Effective Retrograde Dissection by the Floating Tongue-Like Flap Method for Gastric Neoplasm Involving the Pyloric Channel

Seong Min Kim\textsuperscript{1}, Jong-Jae Park\textsuperscript{1}, Moon Kyung Joo\textsuperscript{1}, Beom Jae Lee\textsuperscript{1}, Hoon Jai Chun\textsuperscript{2}, and Sang Woo Lee\textsuperscript{3}

\textsuperscript{1}Division of Gastroenterology, Department of Internal Medicine, Korea University Guro Hospital, \textsuperscript{2}Division of Gastroenterology, Department of Internal Medicine, Korea University Anam Hospital, Korea University College of Medicine, Seoul, and \textsuperscript{3}Division of Gastroenterology, Department of Internal Medicine, Korea University Ansan Hospital, Korea University College of Medicine, Ansan, Korea

\textbf{Article Info}
Received August 26, 2021
Revised November 28, 2021
Accepted December 7, 2021
Published online November 1, 2022

\textbf{Corresponding Author}
Jong-Jae Park
ORCID https://orcid.org/0000-0002-4642-5405
E-mail gi7pjj@korea.ac.kr

\textbf{Background/Aims:} Endoscopic submucosal dissection (ESD) of gastric neoplasm involving the pyloric channel (GNPC) is technically challenging due to difficulty in precise assessment of resection margin and inadequate visualization. The aim of this study was to evaluate the effectiveness and long-term outcome of ESD for GNPC and introduce a noble technique for resection of GNPC.

\textbf{Methods:} A total of 97 patients with GNPC underwent ESD from January 2007 to October 2017. We divided them into a conventional anterograde resection group and a retrograde resection group according to the method of procedure. We compared their clinical outcomes and investigated risk factors for postprocedural complications.

\textbf{Results:} The \textit{en bloc} resection rate was 87.6%, and complete resection rate was 83.5%. Postprocedure stenosis occurred in 16 cases (16.5%). GNPCs of the retrograde resection group were more frequently located from antrum to bulb, were significantly larger, were related to ≥75% resection of the circumference, and involved significantly longer procedure times than those in the anterograde resection group. Multivariate analysis showed that resection ≥75% of the circumference was the only significant risk factor for postprocedure stenosis.

\textbf{Conclusions:} ESD by retrograde resection method is a novel technique to make the procedure easier, depending on the size, location, and circumference of resection. (\textit{Gut Liver} 2022;16:892-898)

\textbf{Key Words:} Gastric neoplasms; Pylorus; Endoscopic submucosal dissection

\section*{INTRODUCTION}

Endoscopic submucosal dissection (ESD) has been widely accepted as a curative procedure for gastric neoplasm such as early gastric cancer (EGC), gastric adenoma, and gastric subepithelial tumor. With the development and widespread of the screening system in South Korea, the diagnosis of gastric adenoma and EGC has increased. The importance of ESD technique is also increasing. As ESD technique developed, there was no difference in the 5-year overall survival rate in treating gastric neoplasm between ESD and surgery. Thus, ESD is currently considered a standard treatment of EGC if cases are corresponding to absolute and expanded indications.\textsuperscript{1-4}

However, it is technically difficult to perform successful ESD if one of the following reasons is present: (1) the lesion is located at the esophago-gastric junction, cardia, high-body, or pyloro-duodenum; (2) large tumor size; (3) ulceration or fibrotic scar coexists; and (4) demarcation line is not clear.\textsuperscript{5-10} Among them, ESD of gastric neoplasm involving the pyloric channel (GNPC) is technically challenging due to narrow lumen of channel and difficulty in precise assessment of the distal margin.\textsuperscript{7,11-13} However, few studies have shown the efficacy and safety of endoscopic resection of GNPC.

