Is Abdominal Computed Tomography Mandatory in Long-term Follow-up of Early Gastric Cancer after Successful Endoscopic Resection?

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Background/Aims: The aim of this study was to verify the necessity of follow-up abdominal CT after curative resection of early gastric cancer (EGC).

Materials and Methods: Retrospective analysis was performed in three institutes of the Catholic University of Korea (Incheon St. Mary's Hospital, Yeouido St. Mary's Hospital, and Seoul St. Mary's Hospital). Inclusion criteria were as follows; patients who underwent curative endoscopic resection of EGC from 2003 to 2006; curative resection and recurrence was confirmed histopathologically; abdominal CT was performed at the time of endoscopic resection and 5 years after the treatment.

Results: Two hundred and forty three patients were reviewed and 36 patients were compatible with the inclusion criteria. Additional endoscopic submucosal dissection was performed in 8 patients due to metachronous recurrence during the follow up period; surgery was performed in 2 patients due to other intra-abdominal organ malignancy; no specific events occurred in 26 patients. All the recurrences were found on gastroscopy and not on abdominal CT.

Conclusions: Follow-up abdominal CT after curative endoscopic resection of EGC has limited value to find metachronous recurrence. However, it can detect other intra-abdominal malignancies. (Korean J Helicobacter Up Gastrointest Res 2013;13:224-228)

Key Words: Early gastric cancer; Endoscopic resection; Computed tomography

INTRODUCTION

Endoscopic resection such as endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) has been established as treatment options for early gastric cancer (EGC) in selected cases in Korea and in other countries. Currently, EMR and ESD for EGC are widely performed in many centers in Korea, but there are no guidelines regarding the follow up methods after successful treatment though there are some suggestions. When the lesion is confirmed as adenocarcinoma histopathologically, endoscopists usually perform abdominal CT to investigate lymph node metastasis before or after endoscopic resection. This is accepted as a mandatory step for staging of the cancer.

Follow up studies for patients after successful endoscopic management are very important because the stomach with chronic inflammation remains. Annual incidence rate of metachronous cancer was reported to be about 3.3%. Regular endoscopic examination and abdominal CT are selected as follow up methods by most centers in Korea. Follow up endoscopy may detect the recurrences at the resected site and synchronous or metachronous lesions. Abdominal CT is recommended as a follow up method after curative resection of gastric cancer when it is necessary. However, there is limited data on the usefulness of follow up CT after curative resection. This radiologic examination may increase the costs and the patients are exposed to radiation hazards. The aim of this study was to evaluate whether follow up CT can detect recurrence after curative endoscopic resection of EGC.

MATERIALS AND METHODS

1. Patients selection

This study protocol was approved by the Institutional
Review Board of The Catholic University of Korea (XC1IRIM0038). Retrospective review was performed in 3 centers of the Catholic University of Korea (Incheon St. Mary’s Hospital, Yeouido St. Mary’s Hospital, and Seoul St. Mary’s Hospital). Indications for endoscopic resection was adults (>18 years) with histopathologic diagnosis of gastric adenocarcinoma without evidence of lymph-node involvement documented by abdominal CT and/or endoscopic ultrasound. Inclusion criteria for this study were as follows: patients who underwent curative endoscopic resection (EMR or ESD) of EGC from 2003 to 2006; curative resection and recurrence was confirmed histopathologically; curative resection for the lesions without ulcer was defined as free lateral margins (≥2 mm), limited within mucosa or minimally invasive submucosal lesions (invasion depth ≤500 μm), differentiated type (well differentiated and moderately differentiated adenocarcinoma), and no lymphovascular invasion; curative resection for the lesions with ulcer was defined as less than 3 cm in long axis with free lateral margins (≥2 mm), limited within mucosa, differentiated type; abdominal CT was performed at the time of endoscopic resection and 5 years after the treatment.

2. Stratification of the patients

We analyzed the patients’ characteristics according to the size of the tumor, differentiation of the cancer, location of the lesion, and combined ulceration of the lesions.

3. Definition of recurrence

Endoscopic recurrence was defined as tumor recurrence at least 1 year after endoscopic resection regardless of the location on endoscopy when confirmed histopathologically. On abdominal CT, enlargement of para-gastric lymph nodes over 1 cm or definite metastasis to other intra-abdominal organs were defined as intra-abdominal recurrence.7

4. Statistic analyses

This study was observational study with one branch and statistical analysis was not performed.

RESULTS

1. Demographic features

Two hundred and fifty three patients underwent ESD during this period and 41 patients (16.2%) underwent follow up abdominal CT. Immediate additional ESD was performed in one patient due to remnant cancer of stomach and immediate additional laparotomy was performed in 4 patients due to undifferentiated cancer of stomach was found in final pathology. The remained 36 patients were included in this study (Fig. 1). Demographic
features of these patients are shown in Table 1. Mean age of the patients were 63.4 years (range 44∼87 at initial diagnosis) and male to female ratio was 23 to 13.

