-349.

17. Thorban S, Böttcher K, Etter M, Roder JD, Busch R, Siewert JR. Prognostic factors in gastric stump carcinoma. Ann Surg 2000;231:188-194.

18. Galata C, Ronellenfitsch U, Weiß C, Blank S, Reißfelder C, Hardt J. Surgery for gastric remnant cancer results in similar overall survival rates compared with primary gastric cancer: a propensity score-matched analysis. Ann Surg Oncol 2020;27:4196-4203.

19. Ramos MF, Pereira MA, Dias AR, Dantas AC, Szor DJ, Ribeiro U Jr, et al. Remnant gastric cancer: an ordinary primary adenocarcinoma or a tumor with its own pattern? World J Gastrointest Surg 2021;13:366-378.

20. Son SY, Lee CM, Jung DH, Lee JH, Ahn SH, Park DJ, et al. Laparoscopic completion total gastrectomy for remnant gastric cancer: a single-institution experience. Gastric Cancer 2015;18:177-182.

21. Dhir M. Gastric remnant cancer: is it different from primary gastric cancer? Insights into a unique clinical entity. Ann Surg Oncol 2020;27:4079-4081.

22. Di Leo A, Pedrazzani C, Bencivenga M, Coniglio A, Rosa F, Morgani P, et al. Gastric stump cancer after distal gastrectomy for benign disease: clinicopathological features and surgical outcomes. Ann Surg Oncol 2014;21:2594-2600.

23. Alhossaini RM, Altamran AA, Cho M, Roh CK, Seo WJ, Choi S, et al. Lower rate of conversion using robotic-assisted surgery compared to laparoscopy in completion total gastrectomy for remnant gastric cancer. Surg Endosc 2020;34:847-852.

24. Ohashi M, Morita S, Fukagawa T, Kushima R, Katai H. Surgical treatment of non-early gastric remnant carcinoma developing after distal gastrectomy for gastric cancer. J Surg Oncol 2015;111:208-212.

25. Booka E, Kaihara M, Mihara K, Nishiya S, Handa K, Ito Y, et al. Laparoscopic total gastrectomy for remnant gastric cancer: a single-institution experience. Asian J Endosc Surg 2019;12:58-63.

26. Liao G, Wen S, Xie X, Wu Q. Laparoscopic gastrectomy for remnant gastric cancer: risk factors associated with conversion and a systematic analysis of literature. Int J Surg 2016;34:17-22.