The method of ESD through retro-flexion of the endoscope for GNPC was first reported in 2002. Several authors later have reported clinical outcomes of ESD through ret-
ro-flexion in case series studies. \(^6,7,12-15\) The retrograde resection method has been studied and used a lot in endoscopic resection of rectal lesions. However, in terms of GNPC, the number of cases is relatively small and specific procedure methods are not demonstrated.\(^16,17\)

In this study, we proposed a novel technique to treat GNPC more effectively and safely. We evaluated the feasibility and effectiveness of the ESD through retro-flexion of the endoscope for GNPC and compared with the conventional anterograde resection method. We also investigated predictive factors for postprocedural stenosis during follow-up.

### MATERIALS AND METHODS

#### 1. Patients

We retrospectively reviewed medical records of a total of 97 patients with GNPC who underwent ESD from January 2007 to October 2017 in a tertiary hospital. We obtained informed consent from all patients before the procedure who agreed to undergo endoscopic resection for the treatment of GNPC and the possibility of occurrence of postprocedural complications including pyloric stenosis. This study was approved by the Ethics Committee of Korea University Guro Hospital (IRB number: K2019-2354-001).

2. **ESD procedure by retrograde method**

All patients underwent ESD procedure under sedation with an intravenous administration of propofol (1.0 mg/kg) or midazolam (0.035 mg/kg) with close cardio-pulmonary function monitoring. We used conventional flexible endoscopy (GIF-Q260J; Olympus, Shinjuku, Tokyo, Japan) for performing ESD. All procedures were performed by an expert (J.J.P) who had experience of performing more than 2,000 cases of gastric ESD.

Initially, we checked the margin of the lesion and marked it using needle coagulation. Injection of diluted epinephrine saline solution (dilution rate 1:10,000) that was mixed with indigo carmine dye was followed. Precutting and limited incision on both sides of the distal margin around the pyloric ring were done using a needle knife (KD-IL-1; Olympus), serving as a starting point for incision with retro-flexed endoscope and retrograde dissection from the bulb to antrum. The small incision pocket enhanced mucosal contraction and bulging of the dissecting flap during dissection within the bulb. Retrograde dissection using an insulated-tipped electrosurgical knife (KD-610L; Olympus) crossing the pyloric channel was done as far as possible in order to lift up the dissected bulbar portion of the lesion over the pyloric ring to make a “floating tongue-like” flap toward antrum. Then, dissecting with anterograde approach from antrum to pyloric channel was done for complete resection. The more distance is dissected by retrograde approach beyond pyloric channel, the

![Fig. 1. Techniques of retrograde transpyloric antral dissection.](https://doi.org/10.5009/gnl210399)
more meeting point moves upwards towards the antrum, making it easier to finalize resection of the lesion with anterograde approach (Fig. 1). After removing the lesion, electro-coagulation or endo-clipping of visible vessel was done to prevent major bleeding.

We did not perform routine preventive method for possible stenosis after ESD for GNPCs. However, if significant stenosis was found during follow-up esophagogastroduodenoscopy, rescue procedure such as endoscopic balloon dilatation was performed whenever necessary.

3. Definition

We defined GNPC as tumors with the distal margin located within a half centimeter from the pyloric ring when the ring was fully open. We defined en bloc resection when the tumor was completely resected as single piece and complete resection as the lesion was resected en bloc with negative vertical and lateral margin without lympho-vascular invasion on microscopic examination. Recurrence was defined as the new lesion confirmed by endoscopic biopsy after the procedure showed local recurrences, synchronous lesions, metachronous lesions, and distant metastatic lesions.18,19 We defined pyloric stenosis when the endoscope could not pass through the lumen of pyloric channel and patients complained symptoms associated with pyloric stenosis such as nausea and vomiting.

4. Post-ESD follow-up and recurrence assessment

After ESD, an esophagogastroduodenoscopy was performed at intervals of 3 to 6 months for the first year and annually thereafter. Biopsy was performed on ESD scars to confirm local recurrence during endoscopic examination. Random biopsy on antrum or corpus or rapid urease test were performed during follow-up esophagogastroduodenoscopy for evaluation of Helicobacter pylori status. We regarded as current infection of was defined H. pylori if either biopsy with special stain or rapid urease test were positive.

