

## The role of endoscopy in inflammatory bowel disease

*This is one of a series of statements discussing the use of GI endoscopy in common clinical situations. The Standards of Practice Committee of the American Society for Gastrointestinal Endoscopy (ASGE) prepared this text. In preparing this guideline, a search of the medical literature by using PubMed from January 1980 through March 2014 was performed by using the keywords “inflammatory bowel disease,” “Crohn’s disease,” “ulcerative colitis,” “gastrointestinal endoscopy,” “endoscopy,” “endoscopic procedures,” and “procedures.” Pertinent studies published in English were reviewed, and additional references were obtained from the bibliographies of the identified articles and from recommendations of expert consultants. When little or no data existed from well-designed prospective trials, emphasis was given to results from large series and reports from recognized experts. Guidelines for appropriate use of endoscopy are based on a critical review of the available data and expert consensus at the time that the guidelines are drafted. Further controlled clinical studies may be needed to clarify aspects of this guideline. This guideline may be revised as necessary to account for changes in technology, new data, or other aspects of clinical practice. The recommendations were based on reviewed studies and were graded on the strength of the supporting evidence by using the GRADE criteria<sup>1</sup> (Table 1).*

*This guideline is intended to be an educational device to provide information that may assist endoscopists in providing care to patients. This guideline is not a rule and should not be construed as establishing a legal standard of care or as encouraging, advocating, requiring, or discouraging any particular treatment. Clinical decisions in any particular case involve a complex analysis of the patient’s condition and available courses of action. Therefore, clinical considerations may lead an endoscopist to take a course of action that varies from these guidelines.*

Endoscopy is fundamental to the care of patients with inflammatory bowel disease (IBD) and is essential for diagnosing and treating both Crohn’s disease (CD) and ulcerative colitis (UC). Endoscopy is used to make an initial diagnosis of IBD, distinguish CD from UC, assess disease extent and activity, monitor response to therapy, survey

for dysplasia, and provide endoscopic treatment. The purpose of this document is to update a previous ASGE Standards of Practice Committee Guideline providing a practical strategy for the use of endoscopy in the evaluation and management of patients with IBD.<sup>2</sup>

### COLONOSCOPY WITH ILEOSCOPY

Colonoscopy with ileoscopy allows direct visualization and biopsy of the mucosa of the rectum, colon, and terminal ileum. Prospective studies have demonstrated that colonoscopy with ileoscopy is a safe procedure with a low rate of adverse events in patients with IBD.<sup>3</sup> Relative contraindications to performing endoscopic procedures in patients with IBD include severe colitis and toxic megacolon. Unless contraindicated, a full colonoscopy with intubation of the terminal ileum should always be performed during the initial evaluation of patients with clinical presentations suggestive of IBD. Sodium phosphate–based bowel cleansing regimens<sup>3-6</sup> and nonsteroidal anti-inflammatory drug (NSAID) use should be discouraged before the examination,<sup>7</sup> because both can cause mucosal changes mimicking IBD. Ideally, at least 2 biopsy specimens should be taken from 5 sites throughout the examined bowel, including the ileum and rectum, during the initial endoscopic evaluation.<sup>8</sup>

Patients with other colitides can have clinical presentations and endoscopic features similar to those observed with IBD. These colitides include infectious colitis, drug-induced colitis, ischemic colitis, and segmental colitis associated with diverticulosis. The value of endoscopy alone in distinguishing IBD from non-IBD colitides is limited,<sup>9</sup> and additional clinical and histologic data often are required.<sup>10</sup>

The acquisition of detailed information from an index colonoscopy before initiating therapy is important for differentiating CD and UC. Therapy, once initiated, may obscure discriminating features of CD from UC such as segmental colitis, patchy distribution of inflammatory changes, and rectal sparing.<sup>11,12</sup> The most useful endoscopic features consistent with CD rather than UC are skip lesions (segmental colitis), rectal sparing, involvement of the terminal ileum, identification of the internal opening of a fistula tract, and anal or perianal disease.<sup>13-16</sup> Other endoscopic features suggestive of CD include aphthous ulcers, deep ulcers, serpiginous ulcers, and cobblestoning.<sup>17,18</sup> Endoscopic features suggestive of UC include diffuse and continuous inflammation proximal to the anal canal, granularity, loss of the normal vascular pattern,

