Comparison of the Diagnostic Usefulness of Conventional Magnification and Near-focus Methods with Narrow-band Imaging for Gastric Epithelial Tumors

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Background/Aims: Dual-focus two-stage optical lens technology has been introduced recently. In near-focus mode (NFM), endoscopists can easily examine the mucosal tissue and capillary networks. This study compared the magnified images obtained using NFM and the conventional magnification method (CMM) under narrow-band imaging in patients with gastric epithelial tumors.

Materials and Methods: An experienced endoscopist performed endoscopy using NFM and CMM in patients with gastric epithelial tumors. We studied 40 images from 40 endoscopy sessions in 20 selected patients. Ten endoscopists rated the image quality independently on a 5-point Likert scale (from poor=1 to excellent=5) in terms of microsurface structure, microvascular structure, and the demarcation line.

Results: The gastric epithelial tumors comprised 10 cases of early gastric cancer, 2 of high-grade dysplasia, and 8 of low-grade dysplasia. The median number of magnified images for each method was 11. The mean observation time (±SD) for magnification was 99.9±64.1 s in NFM and 91.5±64.6 s in CMM (P=0.54). The image quality score for the microsurface structure was higher with NFM than CMM (4.09±0.39 vs. 3.73±0.40, P=0.015), while that for microvascular structure was lower with NFM than in CMM (3.53±0.45 vs. 4.29±0.45, P=0.001).

Conclusions: Magnification using NFM provides higher-quality images of the microsurface structure, although its optical zoom is limited compared with CMM. Since NFM can obtain magnified images easily by pushing a button on the scope, it is useful for evaluating gastric epithelial tumors. (Korean J Helicobacter Up Gastrointest Res 2015;15:39-43)

Key Words: Magnification; Epithelial tumor; Diagnosis, methods; Stomach

INTRODUCTION

Early detection and curative treatment are the best strategies for improving survival in patients with gastric cancer. New techniques has been applied to endoscopy to enhance the visualization of the gastrointestinal mucosa. With no image deterioration after magnification, the optical zoom obtained by moving the lens in the tip of the scope enables close-up observation of the microsurface and microvascular structure. Magnifying endoscopy (ME) using the conventional magnification method (CMM) is used widely as a diagnostic method in hollow organs, including the stomach. Recently, magnification using near-focus mode (NFM) has been introduced to enable close examination under the control of a single button.

As no trials have compared NFM with CMM, we compared the magnified images between NFM and CMM under narrow-band imaging (NBI) in gastric epithelial tumors.

MATERIALS AND METHODS

ME under NBI was performed in patients with gastric epithelial tumors from July 2013 to September 2013. Magnified images were retrieved from the institution’s endoscopy database. Inclusion criteria were patients with gastric dysplasia or early gastric cancer (EGC) who underwent ME using both magnification methods under NBI. After the endoscopic evaluation, all lesions were treated with endoscopic submucosal dissection (ESD). Exclusion criteria were tumors present with an ulcer or minute tumors that were difficult to demarcate.

We used a GIF-H260Z (Olympus, Tokyo, Japan) and a...
19-inch high-definition television (Olympus) for the CMM and a GIF-HQ290 (Olympus) and OEV-261H for the NFM (Table 1). All images were taken by an experienced endoscopist (SJ Hong). Conventional magnifications were obtained using the zoom lever. In NFM, the magnification was controlled using two buttons: one for moving the lens and one that provided up to twofold electronic magnification of the image. Structure enhancement type A mode was used to enhance the contrast of the fine patterns in the image, and no other enhancement mode—such as structure enhancement type B, edge enhancement, or color enhancement—was used. Fig. 1 shows examples of magnified images of a case of EGC. We selected 40 magnified images from 40 endoscopy sessions in 20 patients with gastric epithelial tumors. Ten endoscopists rated the image quality independently in terms of the microsurface structure, microvascular structure, and demarcation line in the endoscopic images (Fig. 2). These

![Fig. 1. Examples of magnified images of a case of early gastric cancer. (A) White-light endoscopy image, (B) conventional magnification method with narrow-band imaging (NBI) image, and (C) near-focus mode with NBI image.](image1)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Conventional magnification method</th>
<th>Near-focus method</th>
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<tbody>
<tr>
<td>Scope model</td>
<td>GIF-H260Z</td>
<td>GIF-HQ290</td>
</tr>
<tr>
<td>Working length (mm)</td>
<td>1,030</td>
<td>1,030</td>
</tr>
<tr>
<td>Insertion tube OD (mm)</td>
<td>10.5</td>
<td>9.9</td>
</tr>
<tr>
<td>Channel diameter (mm)</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Zoom magnification</td>
<td>×85 ×90 with ×2 electronic zoom</td>
<td>×45</td>
</tr>
<tr>
<td>Resolution</td>
<td>HD</td>
<td>HD</td>
</tr>
<tr>
<td>Processor/light source</td>
<td>CV-260SL/260</td>
<td>CLV-290SL/290</td>
</tr>
<tr>
<td>Monitor</td>
<td>19&quot; HDTV</td>
<td>OEV-261H</td>
</tr>
</tbody>
</table>

OD, outer diameter; HD, high definition.

