Chromocolonoscopy

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KEYWORDS

• Chromocolonoscopy • Chromoendoscopy • Advanced imaging
• Screening colonoscopy • Inflammatory bowel disease • Society guidelines

KEY POINTS

- Chromoendoscopy techniques improve the visualization of mucosal structures.
- Chromoendoscopy differentiates neoplastic from non-neoplastic polyps in the average-risk population with high accuracy but does not distinguish both reliably in inflammatory bowel disease (IBD).
- Dye-based chromoendoscopy improves neoplasia detection in colonic IBD surveillance, with the potential to replace random colonic biopsies as the preferred surveillance option.

CHROMOENDOSCOPY

Chromoendoscopy refers to image-enhanced endoscopy through the use of dye spraying or optical techniques. Although initially limited to dye spraying, over the last decade, equipment-based imaging-enhanced optical colonoscopy techniques have been developed that are commonly referred to as *dyeless* or *digital chromoendoscopy*. Chromoendoscopy techniques improve the visualization of mucosal structures and, thus, improve recognition of borders and surface topography of pathologic lesions compared with standard white light colonoscopy. This review focuses on the role of these imaging techniques in the detection of colonic neoplasia.

Why Do We Need Chromoendoscopy?

Polypectomy of colonic neoplasms is the backbone of colorectal cancer (CRC) screening and health prevention measures, as it is associated with a 53% reduction of mortality.[1,2] However, colonoscopy does not fully protect against CRC, with interval CRCs representing between 2% and 6% of all CRCs.[3] There is evidence that most interval cancers arise from missed, rather than new, colorectal neoplastic lesions.[4]

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Adenoma miss rates average 24% and are highest for diminutive adenomas (26%) compared with adenomas greater than 10 mm (2%).[5,6] The reasons for missing colorectal neoplasms during colonoscopy include inadequate bowel preparation; presence of flat polyps, which often resemble normal mucosa at first glance; and technical challenges of colonoscopy limiting mucosal visualization behind folds and in the right colon.[7–9] Fortunately, flat neoplasms, which have a prevalence of 5% to 10%, appear preferentially in the right colon allowing endoscopists to focus their attention in this region when looking for such polyps.[10–12] Sessile serrate adenoma/polyps account for an important subtype of mostly flat and right colonic neoplastic lesions, of which 9.5% contain high-grade dysplasia.[13]

Since Kaminski and colleagues[14] and Corley and colleagues[15] found that a low adenoma detection rate (ADR) is an independent predictor for interval CRC, significant attention has been directed at increasing the ADR.[14,15] Unfortunately, the introduction of high-definition (HD) colonoscopy has resulted in a diagnostic average gain of only 3.8% compared with standard white light colonoscopy.[16] The marginal increase of ADR is mainly limited to diminutive polyps.[17]

Chromoendoscopy has emerged as a method to improve ADR for both average and high-risk CRC screening populations, including those with inflammatory bowel disease (IBD). Chromoendoscopy may also have a role in distinguishing between neoplastic and non-neoplastic colonic lesions allowing for a resect-and-discard strategy for diminutive colonic lesions bypassing formal pathologic assessment.[18]

Application of Dye for Dye-Based Chromoendoscopy

Dye-based chromoendoscopy uses color dyes that are either absorbed by the mucosa (vital dye) or remain on the mucosal surface (nonvital dye). The dye can be applied in a nontargeted fashion to the entire colonic mucosa (pan-chromoendoscopy) or to target certain colonic sections to define borders and predict histology of an area of interest. The two most common dyes used for staining are indigo carmine and methylene blue. Both dyes seem to be equally effective in enhancing dysplasia detection (**Table 1**).

Indigo Carmine

Indigo carmine is not absorbed by cells (nonvital dye). It coats the mucosa highlighting mucosal pits, grooves, erosions, depressions, and subtle colonic contour irregularities. Its deep-blue color enhances the visualization of mucosal structures and allows better distinguishing of borders, depth, and surface topography of lesions.[19]

Methylene Blue

Methylene blue is actively absorbed by small intestine and colonic epithelium (vital dye). This absorption requires waiting about 60 seconds before adequate staining is achieved. Colonic dysplastic and inflamed tissue absorb less or no dye resulting in different staining characteristics compared with normal mucosa. The different staining characteristics provides better resolution to distinguish borders and surface topography of lesions, similar to the application of indigo carmine.[19]

Crystal Violet

Crystal violet is also a vital dye that stains colonic crypts by being preferentially absorbed by the crypts of Lieberkühn. Similar to methylene blue, crystal violet is absorbed by noninflamed mucosa better than by neoplasia and inflamed tissue. Crystal violet was shown to be useful in characterizing pit patterns, particularly in conjunction with indigo carmine.[19,20] This dye is not used commonly in practice.