TABLE 1. GRADE system for rating the quality of evidence for guidelines<sup>1</sup>

Quality of evidence	Definition	Symbol
High	Further research is very unlikely to change our confidence in the estimate of effect.	⊕⊕⊕⊕
Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.	⊕⊕⊕○
Low	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.	⊕⊕○○
Very low	Any estimate of effect is very uncertain.	⊕○○○

friability, superficial ulcerations, and a line of demarcation, which is described as an abrupt transition between normal and abnormal mucosa at the proximal extent of the colitis.<sup>17</sup> Stricture disease is rare in UC and should raise the possibility of CD or malignancy.<sup>19</sup> However, none of these endoscopic features are specific for CD or UC.

Ileoscopy is fundamental in distinguishing true CD ileitis from UC with backwash ileitis. The latter demonstrates a mild mixed inflammatory infiltrate of the lamina propria without crypt distortion, atrophy, or epithelial changes.<sup>16,17,20</sup> Backwash ileitis occurs in up to 25% of patients with UC with pancolitis.<sup>17</sup> Endoscopic features that favor backwash ileitis include a short, contiguous segment of mildly inflamed ileum without stricture, stenosis, or significant ulcerations in which the inflammation appears to be a continuation of the colitis in the cecum.<sup>17,21</sup> Features that favor CD ileitis include extensive inflammation, inflammation in the absence of pancolitis, patchy inflammation, inflammation that is of greater severity than the cecal inflammation, and discrete ulcers or stricturing of the terminal ileum or ileocecal valve.<sup>17,21</sup>

The finding of inflammatory changes around the appendiceal orifice (cecal patch or periappendiceal patch) in the setting of UC with an otherwise normal right side of the colon should not be misdiagnosed as CD.<sup>22,23</sup> The clinical implication of a cecal patch is not clear, and both prospective and retrospective studies have demonstrated that patients with UC who have a cecal patch have a similar rate of remission, relapse, and proximal extension compared with those with no cecal patch.<sup>22,24</sup>

Colonoscopy, together with other diagnostic modalities, can differentiate CD from UC in approximately 90% of patients.<sup>13,25</sup> Patients with colon disease that cannot be classified into one of the two major forms of IBD are defined as having IBD, type unclassified (IBD-U).<sup>26</sup> The term *indeterminate colitis* is reserved for patients who have undergone colectomy and remain unclassified after pathology evaluation of the resection specimen.<sup>26</sup> In a prospective study of more than 350 patients with IBD followed

for >22 months, the index colonoscopy was accurate in distinguishing CD from UC in 89% of cases.<sup>13</sup> Among the remaining patients, the diagnosis was revised in 4%, whereas 7% continued to be categorized as IBD-U. In one multicenter, population-based, follow-up study of 843 cases of IBD in which 739 patients had clinical data available for 5 full years of follow-up, only 9% of patients initially classified as UC or CD had a change in diagnosis.<sup>25</sup> A wide range (5%-30%) in prevalence rates of IBD-U in various pediatric studies<sup>27,28</sup> is considered reflective of variation in classification criteria.<sup>17</sup>

Mucosal biopsy is a critical component of the endoscopic evaluation of patients with suspected IBD and may be necessary to differentiate IBD from other causes of colitis. Because IBD is a chronic disease, histologic features of chronic inflammation can help to make the diagnosis.<sup>10,15,17,18,29,30</sup> Although there is no single pathology criterion that can definitively establish a diagnosis of IBD, biopsy specimens are critical for differentiating CD from UC and for differentiating IBD from other colitides, such as acute self-limited colitis.

