Clinical utility and interobserver agreement of autofluorescence imaging and magnification narrow-band imaging for the evaluation of Barrett's esophagus: a prospective tandem study

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Background: New endoscopic imaging techniques, such as autofluorescence imaging (AFI) and narrow-band imaging (NBI), have been developed to improve the detection of neoplastic lesions in Barrett's esophagus (BE).

Objective: To evaluate the clinical utility of AFI and magnification NBI to detect high-grade dysplasia (HGD) and early esophageal adenocarcinoma (EAC) and the interobserver agreement.

Design: Prospective tandem study of eligible patients.

Setting: Single, academic tertiary care center.

Patients: Forty-two patients with a history of confirmed BE were prospectively enrolled.

Interventions: The BE segment was examined under high-definition white-light endoscopy, and the presence of visible lesions was recorded. Subsequently, AFI and magnification NBI were performed in tandem on areas of the BE segment away from visible lesions; images obtained by these 2 systems were graded according to the color of reflected light and surface patterns, respectively. Biopsy specimens were obtained at the end of the procedure.

Main Outcome Measurements: The sensitivity, specificity, positive predictive value, and negative predictive value (NPV) of the AFI and NBI patterns for the detection of HGD/EAC and interobserver agreement.

Results: Of the 42 patients enrolled, 14 (33%) had HGD/EAC. On patient-based analysis, AFI alone had a sensitivity, specificity, and NPV of 50%, 61%, and 71%, respectively, and the overall accuracy for the detection of HGD/EAC patients was 57%. By using magnification NBI in tandem fashion, the sensitivity and NPV improved to 71% and 76%, respectively, with a decrease in specificity to 46% and in overall accuracy to 55%. The 2 techniques had moderate interobserver agreement for both the patterns and prediction of histology.

Limitations: Uncontrolled study performed at an academic center by expert endoscopists in a high-risk population.

Conclusions: By using a multimodality endoscope, both AFI and magnification NBI had limited clinical accuracy and moderate overall interobserver agreement. AFI does not appear to be useful as a broad-based technique for the detection of neoplasia in patients with BE. (Gastrointest Endosc 2013;77:711-8.)

Abbreviations: AFI, autofluorescence imaging; BE, Barrett's esophagus; CI, confidence interval; EAC, esophageal adenocarcinoma; HD-WLE, high-definition white-light endoscopy; HGD, high-grade dysplasia; IM, intestinal metaplasia; IND, indefinite for dysplasia; LGD, low-grade dysplasia; NBI, narrow-band imaging; NPV, negative predictive value; SD, standard deviation; SD-WLE, standard-definition white-light endoscopy; WLE, white-light endoscopy.

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Esophageal adenocarcinoma (EAC) is a highly lethal cancer and continues to be the most rapidly increasing cancer in the United States and the Western world.[1] The availability of effective and relatively easy to use endoscopic eradication therapy for Barrett's esophagus (BE)–associated high-grade dysplasia (HGD) and early esophageal adenocarcinoma (EAC) makes a compelling argument for accurate and timely detection of dysplasia/cancer in BE. White-light endoscopy (WLE) can detect visible lesions within the BE segment but relies on random biopsies for detection of inconspicuous flat dysplasia/cancer. Random sampling of BE mucosa not only adds to missed opportunities for intervention, but also to the cost by requiring a greater number of biopsies. This has led to evaluation and application of novel imaging techniques such as autofluorescence imaging (AFI) and narrow-band imaging (NBI). However, their use is limited mostly to tertiary referral centers because of the challenges associated with recognition of abnormal/irregular patterns detected by these novel techniques.

We performed a prospective clinical trial using AFI and magnification NBI to (1) calculate the clinical accuracy of AFI alone and of tandem AFI and magnification NBI to predict HGD/EAC in BE and (2) calculate the interobserver agreement of AFI and magnification NBI for the prediction of histology.

Take-home Message

- Autofluorescence imaging (AFI) and magnification narrow-band imaging (multimodality imaging) are not yet accurate enough to rule out cancer in a patient with Barrett's esophagus (BE).
- AFI cannot be routinely used as a broad-based technique to flag dysplastic areas for biopsy.
- Further efforts are needed to identify a new, easy-to-use endoscopic technology with a simple classification system that could improve the detection of high-grade dysplasia and esophageal adenocarcinoma in patients with BE.

BACKGROUND

Previous literature on AFI for the detection of dysplasia in BE reported good sensitivity but high false-positive rates with limited published data on interobserver agreement.[2-4] In these studies, the false-positive rate of AFI decreased after the addition of NBI. These results suggested that AFI could be used as a broad-based "red-flag" technique in combination with magnification NBI to improve the clinical accuracy and efficiency of the detection of dysplasia in BE by potentially reducing the need for random biopsies. Despite these studies, more recent data highlight the use of standard-definition WLE (SD-WLE) with random biopsies as the technique with higher histological yield compared with other imaging techniques (high-definition WLE [HD-WLE], AFI, and magnification NBI).[5,6] Moreover, there are only limited studies on the utility of these novel technologies in North America.

METHODS

Patients

The study protocol and consent form were approved by the Human Subjects Committee of the Veterans Affairs Medical Center, Kansas City, Missouri. Patients with known BE undergoing endoscopic surveillance were recruited from the endoscopy unit and evaluated for inclusion in this trial.

Subjects were enrolled in the study if they met the following inclusion criteria: history of confirmed BE (presence of intestinal metaplasia [IM] in the columnar lined esophagus), older than 18 years of age, and ability to provide written informed consent. Patients with 1 or more of the following criteria were excluded from the study: inability to provide written informed consent, presence of erosive esophagitis at the time of the upper endoscopy, inability to discontinue use of a nonsteroidal anti-inflammatory drug or aspirin before the study, advanced chronic liver disease, severe uncontrolled coagulopathy, and a history of esophageal or gastric surgery. This protocol was approved by our institutional review board.

Forty-five subjects were enrolled in the study. Of the 45 patients, 3 were excluded: 1 had a history of fundoplication and 2 had erosive esophagitis.

Endoscopy

Patients were evaluated with a prototype multimodality endoscope with the ability to switch between HD-WLE, AFI, and NBI modes at the push of a button (GIF Q240, 115×; Olympus Medical Systems Corp, Tokyo, Japan). Standard methods of conscious sedation (eg, midazolam hydrochloride and meperidine citrate) and cardiopulmonary monitoring were used during each procedure. All details of the visual examination were noted in a structured format on the recording form validated by the French Society of Digestive Endoscopy.[7] The extent of BE was defined by using the Prague C&M criteria.[8] All procedures were performed by the senior author of this article (P.S.), who has extensive experience with advanced imaging in BE.

Initially, the entire BE segment was examined under HD-WLE, and the presence of visible lesions such as nodules, plaques, and ulcers was recorded. If mucus impeded visualization of the surface details, the areas were rinsed with water. Subsequently, AFI and magnification NBI were performed in tandem fashion. The areas of the BE segment away from the visible lesions detected during examination with HD-WLE (ie, flat Barrett's mucosa) were examined with AFI and the location of the abnormal areas was noted