Usefulness of narrow-band imaging endoscopy for diagnosis of Barrett’s esophagus

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Background. A newly developed endoscope lighting system called a narrow-band imaging system emphasizes certain histological features such as capillary and crypt patterns. The usefulness of NBI for the diagnosis of Barrett’s esophagus (BE) was evaluated. Methods. Eleven patients with previously diagnosed BE were enrolled in this study. Magnifying endoscopy was performed by an experienced endoscopist, using both a conventional system and an NBI system. All images were recorded by video and by a digital still image filing system. Differences in images were evaluated by another experienced endoscopist. The quality of images for the visualization of the esophagogastric junction, capillary vessels, and columnar-lined esophagus (CLE) was judged as: optimal (score of 4), diagnostic (3), suboptimal (2), or nondiagnostic (1). Results. In contrast to the low rate of visualization of the esophagogastric junction by conventional endoscopy, visualization of this area endoscopy was better by NBI. Net-like blood vessels were more clearly seen on images obtained by NBI endoscopy. Visualization of the CLE was better by NBI endoscopy than by conventional endoscopy. In contrast to conventional endoscopy, NBI endoscopy captured the optimal view of Barrett’s epithelium. The relationship between the endoscopic and histopathologic diagnoses was more accurate by NBI endoscopy than by conventional endoscopy. Conclusions. Magnifying endoscopy by NBI is more useful than conventional magnifying endoscopy for the diagnosis of BE.

Key words: Barrett’s esophagus, narrow-band imaging (NBI), endoscopy

Introduction

Barrett’s esophagus (BE) is defined as the replacement of the normal squamous epithelium by columnar-lined esophagus (CLE) with specialized intestinal metaplasia (SIM). The incidence of esophageal adenocarcinoma in patients with BE is about 30- to 40-fold higher than that in the general population. The number of cases of esophageal adenocarcinoma is currently increasing at a faster rate than the numbers of cases of breast, lung, and colon cancers in Western countries. The poor prognosis for patients with Barrett’s esophageal cancer is due to both the lack of an effective method for early detection (which would enable curative excision) and the inability to cure metastatic disease. Thus, current research efforts are aimed at the establishment of methods for the early identification of preneoplastic lesions and for intervention in Barrett’s esophageal cancer.

One possible method for the early detection of preneoplastic lesions is screening upper endoscopy. Patients with gastroesophageal reflux disease (GERD) are at high risk for the development of BE, which is seen in 8% to 20% of patients undergoing endoscopy. Upper endoscopy is recommended for patients with GERD who are at high risk of developing BE. When a diagnosis of BE is made, surveillance endoscopy is recommended to determine whether epithelial dysplasia, the pathologic precursor of cancer, is present.

CLE can be recognized endoscopically by its velvety red mucosa compared with the normal pale esophageal mucosa. However, not all patients with CLE have the same inherent risk for the development of adenocarcinoma. Among the different histologic subtypes of CLE, only SIM has a significant risk for the development of adenocarcinoma. The conventional method of endoscopic surveillance for SIM in patients with CLE includes four-quadrant biopsies of the CLE, taken at 2-cm intervals. However, SIM will be found histologically in only about 38% of patients with CLE by using this
conventional method of obtaining biopsy specimens.\textsuperscript{5} Sampling error is a potential pitfall, and misdiagnosis is a possibility.

A more accurate method for the endoscopic diagnosis of SIM would be one that improves mucosal visualization. The usefulness of chromoendoscopy with methylene blue staining, and enhanced magnification endoscopy, which combines the use of magnification endoscopy and acetic acid instillation, in patients with previously diagnosed short-segment BE has been reported.\textsuperscript{6,7}

The usefulness of several other endoscopic methods, such as photodynamic diagnosis, endoscopic optical coherence tomography (OCT), high-frequency endoscopic ultrasonography (EUS), and laser-induced fluorescence endoscopy has been studied, but there are still no established means for screening or for the early detection of Barrett’s esophageal adenocarcinoma.

We have tested a new endoscope lighting system called narrow-band imaging (NBI).\textsuperscript{8} This new lighting method emphasizes the imaging of certain histological features such as capillary and crypt patterns. NBI is a simple technique that uses optical filters for red, green and blue (RGB) sequential lighting with a narrow band-width of spectral transmittance. The results obtained by using NBI for the detection of BE are presented in this report.

### Patients and methods

#### Patients

Eleven patients with previously diagnosed BE (including short-segment BE) who were being followed in an endoscopic surveillance program at Sapporo Medical University Hospital were enrolled in this study after informed consent for participation in the study was obtained from each patient. The characteristics of the patients are shown in Table 1.

<table>
<thead>
<tr>
<th>Characteristics of patients</th>
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<tbody>
<tr>
<td>Total no. of patients</td>
<td>11</td>
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<tr>
<td>Mean age (years)</td>
<td>61.2 (37–92)</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>6/5</td>
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<tr>
<td>Short-segment BE/long-segment BE</td>
<td>6/5</td>
</tr>
<tr>
<td>Mean no. of analyzed films</td>
<td>4.7 (3–8)</td>
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</table>

#### NBI system and magnification gastroscope

All procedures were performed using the same magnification videendoscope (GIF-Q240Z; Olympus Optical, Tokyo, Japan) and videoprocessor (CV-240; Olympus Optical) and two lighting units (CLV-U40D; Olympus Optical) for a medical endoscope. The difference between standard magnifying endoscopy and NBI endoscopy involved only one lighting unit, which had spectrally narrowed band filters for time-sequential illumination. The other lighting unit had conventional broadband filters (Fig. 1).\textsuperscript{8}

### Endoscopic procedure

Endoscopic procedures were performed by a gastroenterologist (T.E.) experienced in the technique of magnification endoscopy for the detection of BE. All patients underwent both standard magnifying endoscopy and NBI endoscopy. Patients first underwent standard endoscopy and then magnification endoscopy. The imaging equipment was then changed to NBI equipment with the endoscope still in place, and magnification endoscopy by NBI was performed immediately after the exchange of equipment. All of the examinations were digitally recorded. After the examinations, digitally obtained photographs were put in order for comparison with conventional photographs and NBI photographs.

#### Retrospective evaluation of films

To determine the differences between results obtained by using conventional endoscopy and NBI endoscopy, the quality of images for the visualization of the esophagocardiac junction, capillary vessels, and CLE (pit pattern) was judged as: optimal (score of 4), diagnostic (3), suboptimal (2), or nondiagnostic (1) by another experienced endoscopist (Y.H.) (Table 2). On the basis of the results of magnifying endoscopic examination for evaluating Barrett’s mucosal pit pattern, the areas were divided into two characteristic BE pattern groups: one group of areas with pit patterns 1, 2, or 3, which were suspected of having non-SIM epithelium (considered to be SIM-negative), and one group of areas with pit patterns 4 or 5 which were suspected of having SIM epithelium (considered to be SIM-positive).\textsuperscript{9}

### Results

#### Visualization of esophagogastric junction

In contrast to the low rate of visualization of the esophagogastric junction by conventional endoscopy (17% of images scored as 3 or 4), visualization of the squamocolumnar junction by NBI endoscopy was excellent (58% of images scored as 3 or 4; $P = 0.0002$; Table 3). Figure 2 shows images obtained from a 92 year-old man (case 10) who was treated endoscopically for superficial adenocarcinoma derived from long-segment BE and who received proton-pump inhibitor...