During initial diagnostic endoscopic evaluation, specimens should be obtained from both diseased and normal-appearing mucosa.<sup>31-33</sup> Biopsy specimens from different locations should be separately labeled. Features suggesting chronicity include architectural distortion, basal plasmacytosis, increased cellularity of the lamina propria, pyloric gland metaplasia, and Paneth cell metaplasia in the left side of the colon.<sup>10,16,17,30,34,35</sup> Skip areas of macroscopically and microscopically normal mucosa support a diagnosis of CD.<sup>13,15</sup> Although the presence of epithelioid granuloma suggests CD, granulomas are not pathognomonic for CD and can be found in other diseases such as UC in association with crypt injury, tuberculosis, fungal and bacterial infections, diversion colitis, sarcoidosis, and foreign body reaction.<sup>15,36-38</sup> Only granulomas in the lamina propria, not associated with crypt injury, support a diagnosis of CD.<sup>15</sup> The frequency of detection of granulomas varies from 13.6% to 55.6% of endoscopic

**TABLE 2. Revised Montreal Classification<sup>26</sup>**

<b>Ulcerative colitis</b>		
<b>Classification</b>	<b>Definition</b>	<b>Maximal endoscopic involvement</b>
E1	Proctitis	Limited to rectum
E2	Left-sided	Limited to colonic mucosa distal to splenic flexure
E3	Extensive	Extends proximal to splenic flexure
<b>Crohn's disease</b>		
<b>A: Age of onset</b>	<b>L: Location</b>	<b>B: Behavior</b>
A1 = ≤16 y	L1 = ileal	B1 = non-stricturing, non-penetrating
A2 = 17-40 y	L2 = colonic	B2 = stricturing
A3 = >40 y	L3 = ileocolonic	B3 = penetrating
	L4* = isolated upper GI	+ p = perianal disease is present

\*L4 can be added to L1-3 as a modifier when upper GI Crohn's disease is also present.

biopsy specimens.<sup>39-41</sup> Higher detection rates of granulomas can be achieved when biopsy specimens are taken from the edge of ulcers and aphthous erosions.<sup>42</sup>

In UC, the extent of endoscopic inflammation can be classified as proctitis, left-sided colitis (inflammation distal to the splenic flexure), or extensive colitis. (inflammation proximal to the splenic flexure). This classification system is supported by the revised Montreal Classification (Table 2).<sup>8,26</sup> Macroscopic proximal extension of proctitis or left-side colitis occurs in approximately 20% to 50% of adult patients with UC.<sup>43,44</sup> More than 80% of children with UC have extensive inflammation during the initial colonoscopy.<sup>28</sup> However, the absence of endoscopic inflammation may not necessarily correlate with the absence of histologic inflammation. Colonoscopic imaging can underestimate the extent of disease as compared with histology.<sup>45</sup> Obtaining mucosal biopsy specimens may be necessary to determine the extent of colon that is inflamed, which in turn can aid in determining prognosis, direct appropriate medical and surgical therapy, and stratify risk for dysplasia.<sup>46-48</sup>

There are numerous disease activity scores for adult patients with IBD that are based on clinical symptoms or endoscopic findings.<sup>49-51</sup> To date, there remains poor correlation between available symptom scores in adults and the degree of endoscopic inflammation as well as between clinical remission and mucosal healing.<sup>52,53</sup> Endoscopy may be helpful in predicting the need for intensified medical therapy or surgical intervention<sup>54</sup> and has an established role in the postoperative surveillance of CD.<sup>51,55</sup> Endoscopic scoring systems for both UC and CD as well as postoperative CD, can aid in the reporting of endoscopic findings and assessing endoscopic severity

of disease (Supplemental Tables A-E, available online at [www.giejournal.org](http://www.giejournal.org)). None of these scoring systems has been accepted as the standard, and preference of one system over another remains at the discretion of the practitioner. Consistent among these scoring systems are descriptors that should be included in all endoscopy reports to aid in clinical decision making, which include extent of disease, continuous involvement versus skip areas of involvement, and the presence of erythema, granularity, friability, erosions, ulcerations, and loss of vascular pattern (in CD, by colonic segment). In children, the Pediatric Ulcerative Colitis Activity Index<sup>56,57</sup> has been shown to have excellent correlation with colonoscopic appearance. Nevertheless, even in the assessment of children receiving immunomodulator and biologic therapy for IBD, objective endoscopic findings may be required to assess response to therapy.