5. Study designs

We subdivided cases based on the location of GNPC, the resection method, and the circumference of resection. First, we subdivided the resection method as anterograde and retrograde resection. In anterograde resection, we performed precut incision from distal margin with forward viewing and dissected the submucosa as standard manner. In contrast, in retrograde resection, we performed precut incision and submucosal dissection of distal part with retroflexion of the scope in the bulb and subsequently finished the proximal part with forward viewing. Second, we subdivided the location of GNPC as confined to channel, antrum to channel, channel to bulb, and antrum to bulb through the channel. Third, we subdivided the circumference of resection as <25%, 25% to 75%, and ≥75%. We compared clinical outcomes of anterograde resection to retrograde resection and retrospectively analyzed risk factors with odds ratio for postprocedural stenosis.

6. Statistical analysis

All statistical analyses were performed using SPSS software version 20.0 (IBM Corp., Armonk, NY, USA) with significance level set at p<0.05. The Student t-test was used for continuous data and chi-square test for categorical data to compare clinical outcomes of procedures. A multivariate logistic regression analysis was performed to analyze risk factors and odds ratio for postprocedural stenosis.

RESULTS

1. Baseline Characteristics and procedure outcomes

The mean age of subjects was 63.1±9.6 years (60.8% male). A total of 77 cases (79.4%) were confined to channel with or without involvement of the antrum or bulb. Among them, 23 cases (23.7%) were confined to the channel, 49 cases (50.5%) were confined from the antrum to channel, and 5 cases (5.2%) were confined from the channel to bulb. The other 20 cases (20.6%) were located from the antrum to bulb through the channel. Forty cases (41.2%) showed H. pylori infection. On histopathologic evaluation, 42 cases (43.3%) were low grade dysplasia, 16 cases (16.5%) were high grade dysplasia, and 34 cases (35.1%) were EGC. Mean tumor size was 14.6±9.2 mm (Table 1).

| Variable | Data (n=97) |
|----------|------------|
| Age, mean±SD, yr | 63.1±9.6 |
| Sex, No. (%) | |
| Male | 59 (60.8) |
| Female | 38 (39.2) |
| Location, No. (%) | |
| Confined to channel, antrum or bulb | 77 (79.4) |
| Confined to channel | 23 (23.7) |
| Antrum–channel | 49 (50.5) |
| Channel–bulb | 5 (5.2) |
| Antrum–bulb | 20 (20.6) |
| Helicobacter pylori infection, No. (%) | 40 (41.2) |
| Histopathology, No. (%) | |
| Low grade dysplasia | 42 (43.3) |
| High grade dysplasia | 16 (16.5) |
| Early gastric cancer | 34 (35.1) |
| Miscellaneous | 5 (5.2) |
| Tumor size, mean±SD, mm | 14.6±9.2 |
All cases were resected with the ESD technique. Circumference of resection was <25% in 16 cases (16.5%), 25% to 75% in 39 cases (40.2%), and ≥75% in 42 cases (43.3%). Mean procedure time was 38.2±19.6 minutes. Only four cases (4.2%) showed major complications (perforation and major bleeding in two cases, respectively). *En bloc* resection rate and complete resection rate were 87.6% (85/97) and 83.5% (81/97), respectively. Postprocedure stenosis occurred in 16 cases (16.5%). During 37 months (median, 1 to 118 months) of follow-up period, there was one (1.0%) case of recurrence that was done by anterograde resection. Three cases (3.1%) required additional surgery (Table 2).

