Introduction

Although conventional histopathological diagnosis is considered the gold standard, several novel imaging modalities developed in the past few years allow endoscopists to accurately predict polyp histology in real-time. Dye-based and electronic chromoendoscopy (NBI, i-SCAN, FICE) have been the most used and studied, but other promising imaging systems are emerging.

Main Body

Autofluorescence (AFI) is a wide-field imaging technology. It is based on the principle that illumination of tissue by short-wavelength lights results in stimulation of endogenous fluorophores (NAD, hemoglobin, collagen). When excited electrons return to baseline state, light is emitted and captured, resulting in a pseudo-colored image which depends on fluorophore composition of tissue. Initial experience with AFI has been somewhat disappointing, with specificity of only 69% to distinguish neoplastic from non-neoplastic polyps in meta-analysis.1 However, a more recently developed second generation AFI incorporates a brighter lamp and image-processing algorithm, allowing for less flickering and color splitting, higher resolution images, and less noise interference. Initial experience with the second generation AFI shows significantly improved performance in real-time histology compared to the older system.2

Endocytoscopy (EC) is a narrow-field technology which provides ultra-high magnification (x 1390) of tissue, after staining for nuclear and cytoplasmic elements. EC has shown high accuracy in the distinction between neoplastic and non-neoplastic polyps. In one randomized controlled trial, EC was non-inferior to standard biopsy when compared to the histopathological gold standard.3 A new computer-aided diagnosis system demonstrates high accuracy, in addition to efficiency (diagnosis in about 0.3 second per image), and has potential as a teaching tool for non-expert endoscopists.4

Confocal Laser Endomicroscopy (CLE) is a narrow-field technology which uses laser instead of visible light and intravenous fluorescent agent to visualize and contrast cellular, subcellular, connective tissue and vessel architecture at high resolution. Two types exist: probe-based (pCLE) and endoscope-based (eCLE). When applied in real-time to distinguish neoplastic from non-neoplastic polyps, CLE has shown excellent performance...
characteristics, with sensitivity and specificity of about 94% and 95%, respectively. The learning curve for CLE does not appear steep, and the technology has additional application potential in inflammatory bowel disease for grading of inflammation and for dysplasia surveillance. Limitations of current CLE systems include cost and time consumption.

Molecular imaging enhanced electronic imaging has shown promise to enhance polyp detection, and potentially characterization.

Conclusions

Real-time histology depends on accurate, practical, and cost-effective imaging technology, and in this context, dye-based and especially electronic chromoendoscopy hold a dominant position. However, other technologies such as autofluorescence, endocytoscopy, and confocal endomicroscopy are promising “rising stars”. Additional study is required to define the place of these new technologies in routine clinical practice.

References