In more recent clinical trials, the documentation of endoscopic mucosal healing has become a critical component of outcome measurement, although a validated definition of mucosal healing in IBD patients is lacking.<sup>58-62</sup> Mucosal healing may alter the natural history of both CD and UC by reducing hospitalization and the lifetime risk for surgery,<sup>13-16,61,63-65</sup> although the necessity of treating to mucosal healing is controversial in otherwise asymptomatic patients with mild disease.<sup>58,62,66-74</sup>

## **FLEXIBLE SIGMOIDOSCOPY**

Flexible sigmoidoscopy may provide useful information in patients with IBD; however, it is important to recognize that flexible sigmoidoscopy is inadequate to evaluate

isolated proximal colitides. Flexible sigmoidoscopy should be performed preferentially when colonoscopy is considered high risk (eg, fulminant colitis).<sup>8</sup> It also may be helpful to define disease activity in patients with established UC and in the evaluation for superimposed colitides (eg, cytomegalovirus, *Clostridium difficile* infections, or ischemic colitis) as etiologies of recurrent or persistent symptoms.<sup>34,57</sup> Flexible sigmoidoscopy also may be valuable before immunomodulator rescue therapies are started in adults and children with steroid refractory disease to evaluate for cytomegalovirus or other opportunistic infections.<sup>57,75</sup>

## EGD

EGD can be useful in the evaluation of patients with CD and IBD-U. Upper GI tract involvement (proximal to the ligament of Treitz) occurs in up to 16% of patients with CD<sup>76,77</sup> and can involve the esophagus, stomach,<sup>78</sup> and duodenum.<sup>39,78-80</sup> Endoscopic findings of upper GI CD include erythema, aphthous lesions, ulcerations, strictures, and fistula openings.<sup>76,81</sup> Gastritis without aphthae is not indicative of CD and can be seen in patients with UC.<sup>17</sup> Histologic findings consistent with CD include mucosal edema, inflammation, erosions, ulcerations, attenuated and deformed duodenal villi, and granulomas.<sup>76</sup> Upper GI tract biopsy specimens may be more likely to display granulomas (40%-68%)<sup>76,78,79,82</sup> than colon biopsy specimens (13.6%-55.6%).<sup>39-41</sup>

In patients with IBD-U, upper GI tract involvement can facilitate a diagnosis of CD.<sup>15</sup> At least 2 biopsies should be taken from the esophagus, stomach, and duodenum during EGD for suspected upper tract IBD.<sup>83</sup> There is a strong correlation between upper GI tract CD and the presence of disease in the terminal ileum, colon, or perianal area<sup>84</sup>; therefore, routine EGD is not recommended in adult patients suspected of having CD.<sup>15</sup> Additionally, patients with UC may have upper GI inflammation, such as esophagitis, gastritis, or diffuse duodenitis.<sup>82,85,86</sup> Histologic findings in upper GI tract biopsy specimens from patients with UC commonly include active or chronic inflammation with focal gastritis, gastric basal mixed inflammation, superficial plasmacytosis, diffuse chronic duodenitis, villous atrophy, and intraepithelial lymphocytosis.<sup>82,85</sup>

Contrary to the experience observed in adults, studies in pediatric IBD have shown that isolated upper GI tract granulomas occur in 12% to 28% of newly diagnosed pediatric patients with CD with no other findings on colonoscopy with ileoscopy.<sup>17</sup> EGD is increasingly performed as part of the initial evaluation of children with suspected IBD.<sup>87,88</sup> The European Crohn's and Colitis Organization (ECCO) and European Society for Pediatric Gastroenterology, Hepatology, and Nutrition recommend EGD for all pediatric patients, regardless of upper GI symptoms,

during the initial diagnostic work-up of suspected pediatric IBD.<sup>89,90</sup>