2. Comparison of anterograde resection and retrograde resection

Anterograde resection was performed in 47 patients (48.5%), and retrograde resection was performed in 50 patients (51.5%). In the retrograde resection group, lesions were more frequently located from the antrum to bulb through the channel (3 [6.4%] vs 17 [34.0%], p=0.001) and tumor size was significantly larger (11.7±7.2 mm vs 17.4±10.0 mm, p=0.002). Circumference of resection ≥75% was significantly frequent in the retrograde resection group (14 [29.8%] vs 28 [56.0%], p<0.001). Procedure time was significantly longer in the retrograde group (30.8±17.0 minutes vs 45.1±19.4 minutes, p<0.001). Other variables including *H. pylori* infection rate, histopathology, complication rate, *en bloc* and complete resection rate, recurrence rate, and percentage of additional surgery were not significantly different between the two groups. Postprocedure stenosis occurred in 16 cases (16.5%). During 37 months (median, 1 to 118 months) of follow-up period, there was one (1.0%) case of recurrence that was done by anterograde resection. Three cases (3.1%) required additional surgery (Table 2).

### Table 2. Technical Outcomes of Endoscopic Submucosal Dissection in Gastric Neoplasm Involving the Pyloric Channel

| Variable                              | No. (%)          |
|---------------------------------------|------------------|
| Procedure type                        | Endoscopic submucosal dissection 97 (100) |
| Circumference of resection            |                  |
| <25%                                  | 16 (16.5)        |
| 25% to <75%                          | 39 (40.2)        |
| ≥75%                                  | 42 (43.3)        |
| Procedure time, mean±SD, min          | 38.2±19.6        |
| Immediate complication                |                  |
| Perforation                           | 2 (2.1)          |
| Major bleeding                        | 2 (2.1)          |
| Loss of hemoglobin, mean±SD, g/dL     | 0.5±0.7          |
| *En bloc* resection                   | 85 (87.6)        |
| Complete resection                    | 81 (83.5)        |
| Postprocedural stenosis               | 16 (16.5)        |
| Recurrence rate                       | 1 (1.0)          |
| Additional surgery                    | 3 (3.1)          |

### Table 3. Comparison of Clinicopathological Characteristics of Patients in Anterograde Resection and Retrograde Resection Groups

| Variable                                      | Anterograde resection (n=47) | Retrograde resection (n=50) | p-value  |
|-----------------------------------------------|------------------------------|-----------------------------|----------|
| Age, yr                                       | 62.7±9.1                     | 63.5±10.2                   | 0.694    |
| Male sex                                      | 27 (57.4)                    | 32 (64.0)                   | 0.509    |
| Location                                      |                              |                            | 0.001    |
| Confinement to channel, antrum or bulb        | 44 (93.6)                    | 33 (66.0)                   |          |
| Antrum–bulb                                   | 3 (6.4)                      | 17 (34.0)                   |          |
| *Helicobacter pylori* infection               | 20 (42.6)                    | 20 (40.0)                   | 0.798    |
| Histopathology                                |                              |                            | 0.471    |
| Low grade dysplasia                           | 20 (42.6)                    | 22 (44.0)                   |          |
| High grade dysplasia                          | 7 (14.9)                     | 9 (18.0)                    |          |
| Early gastric cancer                          | 19 (40.4)                    | 15 (30.0)                   |          |
| Miscellaneous                                 | 1 (2.1)                      | 4 (8.0)                     |          |
| Tumor size, mm                                | 11.7±7.2                     | 17.4±10.0                   | 0.002    |
| Circumference of resection                    |                              |                            | <0.001   |
| <25%                                          | 15 (31.9)                    | 1 (2.0)                     |          |
| 25% to <75%                                   | 18 (38.3)                    | 21 (42.0)                   |          |
| ≥75%                                          | 14 (29.8)                    | 28 (56.0)                   |          |
| Procedure time, min                           | 30.8±17.0                    | 45.1±19.4                   | <0.001   |
| Immediate complication                        |                              |                            |          |
| Perforation                                   | 1 (2.1)                      | 1 (2.0)                     | 0.965    |
| Major bleeding                                | 1 (2.1)                      | 1 (2.0)                     | 0.976    |
| Loss of hemoglobin, g/dL                      | 0.6±0.7                      | 0.5±0.7                     | 0.905    |
| *En bloc* resection                           | 41 (87.2)                    | 44 (88.0)                   | 0.909    |
| Complete resection                            | 39 (78.2)                    | 42 (84.0)                   | 0.892    |
| Postprocedural stenosis                       | 5 (10.6)                     | 11 (22.0)                   | 0.132    |
| Recurrence rate                               | 1 (2.1)                      | 0                            | 0.300    |
| Additional surgery                            | 1 (2.1)                      | 2 (4.0)                     | 0.228    |

