An efficient diagnostic strategy for small, depressed early gastric cancer with magnifying narrow-band imaging: a post-hoc analysis of a prospective randomized controlled trial

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Background: We previously reported that magnifying narrow-band imaging (M-NBI) is a high-performance diagnostic tool for small, depressed gastric cancer. However, an efficient diagnostic strategy using endoscopic findings has not been fully elucidated.

Objective: To identify the endoscopic findings that contribute to accurate diagnosis of small, depressed gastric cancer and to propose the ideal diagnostic approach to such lesions.

Design: Post-hoc analysis of a prospective, randomized, controlled trial.

Setting: Nine hospitals.

Patients: Three hundred fifty-three patients with small, depressed gastric lesions.

Interventions: In the M-NBI group (n = 177), cancer diagnosis was made with diagnostic criteria including a demarcation line (DL) and an irregular microvascular pattern (IMVP). In the conventional white-light imaging (C-WLI) group (n = 176), diagnostic criteria were both an irregular margin and a spiny depressed area. In the C-WLI group, M-NBI was performed after C-WLI diagnosis.

Main Outcome Measurements: The diagnostic performance of each criterion in M-NBI alone, C-WLI, and M-NBI after C-WLI was investigated.

Results: M-NBI after C-WLI ultimately showed the best diagnostic performance in each diagnostic criterion. In M-NBI after C-WLI, evaluation of DL is technically easier than that of IMVP, and DL alone had a high sensitivity (95%) and negative predictive value (99%). The IMVP in M-NBI after C-WLI had a high sensitivity and specificity (95% and 96%, respectively) for diagnosis of cancer.

Limitations: Lesions were limited to the small, depressed type.

Conclusions: For a diagnosis using M-NBI after C-WLI, identification of DL is the first step, and subsequent inspection of IMVP diagnosed by DL is an efficient strategy. (Gastrointest Endosc 2014;79:55-63.)

Abbreviations: C-WLI, conventional white-light imaging; DL, demarcation line; ESD, endoscopic submucosal dissection; IM, irregular margin; IMVP, irregular microvascular pattern; M-NBI, magnifying narrow-band imaging; SDA, spiny depressed area.

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Gastric cancer is the second leading cause of cancer deaths worldwide.[1] Early detection and accurate diagnosis of depressed gastric mucosal cancer are effective ways to decrease mortality because the depressed type is the predominant morphology among gastric mucosal cancers.[2-4] Moreover, detection of mucosal cancers ≤ 20 mm in diameter is ideal because they are curable with minimally invasive treatments such as EMR and endoscopic submucosal dissection (ESD).[5,6] However, these approaches have proven difficult when using conventional white-light imaging (C-WLI) endoscopy because depressed-type cancer shows subtle morphologic changes. Accurate diagnosis is hampered by the lack of reliable diagnostic criteria. A novel endoscopic technology, magnifying narrow-band imaging (M-NBI), is a powerful tool for characterizing gastric mucosal lesions because it can visualize the microvascular architecture as well as morphology of such lesions.[7]

We performed a multicenter, prospective, randomized, controlled trial and reported that M-NBI was more useful than C-WLI in terms of the ability to diagnose small, depressed gastric cancerous lesions (UMIN-CTR 000001072).[8] In this randomized controlled trial, 2 criteria,[9,10] the presence of a demarcation line (DL) and an irregular microvascular pattern (IMVP), were used for the endoscopic evaluation of lesions using M-NBI, whereas the presence of an irregular margin (IM) and spiny depressed area (SDA) were used for C-WLI evaluation. However, the endoscopic findings that contribute to the accurate diagnosis of small, depressed gastric cancerous lesions have not been fully identified. Moreover, M-NBI still leads to misdiagnosis of some lesions, and the reasons for these misdiagnoses are unclear. Therefore, the aim of this study was to identify an efficient diagnostic strategy using the most reliable endoscopic findings to diagnose early gastric cancers and propose an ideal diagnostic approach to these cancers.

Take-home Message

- The diagnostic performance of magnifying narrowband imaging (M-NBI) after conventional white-light imaging (C-WLI) using a demarcation line (DL) and an irregular microvascular pattern (IMVP) was significantly high for small, depressed gastric lesions.
- In M-NBI after C-WLI, it is ideal to identify the DL first to diagnose small, depressed gastric cancer, and the subsequent IMVP inspection efficiently excludes false-positive lesions by the DL. The reasons for misdiagnoses include technical and cognitive factors; thus, training should involve both aspects.

METHODS

Study design and endoscopic procedure

This study was conducted as a post-hoc analysis of data collected in our randomized controlled trial.[8] The protocol of the trial was approved by the Ethics Committee of the Kyoto University Graduate School of Medicine on February 14, 2008. The UMIN Clinical Trials Registry identification number for this study is 000001072 on March 15, 2008. In the trial, 1353 patients with concomitant gastric cancer or a history of endoscopic resection of early gastric cancer were enrolled and underwent endoscopic screening with C-WLI between June 2008 and May 2010. The target lesions were "newly detected and undiagnosed" small, depressed gastric lesions ≤ 10 mm in diameter. Only the first lesion detected in each patient was selected for examination.

Among all patients 353 previously undiagnosed lesions were found in 362 patients that were randomly assigned to the M-NBI (n = 177) and C-WLI (n = 176) groups. The diagnosis for the target lesion was made on-site by 1 endoscopist according to predetermined diagnostic criteria for C-WLI and M-NBI, and the result was recorded on a case report form. For the C-WLI group, M-NBI examination was performed after completion of a diagnosis based on C-WLI (M-NBI after C-WLI) to evaluate the effect of using M-NBI in conjunction with C-WLI. At least 2 endoscopic images of the target lesion in each mode were captured and stored in a computer server during the diagnosis. After compilation of all endoscopic diagnoses, at least 1 biopsy specimen was obtained from the target lesion. Lesions diagnosed as cancer or suspicious for cancer were removed by EMR/ESD to obtain a final histologic diagnosis. The demographics of the study samples are summarized in Table 1.

The biopsy and EMR/ESD specimens were evaluated based on the revised Vienna classification. Category C4 (mucosal high-grade neoplasia) and C5 (submucosal invasion by neoplasia) were diagnosed as cancerous lesions, and C1 (negative for neoplasia), C2 (indefinite for neoplasia), and C3 (mucosal low-grade neoplasia) were diagnosed as noncancerous lesions. When indeterminate lesions were encountered, we consulted with a main expert pathologist as a central review system to obtain a final diagnosis. The lesions in the M-NBI group comprised 20 cancerous and 157 noncancerous lesions, and those in the C-WLI group comprised 20 cancerous and 156 noncancerous lesions (Fig. 1). The prevalence rate was almost identical in both groups (11. 2% and 11.3%, respectively).

As described in the previous trial,[8] this study was conducted according to the Standards for the Reporting of Diagnostic Accuracy Studies initiative[11] and the Declaration of Helsinki. Randomization and masking were strictly enforced. Thirty-one endoscopists from 9 institutions in Japan participated after being trained in the acquisition of C-WLI and M-NBI images of small, depressed lesions to minimize diagnostic variation among observers. Ethical concerns were fully addressed.

Endoscopy system and setting

The video endoscopy system used in this study comprised a video processor (EVIS LUCERA CV-260SL; Olympus Medical Systems, Tokyo, Japan) and a light source