## CAPSULE ENDOSCOPY

The performance of capsule endoscopy (CE) allows direct and minimally invasive visualization of the small-bowel mucosa and has a high diagnostic yield in patients with suspected or established CD.<sup>91</sup> It may be particularly useful in identifying superficial lesions not detected by traditional endoscopy and radiography. Findings on CE consistent with CD include erythema, villous atrophy, erosions, ulcerations, and strictures.<sup>92</sup> Data from retrospective studies, case series, and prospective studies have shown that CE is useful for the diagnosis of CD when small-bowel radiology and ileoscopy are unsuccessful or have negative results.<sup>93,94</sup> The diagnostic yield of CE ranges from 26% to 71%, depending on the clinical setting.<sup>17,95</sup> In one prospective, blinded, 4-way comparison trial of CE, CT enterography, colonoscopy with ileoscopy, and small-bowel follow-through for detecting active small-bowel CD, CE had a sensitivity (83%) comparable with CT enterography (83%) but the lowest specificity (53%) of all modalities.<sup>95</sup> A recent meta-analysis of prospective studies demonstrated that CE has a significantly higher diagnostic yield for both suspected and established CD when compared with small-bowel follow-through and CT enterography and a comparable yield to magnetic resonance elastography.<sup>96</sup> The absence of CD findings on CE is associated with a negative predictive value of 96% to 100%.<sup>94,97,98</sup>

In patients with established CD, retrospective case series support the use of CE for further evaluation of unexplained GI symptoms.<sup>99-101</sup> In one study, an abnormal CE was found in 52% of patients, resulting in changes in immunosuppression regimens or initiation of a biologic agent.<sup>101</sup> Another study reported that 62% of patients had a change in medical management resulting from CE.<sup>99</sup>

Few studies have evaluated the benefit of CE in the evaluation of IBD-U. The largest retrospective study found that 19 of 120 patients (15%) with UC with atypical features or IBD-U had CE findings consistent with CD.<sup>102</sup> Two smaller prospective studies suggest that although CE may help reclassify a proportion of patients with IBD-U as CD, clinical management is not affected, and the absence of findings on CE does not exclude a diagnosis of CD.<sup>103,104</sup> There is limited evidence for performing CE in the preoperative evaluation of patients with UC or IBD-U before ileal pouch anal anastomosis. One prospective study of 68 patients (66% with UC, 34% IBD-U) demonstrated no statistical association between the results of preoperative CE and subsequent development of acute or chronic pouchitis, de novo CD, or overall pouch inflammation.<sup>105</sup>

The main limitations of CE in the assessment of small-bowel CD are the lack of uniform criteria for diagnosing



CD, the inability to obtain tissue biopsies or perform therapeutic intervention, and the risk of capsule retention. It is important to note that the finding of mucosal breaks in the small bowel is not necessarily diagnostic of CD.<sup>93</sup> A variety of disease entities can cause small-bowel mucosal ulcerations, such as infection, ischemia, radiation injury, and drug-induced injury.<sup>92</sup> NSAID-induced small-bowel mucosal injury can be detected within 1 to 2 weeks of ingestion.<sup>106,107</sup> Recent guidelines from the European Society of Gastrointestinal Endoscopy (ESGE) and ECCO recommend discontinuing NSAIDs for 1 to 2 months before performing CE to minimize misdiagnosis.<sup>49,91</sup> In addition, it has been reported that up to 14% of healthy individuals may have mucosal breaks and other nonspecific lesions identified on CE.<sup>108</sup> The capsule endoscopy scoring index (Lewis score) for small-bowel mucosal inflammation<sup>109</sup> and the development and validation of the CE Crohn's Disease Activity Index<sup>110</sup> may have a role in standardizing reporting of small-bowel mucosal injury in CD (Supplemental Table A, available online at [www.giejournal.org](http://www.giejournal.org)).