Data are presented as mean±SD or number (%).
steno-sis occurred in five (10.6%) cases of the anterograde group and 11 (22.0%) cases of the retrograde group, showing no significant difference between the two groups (p=0.132). Among three patients who needed additional surgery, one case (2.1%) was in the antegrade resection group with recurrence of tumor and two cases (4.0%) were in the retrograde resection group (one was due to postproce-dure stenosis and the other was due to involvement of deep resection margin by carcinoma) (Table 3).

3. Multivariate analysis of risk factors for postprocedural stenosis

Multivariate analysis showed that circumference resec-tion ≥75% was the only significant risk factor for postproce-dure stenosis (odds ratio, 20.155; 95% confidence interval, 2.105 to 193.000; p=0.009). Location, histopathology, tumor size, procedure time, and piecemeal resection or incomplete resection were not significant risk factors (Table 4).

DISCUSSION

In this study, we tried to devise a more effective endo-scopic method for performing endoscopic resection for EGC and gastric adenoma including pyloric channels and to find out which situations might be closely associated with postprocedural complications such as stenosis.

Conventional anterograde resection is an effective treat-ment for resection of lesions such as low to mid-body and proximal antrum. However, for GNPC, it is technically dif-ficult to properly access the distal margin. As a result, the curative resection rate may decrease and postprocedural complications such as pyloric stenosis may occur. Thus, we assessed GNPC with retrograde resection, a method of accessing the distal margin through the retro-flexion of endo-scope in the duodenal bulb, and compared clinical out-comes with those of conventional anterograde resection.

As mentioned in results, the retrograde resection group had larger lesion size with lesions located through the antrum to bulb and resected circumference over 75%. However, there were no significant differences in en bloc resection rate, complete resection rate, recurrence rate, or frequency of postprocedural complication rate. These results suggest that in GNPC, retrograde resection can be an effective method if the lesion has a larger size or if it is located through the antrum to bulb. This might be caused by the easy access to the distal margin through the retro-flexion of the endoscope. Meanwhile, procedure time was significantly longer in the retrograde resection group, which might be caused by the larger lesion size and difficult assess to the lesion when it is located through antrum and bulb.

Postprocedural stenosis, one of the most concerned postprocedural complications of GNPC, was likely to occur in the case of channel circumference of resec-tion ≥75%. Previous Korean and Japanese studies demonstrated that circumference of resection over 75% were significant risk factors for postprocedural stenosis in ESD of GNPCs in common, which was consistent with our result. More frequent follow-ups should be considered and endoscopic balloon dilatation might be required if stenosis occurs.

This study was meaningful in that it introduced an ef-fective method of resection of GNPC and identified risk factors for predicting postprocedural stenosis, a major complication. However, this study had several limitations. First, in addition to postprocedural stenosis, this study did not identify risk factors for bleeding or perforation. Bleeding and perforation are severe complications that could occur after ESD. However, we had only two cases of perforation and bleeding, respectively, suggesting that ESD in GNPC might be a safe therapeutic modality. Second, this study was based on a retrospective, single-center study. Therefore, several variables such as range of the lesion, tumor size, circumference of resection and procedure time are not fairly matched. Thus, it is premature to generalize our results. Further studies including larger cases per-formed by a multicenter are needed in the future.

