

Case Report

## Can Narrow-band Imaging Be Used to Determine the Surgical Margin of Superficial Hypopharyngeal Cancer?

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Narrow-band imaging (NBI) is a novel optical technique that uses narrow bandwidth filters in a video endoscope system to improve the diagnostic capability of endoscopes in characterizing tissues. It is well known that early identification of neoplasia in the gastrointestinal tract using this technique might make it possible to reduce the suffering of patients caused by loss of function or severe complications after radical surgery. Several reports have introduced this system as a preoperative examination to evaluate the lateral spread of the neoplastic lesions in the oropharynx or hypopharynx. We experienced a case with hypopharyngeal cancer in which we were able to avoid underestimating cancer lesions following insufficient resection using the NBI system. A 62-year-old female underwent partial hypopharyngectomy with the margin estimated by an NBI view coupled with reconstruction of the hypopharynx while preserving the larynx. The resected specimen was cut into serial sections for a detailed pathology examination. The surgical margin seemed to be wide enough and it could be assumed that if possible we should observe these cancers with conventional electroendoscopy and NBI before treatment.

**Key words:** narrow-band imaging, hypopharyngeal cancer, surgical margin

The narrow-band imaging (NBI) system consists of a sequential electronic endoscope system and a source of light equipped with new narrow-band filters. This system was recently developed to improve the quality of endoscopic images and to enhance the visualization of microvasculature on mucosal surfaces. The light source unit of this system has a xenon lamp and a filter disk. Three optical interference filters are mounted on the filter disk. Red, green and blue filters

are ordinarily used, and the divided visible wavelength ranges into 3 bands. The shorter wavelength light can propagate to the shallow region of the mucosa, and the longer wavelength can propagate more deeply into the tissue (red: 485-515 nm, green: 430-460 nm, blue: 400-430 nm). To emphasize features such as the capillary and crypt pattern, NBI restricts special shapes in the short wavelength range, by narrowing spectral shapes [1]. Areas of nondysplastic tissue have fine capillary patterns with normal size and distribution of these fine blood vessels; in contrast, areas harboring high-grade dysplasia have an abnormal capillary pattern with an increased number, size, and

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dilation of the fine capillaries. By just changing the optical filters for sequential lighting from the conventional broadband type to the narrow band type, the NBI system can be installed. Magnifying endoscopy combined with the NBI yields very clear images of not only the fine mucosal patterns but also the capillaries on the mucosal surface of the colon, esophagus, or oral cavity [1]. Current research efforts are aimed at establishing the early identification of neoplasia [2, 3] or preneoplastic lesions [4] in the gastrointestinal tract. Atrophic gastritis, intestinal metaplasia [3], adenoma in the colon [5], Barrett's esophagus or early adenocarcinoma [4] might be detectable by NBI. In addition, this technique might make it possible to identify even low grade intestinal dysplasia [6] and to differentiate neoplastic lesions from inflammatory changes [7] in the intestine. Recently it has been reported that magnifying endoscopy by NBI would also be useful for screening for hypopharyngeal neoplasia [8]. To our knowledge, there have been a few reports on the use of the NBI system in determining the surgical margin of neoplasia in the head and neck region. We now present a case of superficial hypopharyngeal cancer (SHC) whose surgical extent was estimated by NBI and discuss the effectiveness of the NBI in determining the surgical margin of SHC.

### Case Report

**Clinical presentation.** A 62-year-old Japanese woman was admitted to the Cancer Institute Hospital of the Japanese Foundation for Cancer Research on 21 Oct 2005 for a quarterly follow-up examination that she has undergone regularly since her treatment for hypopharyngeal cancer (limited to the left pyriform sinus with left recurrent nerve paralysis: T3N0M0) in 1998. The patient had received radiation therapy (total 70 Gy) and chemotherapy (CDDP + 5-FU  $\times$  2 courses) and had a complete response. However, during the electroendoscopic examination a small hypopharyngeal tumor was found in the left arytenoid mucosa (Fig. 1). A biopsy was performed and the histology examination revealed the recurrence of squamous cell carcinoma. Computed tomography and magnetic resonance imaging could not detect the lesion because of its small size, and there was no evidence of metastases. Thus, endoscopic mucosal resection seemed to be the appropriate treatment for this lesion.

However, gastrointestinal endoscopy by NBI revealed that irregularly distributed vessels were present to a wider extent than the tumor lesion as defined by conventional endoscopy. The irregular pattern of capillaries spread from the arytenoid mucosa to the lateral wall of the pyriform sinus and extended nearly to the orifice of the cervical esophagus (Figs. 2A-C). The patient underwent partial hypopharyngectomy and reconstruction of the hypopharynx with a forearm flap.