Capsule retention because of small-bowel strictures occurs in up to 13% of patients with suspected or known CD.<sup>111-113</sup> In pediatric patients, a single center review suggested an increased risk of capsule retention at the time of initial presentation and during assessments of suspected small-bowel disease.<sup>114</sup> A before-ingestion radiologic study (CT enterography, magnetic resonance enterography, or small-bowel follow-through) or patency capsule examination is recommended in patients with established CD.<sup>49,91</sup> Patients with CD obstructive symptoms or with endoscopic and radiographic evidence of small-bowel narrowing, especially if associated with failure to pass a patency capsule, should not undergo CE. A retained capsule above a CD stricture may be amenable to anti-inflammatory medications or retrieval with balloon assisted enteroscopy,<sup>115</sup> but if not, surgery may be required for capsule retrieval. Retained capsules also may be used to help guide surgical therapy of symptomatic strictures.<sup>92,116</sup>

## ENTEROSCOPY

Enteroscopy has a limited role in the initial evaluation of patients with known or suspected IBD because of the high diagnostic yields of less-invasive modalities such as CE and radiologic small-bowel imaging. In patients with abnormalities seen on other imaging studies that are within reach, enteroscopy allows endoscopic and histologic evaluation and the potential for therapeutic interventions such as hemostasis, stricture dilation, or foreign body retrieval.<sup>92,117,118</sup> Endoscopic strategies for small-bowel evaluation in CD include push enteroscopy or device-assisted enteroscopy, such as single-balloon enteroscopy and double-balloon enteroscopy as well as intraoperative endoscopy.<sup>92,119</sup>

In patients with suspected CD, the overall yield of balloon-assisted enteroscopy ranges from 30% to 59%, with an adverse event rate of diagnostic enteroscopy of approximately 1%.<sup>92,118,120</sup> A systematic review of diagnostic double-balloon enteroscopy found a pooled detection rate of 63.4% (95% confidence interval [CI], 42%-82.3%) in patients with definite or suspected CD, a minor adverse event rate (ie, throat discomfort, abdominal distension, fever) of 9.1%, and a major adverse event rate (ie, perforation, pancreatitis, bleeding, and aspiration pneumonia) of 0.72%.<sup>121</sup> Although a recent meta-analysis demonstrated a comparable diagnostic yield of inflammatory lesions for both double-balloon enteroscopy (16%) and CE (18%), CE often is the preferred initial test because it is noninvasive, can view the entire small bowel, and can help guide initial approach for double-balloon enteroscopy.<sup>118,122</sup>

In one prospective study where step-up therapy was offered to patients with established CD with suspected small bowel involvement, double-balloon enteroscopy was shown to change clinical management in 74% of patients and to facilitate clinical remission in 88%.<sup>123</sup> Balloon-assisted enteroscopy with dilation of symptomatic CD strictures has a reported success rate of approximately 70%.<sup>117,124,125</sup> Adverse events range from 8% to 11%.<sup>117,124,125</sup> Double-balloon enteroscopy may be technically difficult in patients with adhesions secondary to CD or prior intestinal surgery,<sup>117</sup> and dilation may be less successful for small-bowel strictures >3 cm in length.<sup>125</sup> Techniques for enteroscopy are addressed in other ASGE documents.<sup>126</sup>

## EUS

EUS has been used to assess disease activity of colitis<sup>127,128</sup> and to differentiate CD from UC.<sup>127</sup> EUS also has an established role in diagnosing patients with CD-related perianal disease, especially perianal fistulae and abscesses.<sup>129-131</sup> Studies comparing tests for classifying fistula anatomy demonstrated an accuracy of 91% with EUS, 87% with magnetic resonance imaging (MRI), 91% with examination with the patient under anesthesia, and 100% by using a combination of any 2 methods.<sup>132</sup> A recent meta-analysis of 4 studies demonstrated that MRI may be superior to EUS for fistula detection, with a sensitivity and specificity of 87% (95% CI, 0.63-0.96) and 69% (95% CI, 0.51-0.98) compared with 87% (95% CI, 0.70-0.95) and 43% (95% CI, 0.21-0.69) with EUS, although a high degree of heterogeneity among studies was observed.<sup>133</sup> ECCO consensus guidelines recommend pelvic MRI as the initial evaluation of choice in the diagnosis of perianal fistulae.<sup>134</sup> EUS can be used to monitor medical and surgical therapy for CD perianal fistulae<sup>130,135</sup> and may result in improved clinical outcomes, although larger trials are needed to confirm this approach.<sup>130,135,136</sup>

