Usefulness of white-light imaging–guided narrow-band imaging for the differential diagnosis of small ampullary lesions

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Background: Small ampullary tumors and inflammatory lesions have similar endoscopic findings and are difficult to differentiate. Narrow-band imaging (NBI) can visualize microvessels and mucosal microstructure clearly and is widely used to diagnose early gastric and colon cancer.

Objective: To evaluate the usefulness of NBI for differentiating ampullary tumors from benign diseases.

Design: Retrospective cohort study.

Setting: Tertiary-care hospital.

Patients: All 45 patients who had suspicious ampullary lesions (enlarged or protruded morphology) during duodenoscopy and underwent NBI between March 2010 and January 2011.

Interventions: NBI.

Main Outcome Measurements: NBI images were assessed for irregular villous arrangement, irregular villous size, ridge disappearance, demarcation with normal villi, and abnormal microvasculature. Histology of NBI-guided lesion biopsy specimens provided the final diagnoses. Agreement between NBI images and histologic findings was analyzed.

Results: Of the 60 ampullary lesions, 11, 26, and 23 were adenocarcinomas, adenomas, and benign inflammatory diseases, respectively. Irregular villous arrangement, irregular villous size, ridge disappearance, demarcation with normal villi, and abnormal microvasculature were observed in 45%, 63%, 50%, 48%, and 58% of the lesions, respectively. Multivariate analysis revealed that irregular villous arrangement (odds ratio [OR] 15.76; 95% confidence interval [CI], 3.38-64.12; $P < .001$) and abnormal microvasculature (OR 86.63; 95% CI, 14.56-515.41; $P < .001$) were significant independent factors for identifying ampullary adenomas and adenocarcinoma. All tumors had at least one abnormal NBI feature.

Limitations: Retrospective design.

Conclusion: The NBI findings of irregular villous arrangement and/or abnormal microvasculature were useful for differentially diagnosing ampullary tumors. NBI may complement the accurate diagnosis of ampullary lesions by white-light imaging. (Gastrointest Endosc 2015;82:94-101.)

Ampullary tumors are rare and account for approximately 5% of all GI neoplasms.[1] However, the diagnosis of ampullary tumors is increasing as a result of increased screening endoscopic examination.[2] Although the methods for diagnosing ampullary tumors are improving as endoscopic techniques are being developed, it is still

Abbreviations: CI, confidence interval; NBI, narrow-band imaging; NPV, negative predictive value; PPV, positive predictive value; WLI, white-light imaging.

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sometimes difficult to differentiate between ampullary tumors and inflammatory lesions, especially when the ampullary lesions are small. Endoscopic appearance and histologic examination have been used to evaluate ampullary lesions. On endoscopy, ampullary adenoma is suspected if discolored lobular or pine cone–like lesions are detected. Moreover, a reddish nodular lesion associated with ulceration, erosion, and friability is suggestive of ampullary cancer.[3] When the ampullary lesions are large and have typical endoscopic features, the sensitivity of diagnosing malignancy by forceps biopsies is high (90%).[4] However, because the endoscopic appearance of ampullary tumors can vary widely, it can be difficult to distinguish ampullary tumors from benign ampullary lesions on the basis of endoscopic appearance alone.[5] Even with the addition of forceps biopsy in these situations, there is a risk of missing tumor foci within the ampulla, which would lead to a false-negative result. One study showed that when ampullary tumors were evaluated preoperatively with forceps biopsy specimens taken through a duodenoscope, approximately 30% of the biopsy results were falsely negative for malignancy.[6] Whereas multiple forceps biopsies have been recommended to overcome this low diagnostic accuracy, repeated biopsy of the ampullary region can cause acute pancreatitis.[7,8] Therefore, to improve the accuracy of ampullary tumor diagnosis, better diagnostic tools that complement the conventional endoscopic examination are needed.

The narrow-band imaging (NBI) system is an endoscopic imaging technique that can clearly visualize the microvascular architecture and the microsurface structure of the mucosa in GI tract diseases.[9] NBI is regarded as an excellent method for diagnosing these diseases and is increasingly being used to differentiate between benign and malignant disease in gastric and colon lesions.[10] However, the usefulness of NBI for diagnosing ampullary tumors is unclear.

The purpose of this study was to determine whether abnormal NBI features could be used to diagnose ampullary tumors and differentiate between benign and malignant ampullary lesions. For this, 4 abnormal villous features that can be detected by NBI were defined. The ability of these features and NBI-detected abnormal microvasculature to correctly diagnose suspicious ampullary lesions was assessed.

METHODS

Study design and patients

This retrospective cohort study was conducted at the Asan Medical Center, which is a tertiary-care hospital in Seoul, Korea. The study protocol and amendments were approved by the institutional review boards of the hospital. The study cohort consisted of all patients who underwent white-light imaging (WLI) between March 2010 and January 2011 and were found to have an ambiguous enlarged or protruded ampulla (ie, it was not possible to distinguish between inflammatory disease and tumor). Therefore, patients with an ampulla that had clearly malignant features (eg, large ulceration, spontaneous bleeding, or large size) were excluded from the study. All enrolled patients also underwent further detailed examination of their ampullary lesions by NBI.

NBI and definition of meaningful NBI features

A conventional duodenoscope (JF-260V, TJF 260V; Olympus Medical Systems, Tokyo, Japan) was used in the current study. The NBI system (CV-260SL processor, CLV-260SL light source; Olympus) used in this study was based on a modification of the spectral features, with each NBI filter narrowing the bandwidth of spectral transmittance.[11] The NBI filter can split white light into 2 specific lights with narrower bandwidths—namely, blue (400-430 nm) and green (530-550 nm), while the contribution of the red light is taken out. The final endoscopic image generated by using both band images was synthesized by using a video processor.

All NBI examinations were performed by an experienced endoscopist (D.W.S.). Overlying mucus or bile juice was flushed with water until the mucosal surface of the ampulla could be visualized clearly. The NBI evaluation aimed to detect circumscribed irregular villous patterns and abnormal microvasculature of the ampullary lesions (Fig. 1). Four types of meaningful irregular villous patterns were identified, as follows: irregular villous arrangement (ie, there is no array direction of the villi or it is unclear), irregular villous size (ie, the villous is smaller or larger than the normal surrounding villi), disappearance of the ridge (ie, the ridge between the villi has vanished), and demarcation with normal villi. Moreover, a lesion was deemed to have abnormal microvasculature if dotted or markedly dilated vessels were observed.

Biopsy specimens and histopathology

Biopsy specimens were taken from all ampullary lesions. If an ampullary lesion had several of the meaningful NBI features described, additional biopsies were performed at the relevant sites. All biopsy specimens underwent standard histologic assessment by one GI pathologist who was blinded to the NBI information. The histopathologic diagnosis served as the criterion standard.

Diagnostic accuracy of WLI with meaningful NBI features

All endoscopic examinations of the enrolled patients were recorded and were later reviewed by a single endoscopist (J.S.P.) who was blinded to the histologic results. A series of standardized abnormal NBI images was used for educational purposes before the start of this study.