**Pathologic observations.** The resected specimen was cut in parallel sections and the lesion with some abnormality was mapped on the picture of the specimen (Fig. 3). The distribution of the high grade intraepithelial neoplasia was consistent with that of the irregular vessels observed by NBI. The surgical margin seemed to be wide enough. Immunohistochemical examination revealed that irregularly distributed microvessels were present in the mucosa of the high-grade intraepithelial neoplasia (Figs. 4A, B) that had been detected by NBI.

### Discussion

The diagnosis by NBI with regard to the microvascular pattern of the hypopharynx mucosa corresponded well with the histopathology results. Although biopsy examination and the Lugol test [9] are the gold standards for defining the surgical margin of SHC, it is relatively difficult to administer those tests in the hypopharynx before surgery. Thus, NBI could be useful, especially for determining the margin of the SHC preoperatively. In the present study, Lugol-voiding lesions seemed to be limited in extent as estimated by conventional endoscopic observation. Although our Lugol staining might involve some technique errors some reports have emphasized that macroscopic examination using Lugol sometimes fails to identify minute foci of early cancer, and that stained mucosa does not exclude cancer risk [10].

Many reports about magnifying endoscopy coupled with NBI have delineated the effectiveness of the early detection of gastrointestinal neoplastic lesions, which might make it possible to reduce the suffering caused by the loss of speaking and swallowing functions after radical surgery [1-4, 8]. We tried to use this technique rather to prevent the underestimation of cancer lesions. In this case, NBI was more accurate in rec-

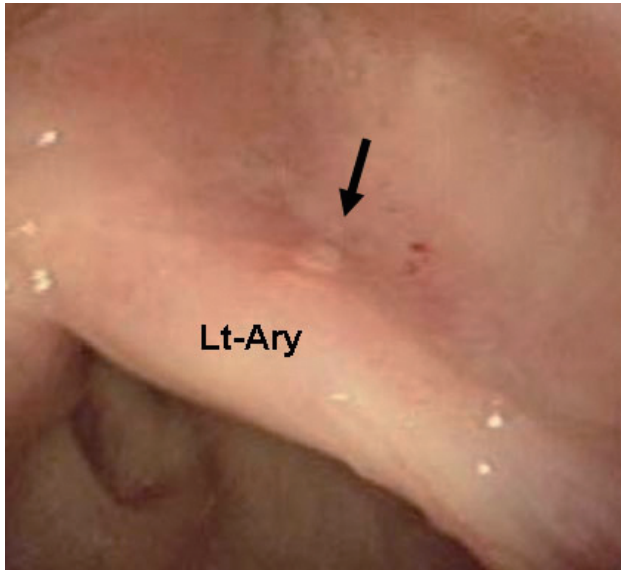


Fig. 1 Conventional electroendoscopic observation. A small hypopharyngeal tumor is observed in the left arytenoid mucosa. Ary, arytenoid; Lt, left.

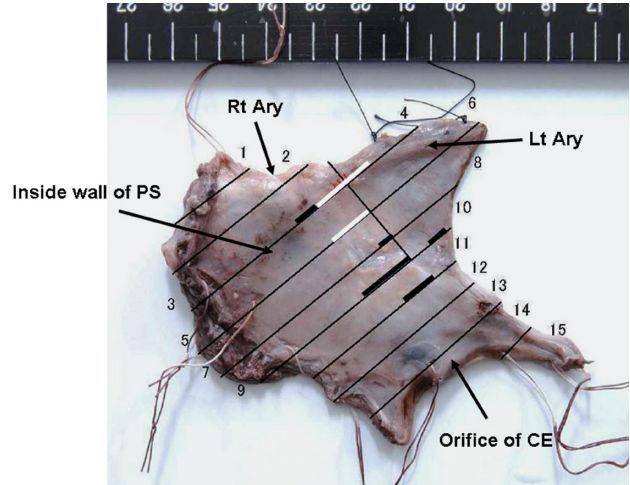


Fig. 3 Resected specimen. The extent of the tumor is not made clear by macroscopic observation. Abnormality is mapped on a picture of the specimen by histological study. White lines, cancer; Black lines, severe dysplasia; Rt, right; Lt, left; PS, pyriform sinus; CE, cervical esophagus.