**TABLE 3. Rutgeerts score and risk of recurrence after surgery for Crohn's disease<sup>51</sup>**

Rutgeerts score	Endoscopic appearance	Clinical recurrence rate
i0	No lesions	< 10% at 10 y
i1	≤5 Aphthous lesions	
i2	> 5 Aphthous lesions with normal intervening mucosa or lesions confined to ileocolonic anastomosis (<1 cm in length)	20% at 5 y
i3	Diffuse aphthous ileitis with diffusely inflamed mucosa	50%-100% over 5 y
i4	Diffuse inflammation with large ulcers, nodules, and/or narrowing	

## CLASSIFICATION AND SCORING SYSTEMS

Ideally, IBD phenotypes should be classified according to validated classification systems, and documentation of endoscopic disease activity should be standardized. The Montreal classification system for classifying disease extent in adults with both UC and CD (Table 2) has been endorsed by both the ECCO and British Society of Gastroenterology (BSG).<sup>8,16,26</sup> No consensus exists for endoscopic disease severity scores. Commonly used endoscopic scoring systems are available for review in the supplementary material on-line<sup>137-144</sup> (Supplemental Tables B, C, D, and E available online at [www.giejournal.org](http://www.giejournal.org)). The Rutgeerts Anastomotic Score (Table 3) has an established role in the postoperative evaluation of ileocolonic CD to identify patients at high risk for symptomatic recurrence and worse outcomes.<sup>51</sup>

## ENDOSCOPY IN PATIENTS WITH IBD-RELATED SURGERY

### Ileal pouch endoscopy

Ileal pouch anal anastomosis has become the surgical treatment of choice for patients with UC who require colectomy and has been associated with improved health-related quality of life.<sup>145,146</sup> The normal anatomy of a J-pouch has been described as having the endoscopic appearance of owl's eyes, with one "eye" leading to the afferent limb and the other to the tip of the J-pouch, with a long sharp "beak" of mucosa between the two.<sup>147</sup> Immediate postoperative and long-term adverse events of ileal pouch anal anastomosis include pouch leakage and abscess, pouchitis, "cuffitis," irritable pouch syndrome, and CD of the pouch, with a reported pouch failure incidence of 3.5% to 15%.<sup>48,147,148</sup> Pouchitis is the most common long-term adverse event after the procedure, occurring in up to 50% of patients over 10 years of follow-up.<sup>48,149</sup> Endoscopic and histologic assessment

facilitates the diagnosis of pouchitis and/or the exclusion of other causes of symptoms.<sup>149,150</sup>

A gastroscope may be easier to use than a flexible sigmoidoscope for pouch evaluation because of its smaller caliber and greater maneuverability.<sup>48</sup> When a pouch is assessed, both the pouch itself and the afferent small-bowel limb should be evaluated carefully. Endoscopic findings consistent with pouchitis include erythema, edema, granularity, friability, spontaneous or contact bleeding, erosions, and ulcerations.<sup>48</sup> These findings can also be seen in CD of the pouch. Abnormalities isolated to the anastomosis are not necessarily indicative of pouchitis. Endoscopic findings most consistent with CD include a long segment ( $\geq 10$  cm) of involved afferent limb mucosa,<sup>151</sup> especially if there are concomitant discrete ulcers,<sup>37</sup> although the differential diagnosis can include pre-pouch ileitis, NSAID enteritis, infection, and ischemia.<sup>48,152,153</sup>

