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ORIGINAL ARTICLE

Comparison of narrow-band imaging and confocal laser endomicroscopy for the detection of neoplasia in Barrett's esophagus: A meta-analysis

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KEYWORDS
Barrett's esophagus;
Neoplasia;
Narrow band imaging;
Confocal laser endomicroscopy;
Meta-analysis

Summary
Aims: Barrett's esophagus (BE) predisposes to the development of esophageal neoplasia, including high-grade dysplasia (HGD) and esophageal adenocarcinoma (EAC). A systematic literature review and meta-analysis were performed to assess the accuracy of within-patient comparisons of narrow band imaging (NBI) and confocal laser endomicroscopy (CLE) for diagnosis of HGD/EAC in patients with BE.
Methods: The following databases were examined up to April 2016 without language restriction: PubMed, Embase, Medline, Web of Science and the Cochrane Library. The QUADAS-2 tool for assessing the quality of included studies was used. The meta-analysis included pooled additional detection rate (ADR), diagnostic accuracy, and 95% confidence intervals (CI). The I^2 and Q-test were used to determine study heterogeneity.
Results: Five studies involving 251 patients, reported within-patient comparisons of NBI and CLE, were eligible for meta-analysis. Compared with NBI, pooled ADR of CLE for per-lesion detection of neoplasia in patients with BE was 19.3% (95% CI: 0.05–0.33, $I^2 = 74.6\%$). The pooled sensitivity of NBI was 62.8% (95% CI: 0.56–0.69, $I^2 = 94.6\%$), which was lower (not significantly) than that of CLE (72.3%, 95% CI: 0.66–0.78, $I^2 = 89.3\%$). The pooled specificity of NBI and CLE were similar [85.3% (95% CI: 0.84–0.87, $I^2 = 92.1\%$) vs 83.8% (95% CI: 0.82–0.85, $I^2 = 96.8\%$)].

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Conclusions: When compared with NBI, CLE significantly increased the per-lesion detection rate of esophageal neoplasia, HGD, and EAC in BE patients. Whether CLE is superior to NBI in neoplasia detection at per-patient level needs to be further investigated.

What is already known on this subject?

Previous studies revealed both NBI and CLE had high accuracy for diagnosis of neoplasia in patients with BE. However, whether there is any significant advantage in the clinical use of CLE compared with NBI is unclear.

What are the new findings?

Compared with NBI, CLE significantly increased the per-lesion detection rate of esophageal neoplasia, HGD, and EAC in BE patients.

How might it impact on clinical practice in the foreseeable future?

Since the higher detection rate, CLE should be extensively introduced to BE surveillance and early diagnosis of esophageal neoplasia

Introduction

Barrett's esophagus (BE) is the name given to the replacement of stratified squamous epithelium of the lower esophagus with metaplastic columnar glandular epithelium. [1] BE predisposes to the development of esophageal neoplasia, including high-grade dysplasia (HGD) and esophageal adenocarcinoma (EAC) [1]. BE can lead to a 30-fold to 50-fold increase in risk for EAC [1]. Regular clinical surveillance is recommended for BE patients in an attempt to identify neoplasia of the esophagus at an early and treatable stage [2]. Standard surveillance of patients with BE relies on the acquisition of random four-quadrant biopsies at set intervals along the BE segment, according to the Seattle protocol [3]. However, there are several recognized limitations of the current surveillance strategy in BE patients, including the invasive nature of the procedure of biopsy diagnosis, sampling error, inconsistencies in histological interpretation, and low diagnostic yield for early and focal neoplasia arising [4] Therefore, there is a pressing need for more accurate and less invasive techniques for the endoscopic diagnosis and surveillance of neoplasia, including HGD and EAC in patients with BE [5].

Several advanced diagnostic imaging techniques have emerged over the past decades to enhance the ability of imaging, diagnosis, and surveillance of neoplasia in patients with BE, including narrow-band imaging (NBI) and confocal laser endomicroscopy (CLE) [6]. NBI is a high-resolution, wide-field endoscopic technique that improves detection of HGD and EAC through enhanced visualization of the mucosal and submucosal vasculature without using exogenous dye. The current NBI devices (Olympus Corp, Tokyo, Japan) filter white light into two wavelengths (415 nm and 540 nm) that provide contrast between capillaries and the surrounding tissue in esophageal mucosa [7]. Following the first report, in 2004, of using NBI in patients with BE, by Hamamoto et al., [8] several studies have since assessed the accuracy of NBI for diagnosis of HGD and EAC [9—11]. However, these studies have resulted in inconsistent findings for the sensitivity (47—100%) and specificity (72—100%) of NBI [9—11].

CLE is an advanced endoscopic technique providing high-resolution microscopic images with subcellular resolution, which are similar to images provided by light microscopy and histopathology [12]. CLE has now been widely applied to diagnosis of colorectal cancer, skin cancer, oral cancer, conjunctival tumors, and gastrointestinal dysplasia [13—17]. There are two commercially available CLE systems used to detect neoplasia in patients with BE: probe-based CLE (pCLE) (Mauna Kea Technologies, Paris, France) and endoscope-based CLE (eCLE) (Pentax Medical Corporation, Tokyo, Japan) [18]. As the probe can be inserted through the working channel of any standard endoscope, pCLE is more convenient and practical than eCLE in clinical practice [18,19]. Challenges for the clinical application of CLE have been miniaturization and integration of imaging technology into the endoscopic equipment.

Currently, several systematic reviews have been conducted to assess the pooled accuracy of NBI and CLE for diagnosis of neoplasia, including HGD and EAC in patients with BE [20—22]. A meta-analysis, including 502 patients, showed that pooled per-patient sensitivity and specificity of NBI for identifying HGD were 91% and 95%, respectively [20]. Another meta-analysis [21] including 473 patients reported that pooled sensitivity and specificity of CLE for the diagnosis of neoplasia, including HGD and EAC in patients with BE were 89% and 83%, respectively. A meta-analysis performed by the American Society for Gastrointestinal Endoscopy Technology Committee showed diagnosis accuracy of NBI and CLE were similar with pooled sensitivity of 94.2% and 90.4%, specificity of 94.4% and 98.3% [22].

However, there is still a lack of evidence from the direct comparison of NBI and CLE for the same patients, and so it is still unclear whether there is any significant advantage in the clinical use of NBI compared with CLE, or CLE compared with NBI. For this reason, we performed a systematic literature review and meta-analysis to evaluate the accuracy of within-patient comparisons of the two endoscopic imaging methods, NBI, and CLE, in the diagnosis of neoplasia, including HGD and EAC, in patients with BE.

Methods

This meta-analysis was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses

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