Confocal Microscopy in the Esophagus and Stomach

Joo Ha Hwang, M.D., Ph.D.
Division of Gastroenterology, Department of Medicine, University of Washington, Seattle, USA

Introduction

Probe based confocal microscopy (pCLE) is actively being investigated for applications in the esophagus and stomach. The use of pCLE allows for real-time in vivo microscopy to evaluate the microarchitecture of the mucosal epithelium. It appears to be particularly useful in identifying mucosal dysplasia and early malignancies that cannot be clearly distinguished using high-definition white light endoscopy, chromoendoscopy, or magnification endoscopy.

Confocal Microscopy in Barrett’s Esophagus

The current method for surveillance of Barrett’s esophagus (BE) with targeted biopsies of endoscopically visible lesions followed by four-quadrant biopsies every 1-2 cm (depending on whether surveillance is for dysplastic or non-dysplastic BE) is both time consuming and expensive. Society guidelines recommend endoscopic surveillance of all patients with established BE. However, adherence rates to surveillance biopsy guidelines have been reported to be as low as 51% in the community setting. Therefore, a method that improves on the efficiency (cost and time) of performing endoscopic surveillance in patients with BE would have a positive impact on the management of patients with Barrett’s esophagus from both a clinical and economic standpoint. Probe-based confocal laser endomicroscopy (pCLE) is currently being investigated as a possible tool to image BE. Criteria for differentiating non-dysplastic BE from dysplastic BE and adenocarcinoma have been established and validated. The use of pCLE theoretically will allow survey a greater number of locations within the esophagus while reducing the total number of biopsies taken and increasing the yield of the biopsies taken. A randomized multi-center trial using pCLE in BE demonstrated pCLE to be superior to high-definition white light (HDWL) endoscopy for detection of BE HGD, and allowed a significant reduction in the number of biopsies.

Another area that pCLE has potential to impact management of patients with BE is in patients undergoing ablative therapy. Ablative therapy is now recommended for patients with BE with flat HGD. These patients often require multiple ablation sessions. Probe-based CLE may play a role in guiding ablative therapy both prior to ablation and during ablation sessions. A multi-center randomized clinical trial comparing HDWL endoscopy...
to HDWL + pCLE in the detection of residual BE in patients who have had ablative therapy was recently performed. As ablative therapy for BE increases, pCLE may develop a greater role in guiding and assessing therapy.

Confocal Microscopy for Assessment of Gastric Intestinal Metaplasia, Dysplasia, and Cancer

The potential applications for using pCLE in the stomach are similar to that of the esophagus, especially in populations with a high incidence of gastric cancer. The current method for gastric cancer screening using endoscopy typically involves a careful visual examination with white light endoscopy with targeted biopsies of endoscopically visible lesions followed by random biopsies in various regions of the stomach (antrum, body, and incisura) is both time consuming and expensive. In addition, the use of chromoendoscopy, narrow band imaging, or other digital enhancement techniques have increased the accuracy of detecting gastric intestinal metaplasia (GIM) and early gastric cancer (EGC); however, these techniques remain inadequate with significant interobserver variability. In addition, suspicious areas still require biopsy to confirm the presence of GIM or EGC and no studies have demonstrated the ability to accurately diagnose dysplasia. The use of pCLE is currently being investigated for diagnosing GIM, dysplasia, and EGC in vivo with results demonstrating a high sensitivity (98%) for GIM detection. Similar to the applications in BE, pCLE has the potential to identify dysplasia and EGC in vivo to increase the yield of biopsies and to identify lesions that may warrant endoscopic resection. Further studies are needed to evaluate this potentially valuable application of pCLE.

Conclusions

Probe-based CLE is a promising technology with several potential applications in the management of patients with BE and gastric intestinal metaplasia. Studies have demonstrated the ability of pCLE to diagnose dysplasia while reducing the total number of biopsies. However, in order to achieve wider adoption of this technology, further studies will need to be performed to demonstrate that the strategy of targeted biopsies based on pCLE findings is as accurate. In addition, the role of pCLE in guiding therapy warrants further investigation.

References