Introduction

Recently endoscopic image quality has improved as the equipment has advanced technologically, including digital chromoendoscopy, high resolution and magnification endoscopy. Although these technologies improve the visualization of the lesion, biopsy of the suspicious lesion should be done for confirmative diagnosis. Furthermore, in case of lesions was not exactly determined by white light endoscopy, many of random biopsy are needed. Random biopsy is time-consuming procedure and can be associated with complications, including bleeding and perforation. Critically random biopsy may miss the fundamental lesion despite of laborious efforts and costs.

Confocal laser endomicroscopy (CLE) enabled endoscopists to collect real-time in vivo histological images, or “virtual biopsies”, of the gastointestinal mucosa during endoscopy, and has stimulated significant interest in the application of this technique in clinical gastroenterology. Here I will focus on the clinical applications of CLE in gastrointestinal tract.

Clinical applications of CLE in GI tract

1. Esophagus

Esophagus is the most well-known organ where the CLE showed clinical usefulness. Among them, Barrett’s esophagus is a disease where clinical trials have most established the yield of CLE. For the surveillance of Barrett’s esophagus random biopsy suggested by Seattle protocol was used from long time ago despite the concerns that this would not be very helpful. A multicenter randomized controlled trial showed that sensitivity of the diagnosis of high-grade dysplasia or early cancer increased by adding NBI and probe based-CLE (pLCE): 34.2% by high-definition white-light endoscopy alone (HD-WLE), 45.0% by HD-WLE or narrow band image (NBI) and 75.8% by HD-WLE, NBI or pCLE. In this study, pCLE combined with HD-WLE significantly improved the ability to detect neoplasia in Barrett’s esophagus compared with HD-WLE. pCLE may allow better informed decisions to be made for the management of Barrett’s esophagus.

2. Colon

In the colon, CLE was tested in several clinical applications including differential diagnosis of polyp
(neoplastic vs. hyperplastic polyp), detection of dysplastic lesion from background of chronic inflammatory bowel disease, and predicting the relapse of inflammatory bowel disease. In the differential diagnosis of neoplastic vs. hyperplastic polyps in the colon, the pCLE had higher sensitivity compared to virtual chromoendoscopy when considering histopathology as gold standard (91% vs 77%; \( P = .010 \)) and modified gold standard (88% vs 76%; \( P = .037 \)). In other two clinical indications, data did not show clear efficacy of pCLE or there is too few data to draw a conclusion.

3. Stomach

CLE was tried to characterize dysplasia or cancer and to find the risk factors of gastric cancer such as intestinal metaplasia and existence of *Helicobacter pylori* in vivo. Sensitivity and specificity of gastric intestinal metaplasia were both >90% by the interpretation of experienced endoscopists or in combination with virtual chromoendoscopy. When pCLE based biopsy was compared to conventional endoscopic forceps biopsy, the overall accuracy for the diagnosis of adenocarcinoma was 91.7% for pCLE and 85.2% for conventional biopsies (\( P = .065 \)). The combined accuracy of conventional endoscopic biopsies and pCLE was 98.1%. However there is very little data about efficacy of pCLE with virtual chromoendoscopy with magnification in determining gastric dysplasia and carcinoma.

4. Pancreas and biliary tract

There is few tools to effectively determine the nature of pancreatobiliary stricture till now. In a large prospective multicenter trial of pCLE during ERCP for pancreatobiliary stricture, the sensitivity, specificity, positive-predictive value, and negative-predictive value of pCLE for detecting cancerous strictures were 98%, 67%, 71%, and 97%, respectively, compared with 45%, 100%, 100%, and 69% for index pathology. This resulted in an overall accuracy of 81% for pCLE compared with 75% for index pathology. Accuracy for combination of ERCP and pCLE was significantly higher compared with ERCP with tissue acquisition (90% vs 73%; \( P = .001 \)).

For the differential diagnosis of pancreatic cysts, needle-based CLE (nCLE; AQ-Flex19; Mauna Kea) under EUS guidance is invested recently.

**Conclusions**

CLE is new technology which can enable in vivo histological evaluation during endoscopy. Clinical implication of CLE is growing as clinical efficacy of CLE is evident in some clinical situation. Currently clinical benefit for surveillance of Barrett’s esophagus is the most noticeable, however experimental attempt is expanding its clinical implications to functional or molecular imaging.

**References**