During the follow up period, 8 patients underwent additional ESD due to metachronous recurrence of the gastric neoplasia including adenoma and adenocarcinoma. Two patients underwent additional laparotomy due to colorectal cancer during the follow up period (Fig. 1).

### Table 1. Demographic Features of the Patients

| Variable                  | Value                  |
|---------------------------|------------------------|
| Mean age (yr)             | 63.4±9.3               |
| Male:Female               | 23:13                  |
| Median follow-up period (mo) | 67.7±7.0             |
| Size of the lesions (mm)  |                        |
| ≤10                       | 13                     |
| 11∼20                     | 21                     |
| 21∼30                     | 2                      |
| EMR:ESD                  | 14:22                  |
| Location of the lesions   |                        |
| Upper 1/3                 | 1                      |
| Middle 1/3                | 7                      |
| Lower 1/3                 | 28                     |
| Final histopathology      |                        |
| Well differentiated       | 22                     |
| Moderately differentiated | 14                     |
| Combined ulcer            |                        |
| Yes                       | 7                      |
| No                        | 29                     |
| Macroscopic types         |                        |
| Elevated                  | 22                     |
| Flat                      | 5                      |
| Depressed                 | 9                      |

Values are presented as mean±SD or n.

EMR, endoscopic mucosal resection; ESD, endoscopic submucosal dissection.

### Table 2. Summary of Metachronous Recurrences

| Case number | Age at initial ESD (yr) | Sex     | Location of initial lesion | Resection method | Location of metachronous lesion | Pathology of metachronous lesion | Interval between initial and metachronous lesion (mo) |
|-------------|-------------------------|---------|----------------------------|------------------|---------------------------------|----------------------------------|-------------------------------------------------------|
| 1           | 79                      | Female  | Antrum, GC                 | EMR              | Antrum, AW                      | Adenoma, HGD                     | 56                                                    |
| 2           | 59                      | Female  | Antrum, LC                 | EMR              | Body, LC                        | Adenoma, LGD                     | 39                                                    |
| 3           | 63                      | Male    | Antrum, AW                 | ESD              | Antrum, PW                      | Adenoma, LGD                     | 14                                                    |
| 4           | 61                      | Male    | Body, LC                   | ESD              | Antrum, LC                      | Adenoma, WD                      | 60                                                    |
| 5           | 59                      | Female  | Body, LC                   | EMR              | Body, LC                        | Adenoma, LGD                     | 26                                                    |
| 6           | 71                      | Male    | Antrum, AW                 | ESD              | Antrum, LC                      | Adenoma, WD                      | 56                                                    |
| 7           | 49                      | Male    | Body, LC                   | ESD              | Antrum, LC                      | Adenoma, LGD                     | 18                                                    |
| 8           | 66                      | Female  | Antrum, LC                 | ESD              | Angle                           | Adenoma, LGD                     | 18                                                    |

ESD, endoscopic submucosal dissection; GC, greater curvature side; EMR, endoscopic mucosal resection; AW, anterior wall side; HGD, high grade dysplasia; LGD, low grade dysplasia; LC, lesser curvature side; PW, posterior wall side; Adeno., adenocarcinoma; WD, well differentiated.

2. Recurrence detected by endoscopy and CT

Metachronous lesions were found in 8 patients during the follow up period (Table 2). All the lesions were detected with gastroscopy and none of the gastric lesions were detected by abdominal CT. Other intra-abdominal cancer was detected by abdominal CT after colonoscopic confirmation in 2 patients. Both of the patients underwent laparoscopic colectomy.

### DISCUSSION

In one study, abdominal CT images of lesions immediately after ESD appeared as deep benign ulcers and evolved over time into shallow depressed ulcers, which suggests that the role of immediate abdominal CT after ESD is very limited.8 Another study showed that even multi-detector CT still has limitations in detecting gastric cancers confined within the mucosa or submucosa.9 Ever since first performing ESD for EGC a decade ago, most physicians have wanted to investigate regional lymph node status regularly after ESD. However, there are no reports on the usefulness of follow-up abdominal CT after curative endoscopic resection of EGC.

In this retrospective study, we found that all the metachronous gastric lesions were found on gastroscopy after curative endoscopic resection and not on abdominal CT. Considering that gastric adenocarcinoma develops from the gastric epithelia, the lesions usually protrude into the gastric lumen. When curative resection is defined as a clear resection margin without lymphovascular inva-
sion, the lesion does not invade the peri-gastric lymph nodes and distant metastasis does not occur. We only included differentiated adenocarcinoma of the stomach in this study and 6 patients with undifferentiated adenocarcinoma of the stomach underwent addition laparotomy, which might have reduced the necessity of abdominal CT. Immediate additional ESD was performed in 1 patient after histopathologic confirmation of recurrence.