In conclusion, ESD is a feasible method for treating GNPC and retrograde resection method may be effective for larger tumor located throughout the antrum and bulb with circumference of resection ≥75%. For a successful ESD of GNPCs, a systematic therapeutic strategy and appropriate response to complications based on abundant

| Variable                     | Odds ratio (95% CI) | p-value |
|-------------------------------|--------------------|---------|
| Location                      |                    |         |
| Confined to channel, antrum or bulb | Reference         |         |
| Antrum–bulb                   | 2.703 (0.472–15.479) | 0.264  |
| Histopathology                |                    |         |
| Low grade dysplasia           | Reference          |         |
| High grade dysplasia          | 8.029 (0.664–97.084) | 0.101  |
| Early gastric cancer          | 3.608 (0.377–34.526) | 0.265  |
| Tumor size                    | 1.142 (0.973–1.341)  | 0.103  |
| Circumference of resection    |                    |         |
| <75%                          | Reference          |         |
| ≥75%                          | 20.155 (2.105–193.000) | 0.009  |
| Procedure time                | 0.968 (0.920–1.018)  | 0.204  |
| Piecemeal resection           | 0.318 (0.011–9.420)  | 0.507  |
| Incomplete resection          | 2.433 (0.144–41.018) | 0.537  |

CI, confidence interval.
clinical experiences would be necessary.

### CONFLICTS OF INTEREST

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

### AUTHOR CONTRIBUTIONS

Study design and concept: S.M.K., J.J.P. Performance of endoscopic procedure: J.J.P. Data collection and statistical analysis: all authors. Writing of manuscript: S.M.K., J.J.P., M.K.J. Advice for study design and writing of manuscript: B.J.L., J.J.P., S.W.L., H.J.C. Reading of article and final approval: all authors.

### ORCID

Seong Min Kim https://orcid.org/0000-0003-4438-2955  
Jong-Jae Park https://orcid.org/0000-0002-4642-5405  
Moon Kyung Joo https://orcid.org/0000-0001-6050-3695  
Beom Jae Lee https://orcid.org/0000-0003-2449-4968  
Hoon Jai Chun https://orcid.org/0000-0002-5539-361X  
Sang Woo Lee https://orcid.org/0000-0003-3491-0371