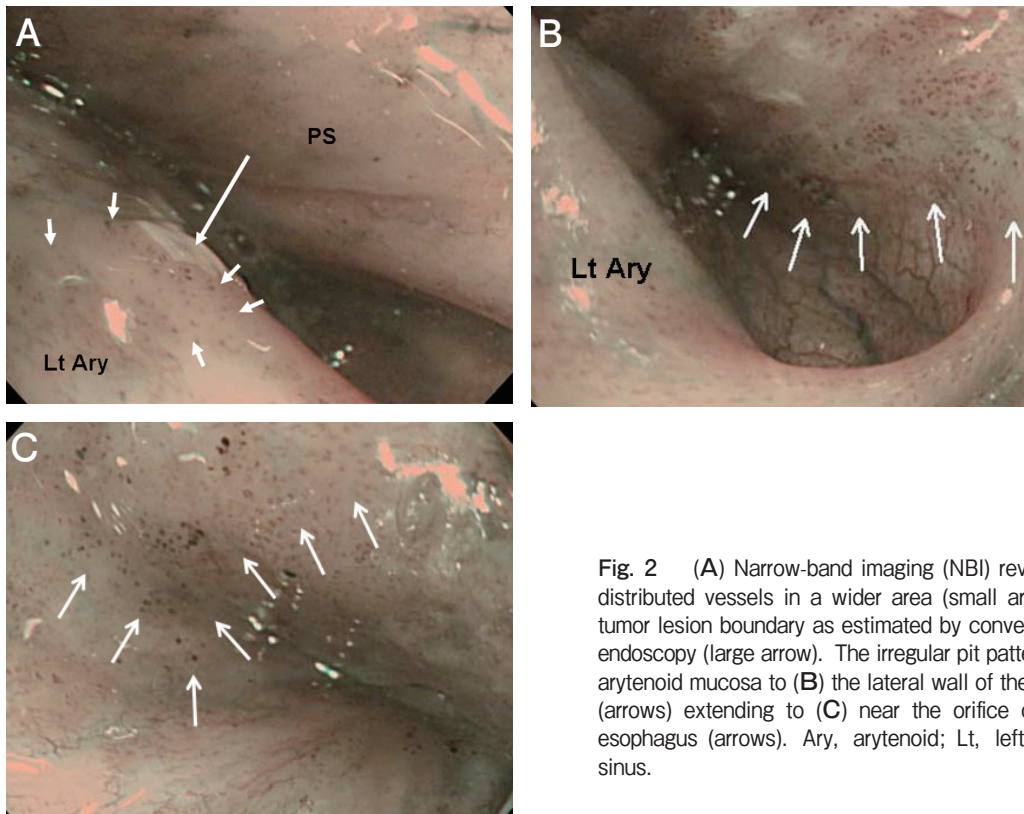
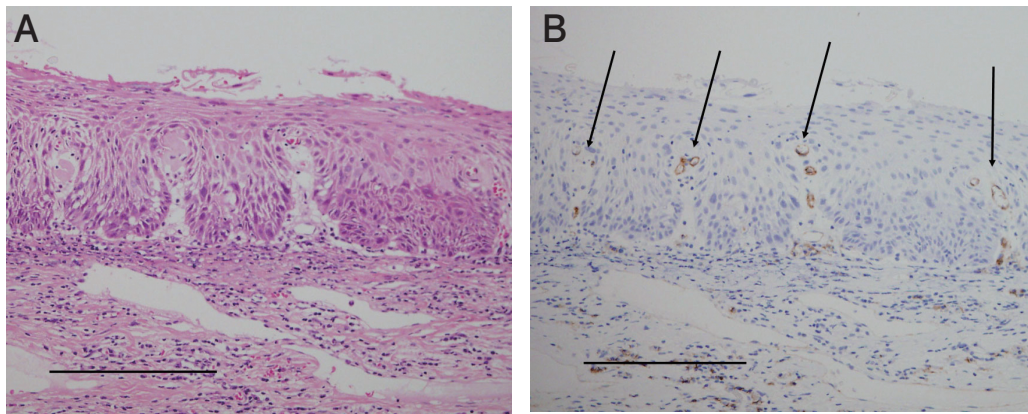


Fig. 2 (A) Narrow-band imaging (NBI) reveals irregularly distributed vessels in a wider area (small arrows) than the tumor lesion boundary as estimated by conventional electroendoscopy (large arrow). The irregular pit pattern spread from arytenoid mucosa to (B) the lateral wall of the pyriform sinus (arrows) extending to (C) near the orifice of the cervical esophagus (arrows). Ary, arytenoid; Lt, left; PS, pyriform sinus.



**Fig. 4** Severe dysplasia of hypopharyngeal mucosa: (A) hematoxylin and eosin stain. (B) CD31 immunohistochemistry highlights the irregularly distributed microvessels in severe dysplasia (arrows). Scale bar: 200  $\mu$ m.

ognizing SHC than conventional electroendoscopy. Magnifying endoscopy performed in combination with NBI has not yet replaced conventional histology or Lugol staining, but at least this technique is capable of avoiding the underestimation of cancer lesions following insufficient resection as well as intraoperative changes related to the operative procedure. Although a larger number of patients is required to determine statistically meaningful associations between the results of NBI and the width or histological characteristics of cancer lesions in the hypopharynx, it is likely that we should use NBI to observe SHC mainly for the pre- or intra-operative formulation of the surgical procedure and in combination with the intra-operative Lugol test and biopsy examination to determine the surgical margin.

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