Abdominal CT has limited sensitivity for lymph node metastasis due to non-enlarged tumor harboring lymph nodes, and limited specificity due to inflammatory lymph nodes, especially after ESD.10 Conventional CT scans could not detect local recurrence of cancer during the follow-up period after endoscopic treatment in one study as in our results.11 However, the mean follow-up period in this study was only 24 months. In one blinded study, abdominal CT only detected 62~71% of gastric cancer including advanced types before treatment.5 In this study, abdominal CT did not detect any metachronous recurrence.

Peri-gastric lymph node enlargement was not found during the follow up period and distant metastasis was not found after curative endoscopic resection by abdominal CT. Tumors of other intra-abdominal organs were found in 2 patients after colonoscopic confirmation of colorectal cancer by abdominal CT.

Abdominal CT scan requires additional costs and patients are exposed to radiation hazards. Median reported effective doses for the abdomen and pelvis is known to be 7.9 mSv (1.4~31.2 mSv) and 7.6 mSv (2.5~36.5 mSv), respectively.12 When the patients receive abdominal CT twice a year, they will be exposed to a radiation dose of over 31 mSv/year, which is a much higher dose than is naturally allowed for humans.

Given the retrospective nature of this study several limitations have to be noted. The follow up period was not unified among the three centers and different CT techniques such as multi-detector CT versus other types of CT have been used which might have affected the results. Also, there was no control group to compare the effectiveness of performing abdominal CT. This retrospective study investigated differentiated type intra-mucosal adenocarcinoma of stomach only and very limited number of patients. Since this study enrolled the patients who underwent follow up abdominal CT 5 years after endoscopic resection, selection bias might be high. Other diagnostic modalities such as endoscopic ultrasound and positron emission tomography were not performed as a follow up study, which may affect the results.

In conclusion, abdominal CT scan after curative endoscopic resection of differentiated type intra-mucosal adenocarcinoma of stomach without lymphovascular invasion has limited value for evaluation of metachronous gastric neoplasias. However, it can detect other intra-abdominal malignancies. Additional prospective studies to find out the adequate follow up methods are anticipated in the future.

REFERENCES

1. Kang KJ, Kim KM, Min BH, Lee JH, Kim JJ. Endoscopic submucosal dissection of early gastric cancer. Gut Liver 2011;5:418-426.
2. Ono H, Kondo H, Gotoda T, et al. Endoscopic mucosal resection for treatment of early gastric cancer. Gut 2001;48:225-229.
3. Manner H, Rabenstein T, May A, et al. Long-term results of endoscopic resection in early gastric cancer: the Western experience. Am J Gastroenterol 2009;104:566-573.
4. Tanaka M, Ono H, Hasukie N, Takizawa K. Endoscopic submucosal dissection of early gastric cancer. Digestion 2008;77(Suppl 1):23-28.
5. Kim HJ, Lee DH, Ko YT. Comparison between blinded and partially blinded detection of gastric cancer with multidetector CT using surgery and endoscopic submucosal dissection as reference standards. Br J Radiol 2010;83:674-682.
6. Ajani JA, Barthel JS, Bekaii-Saab T, et al; NCCN Gastric Cancer Panel. Gastric cancer. J Natl Compr Canc Netw 2010;8:378-409.
7. Kim DW, Park SA, Kim CG. Detecting the recurrence of gastric cancer after curative resection: comparison of FDG PET/CT and contrast-enhanced abdominal CT. J Korean Med Sci 2011;26:875-880.
8. Drenth JP, Nagengast FM, Oven WJ. Evaluation of (pre-)malignant colonic abnormalities: endoscopic validation of FDG-PET findings. Eur J Nucl Med 2001;28:1766-1769.
9. Lee JU, Kim SH, Lee JM, et al. Multidetector row computed tomographic gastrography findings after endoscopic submucosal dissection for early gastric cancer: emphasis on time evolution and factors for predicting residual tumor. J Comput Assist Tomogr 2009;33:273-279.
10. Han JS, Jang JS, Choi SR, et al. A study of metachronous cancer after endoscopic resection of early gastric cancer. Scand J...
11. Sohn YJ, Jang JS, Choi SR, et al. Early detection of recurrence after endoscopic treatment for early gastric cancer. Scand J Gastroenterol 2009;44:1109-1114.

12. Pantos I, Thalassinou S, Argentos S, Kelekis NL, Panayiotakis G, Efstathopoulos EP. Adult patient radiation doses from non-cardiac CT examinations: a review of published results. Br J Radiol 2011;84:293-303.