### REFERENCES

1. Kwon YH. Long-term clinical efficacy and safety of endoscopic submucosal dissection for early gastric cancer in Korea. Gut Liver 2018;12:371-372.
2. Choi IJ, Lee JH, Kim YI, et al. Long-term outcome comparison of endoscopic resection and surgery in early gastric cancer meeting the absolute indication for endoscopic resection. Gastrointest Endosc 2015;81:333-341.
3. Chang JY, Shim KN, Tae CH, et al. Comparison of clinical outcomes after endoscopic submucosal dissection and surgery in the treatment of early gastric cancer: a single-institute study. Medicine (Baltimore) 2017;96:e7210.
4. Lee S, Choi KD, Han M, et al. Long-term outcomes of endoscopic submucosal dissection versus surgery in early gastric cancer meeting expanded indication including undifferentiated-type tumors: a criteria-based analysis. Gastric Cancer 2018;21:490-499.
5. Chung IK, Lee JH, Lee SH, et al. Therapeutic outcomes in 1000 cases of endoscopic submucosal dissection for early gastric neoplasms: Korean ESD Study Group multicenter study. Gastrointest Endosc 2009;69:1228-1235.
6. Jung SW, Jeong ID, Bang SJ, Shin JW, Park NH, Kim DH. Successful outcomes of endoscopic resection for gastric adenomas and early cancers located on the pyloric ring (with video). Gastrointest Endosc 2010;71:625-629.
7. Lim CH, Park JM, Park CH, et al. Endoscopic submucosal dissection of gastric neoplasia involving the pyloric channel by retroflexion in the duodenum. Dig Dis Sci 2012;57:148-154.
8. Park CH, Kim EH, Kim HY, Roh YH, Lee YC. Clinical outcomes of endoscopic submucosal dissection for early stage esophagogastric junction cancer: a systematic review and meta-analysis. Dig Liver Dis 2015;47:37-44.
9. Kim JH, Nam HS, Choi CW, et al. Risk factors associated with difficult gastric endoscopic submucosal dissection: predicting difficult ESD. Surg Endosc 2017;31:1617-1626.
10. Yano T, Hasuiku N, Ono H, et al. Factors associated with technical difficulty of endoscopic submucosal dissection for early gastric cancer that met the expanded indication criteria: post hoc analysis of a multi-institutional prospective confirmatory trial (JCOG0607). Gastric Cancer 2020;23:168-174.
11. Bae JH, Kim GH, Lee BE, et al. Factors associated with the outcomes of endoscopic submucosal dissection in pyloric neoplasms. Gastrointest Endosc 2015;81:303-311.
12. Gong EJ, Kim DH, Jung HY, et al. Clinical outcomes of endoscopic resection for gastric neoplasms in the pylorus. Surg Endosc 2015;29:3491-3498.
13. Park JC, Kim JH, Youn YH, et al. How to manage pyloric tumours that are difficult to resect completely with endoscopic resection: comparison of the retroflexion vs. forward view technique. Dig Liver Dis 2011;43:958-964.
14. Brandt LJ, Gotian A. Retroflexion in the duodenum for evaluation of duodenal bulb lesions. Gastrointest Endosc 2002;55:438-440.
15. Onozato Y, Ishihara H, Iizuka H, et al. A large flat adenoma located on the pylorus ring successfully treated by endoscopic submucosal dissection. Dig Dis Sci 2007;52:1738-1740.
16. Fujihara S, Kobara H, Mori H, et al. Comparison of retroflexed and forward views for colorectal endoscopic submucosal dissection. Int J Med Sci 2015;12:450-457.
17. Liu S, Li Y, Yang H, et al. Retroflexion-assisted endoscopic mucosal resection: a useful and safe method for removal of low rectal laterally spreading tumors. Surg Endosc 2016;30:139-146.
18. Ono H, Yao K, Fujishiro M, et al. Guidelines for endoscopic submucosal dissection and endoscopic mucosal resection for early gastric cancer. Dig Endosc 2016;28:3-15.
19. Pimentel-Nunes P, Dinis-Ribeiro M, Ponchon T, et al. Endoscopic submucosal dissection: European Society of Gastrointestinal Endoscopy (ESGE) Guideline. Endoscopy 2015;47:829-854.
20. Ahn JY, Choi KD, Choi JY, et al. Procedure time of endoscopic submucosal dissection according to the size and location of early gastric cancers: analysis of 916 dissections performed by 4 experts. Gastrointest Endosc 2011;73:911-916.

21. Takenaka R, Kawahara Y, Okada H, et al. Risk factors associated with local recurrence of early gastric cancers after endoscopic submucosal dissection. Gastrointest Endosc 2008;68:887-894.

22. Imagawa A, Okada H, Kawahara Y, et al. Endoscopic submucosal dissection for early gastric cancer: results and degrees of technical difficulty as well as success. Endoscopy 2006;38:987-990.

23. Iizuka H, Kakizaki S, Sohara N, et al. Stricture after endoscopic submucosal dissection for early gastric cancers and adenomas. Dig Endosc 2010;22:282-288.

24. Coda S, Oda I, Gotoda T, Yokoi C, Kikuchi T, Ono H. Risk factors for cardiac and pyloric stenosis after endoscopic submucosal dissection, and efficacy of endoscopic balloon dilation treatment. Endoscopy 2009;41:421-426.

25. Hahn KY, Park JC, Lee HJ, et al. Antral or pyloric deformity is a risk factor for the development of postendoscopic submucosal dissection pyloric strictures. Gut Liver 2016;10:757-763.

26. Lee JU, Park MS, Yun SH, et al. Risk factors and management for pyloric stenosis occurred after endoscopic submucosal dissection adjacent to pylorus. Medicine (Baltimore) 2016;95:e5633.