![Fig. 2. (A, B) Magnifying endoscopy with narrow-band imaging for gastric epithelial tumors. The microsurface structure, microvascular structure, and demarcation line were evaluated in the magnified images.](image2)
subjective ratings were based on a 5-point Likert scale: 1=poor, 2=fair, 3=good, 4=very good, 5=excellent.

Statistical analysis was performed using SPSS ver. 14.0 (SPSS, Chicago, IL, USA). The Stuart-Maxwell test was used to compare the mean Likert scores between CMM and NFM. Statistical significance was established at $P<0.05$. The interobserver agreement was assessed using the intraclass correlation coefficient (ICC), which was interpreted as follows: 0~0.20, poor; 0.21~0.40, fair; 0.41~0.60, moderate; 0.61~0.80, good; and 0.81~1.00, excellent.18

**RESULTS**

The mean age of the enrolled patients was 65.7 years and 75% were male. The final diagnosis after ESD revealed 10 cases (50%) of EGC, 2 cases (10%) of high-grade dysplasia, and 8 cases of low-grade dysplasia (Table 2).

The mean observation time (±SD) was 91.5±64.6 s for CMM and 99.9±64.1 s for NFM ($P=0.54$). Each method produced a median of 11 magnified images (Table 3).

Based on the 10 endoscopists’ subjective ratings, the mean image quality scores for the microsurface structure were 4.09±0.39 in NFM and 3.73±0.40 in CMM ($P=0.015$). The mean image quality scores for the microvascular structure were 3.53±0.45 in NFM and 4.29±0.45 in CMM ($P=0.001$). The mean image quality scores for the demarcation line were 3.91±0.41 in NFM and 3.61±0.54 in CMM ($P=0.089$; Table 3).

The ICC for CMM was 0.252 (95% CI, 0.165~0.363) and that for NFM was 0.171 (95% CI, 0.103~0.267); these values imply poor interobserver agreement.

**DISCUSSION**

Our study showed that ME using NFM provided clearer images of the microsurface structure than CMM under NBI. However, CMM was more useful for observing the microvascular structure than was NFM.

New endoscopic methods have been developed to improve diagnostic sensitivity by enhancing the detection of suspicious lesions, followed by targeted biopsies.6 While white light endoscopy uses the visible spectrum of light to form an image, NBI utilizes specific blue and green bands that are strongly absorbed by hemoglobin in the blood vessels. This enhances the visualization of the capillary network and mucosal morphology in a similar way to chromoendoscopy.

ME with NBI was reported to be useful for the accurate diagnosis of gastric abnormalities, such as cancers, adenomas, and intestinal metaplasia.10-14,10-21 In CMM, the endoscopist needs to move the scope close to the lesion to acquire a clear magnified image because the depth of field is 1.5~3.0 mm. The scope must be held steady due to the narrow range of distance at which a clear image can be maintained during ME with CMM. To maintain a consistent distance of about 2 mm from the mucosa, the mount of the soft black hood at the tip of the endoscope can be helpful.22 If the scope cannot approach within the depth of field, no clear magnified image is acquired. Compared to CMM, the depth of field of NFM is relatively wide (3.0~7.0 mm) and a magnified image can be observed easily with the simple push of a scope button. Moreover, the combination of the improved scope and
system provides a brighter endoscopic view. We postulated that the score of image quality for microsurface structure would be higher given the higher resolution of ME using NFM.

Using optical zoom, the magnification can reach 85- and 45-fold for CMM and NFM, respectively. When the endoscopist applies twofold electronic magnification, a total of 90-fold magnification is achieved using the specific monitor provided for NFM. However, electronic zoom can also reduce image quality. In our study, the image quality score for the microvascular structure was higher with CMM than NFM. This might have resulted from the larger image magnification without deterioration in CMM.

Our study had several limitations. First, it was performed at a single center and a small number of gastric epithelial tumors were assessed. Further study using more tumors should yield clearer results in terms of the comparison of the two magnifying methods. Second, the independent endoscopists could determine which imaging modality was used, as the NFM images were brighter than the CMM images because of the improved light source and different NBI filter design. Third, the interobserver agreement was poor because each endoscopist scored both methods subjectively. These results suggest individual variation in evaluation of the image quality of CMM and NFM under NBI.

In conclusion, magnification using NFM under NBI provides high-quality images of the microsurface structures in gastric epithelial tumors. Using this magnifying method, magnified images can be acquired by simply pushing a button on the scope.

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