A biopsy specimen should be taken of any abnormalities of the afferent small bowel detected during pouchoscopy to evaluate for the possibility of CD. Afferent limb ulcers are suggestive of CD when NSAID use and infection are excluded.<sup>154,155</sup> Biopsies of the staple line should be avoided, because of the possibility of misdiagnosis by the detection of foreign-body granulomas or pseudogranulomas.<sup>37</sup> Endoscopic therapy such as pouch stricture dilation can be performed and has been shown to be safe and effective, allowing a majority of patients to retain their pouches.<sup>156</sup> Endoscopic evaluation is useful for evaluating symptomatic patients with ileal pouch-rectal anastomoses, Koch pouches, and Brooke ileostomies and for surveillance of dysplasia.

### Colonoscopy after partial colectomy or partial ileocolectomy

Recurrence of CD after partial colectomy or partial ileocolectomy is common, typically occurring at the surgical anastomosis and neoterminal ileum. Endoscopic recurrence generally precedes symptom relapse and may occur

in 70% to 90% of patients within 1 year of surgery.<sup>51,55,157</sup> Changes in the neoterminal ileum after surgery are the most important prognostic factors for clinical recurrence, and the Rutgeerts Anastomotic Score<sup>51</sup> may be used to classify the risk of CD recurrence after resection (Table 3). Endoscopic evaluation of the neoterminal ileum 6 to 12 months after surgery should be considered in order to risk-stratify patients whose medical management may be affected by endoscopic recurrence.<sup>49,134</sup>

## COLORECTAL CANCER SCREENING AND SURVEILLANCE

Individuals with long-standing UC and extensive CD colitis are at increased risk for development of dysplasia and colorectal cancer (CRC) and should undergo colonoscopic screening and surveillance.<sup>8,158-161</sup> The risk of CRC increases with longer duration and extent of severe colitis, family history of CRC, young age at disease onset, personal history of primary sclerosing cholangitis, personal history of dysplasia, or, in the case of UC, stricturing disease. Patients with UC who have at least left-sided disease and patients with CD with colon disease involving more than a third of the colon are at increased risk of CRC.<sup>162-165</sup> The extent of colon involvement should be based on both endoscopic and histologic criteria, whichever reveals more extensive disease.<sup>159,161</sup> The presence of proctitis alone has not been proven to increase the risk for CRC,<sup>163</sup> but many patients with proctitis will develop more proximal disease over their lives.

No randomized controlled trials have evaluated the efficacy of surveillance colonoscopy in IBD. Case series, case control studies, and population-based cohort studies support the use of surveillance colonoscopy in patients with IBD, suggesting an earlier cancer stage at diagnosis and improved CRC-related survival.<sup>166-170</sup> Although a Cochrane analysis concluded that there is not clear evidence that surveillance colonoscopy prolongs survival,<sup>171</sup> a subsequent cohort study found a 100% CRC-related 5-year survival in 23 patients in a surveillance program compared with 74% in a non-surveillance group ( $P = .042$ ).<sup>170</sup> A recent analysis of the National Institute for Health and Clinical Excellence (NICE) IBD surveillance guidelines found that surveillance colonoscopy is cost effective in the highest risk groups, defined as extensive UC or Crohn's colitis, with moderate or severe active inflammation, primary sclerosing cholangitis, a family history of CRC in a first-degree relative aged <50 years, stricture, or any degree of dysplasia in the previous 5 years.<sup>172</sup>

Surveillance colonoscopy in patients with IBD is endorsed by multiple societies.<sup>8,48,158-161,172-175</sup> Recommendations vary, however, regarding optimal timing of initial screening and subsequent surveillance intervals (Table 4 for summary of ASGE recommendations; Supplemental Table F [available online at [www.giejournal.org](http://www.giejournal.org)] for

a summary of multiple guidelines). Surveillance should be offered to all patients with UC with macroscopic or histologic evidence of inflammation within and proximal to the sigmoid colon and patients with CD involving >1 segment and/or at least one third of the colon.

Random biopsy protocols have been advocated previously. Colon biopsies are obtained from involved colon segments in an attempt to detect endoscopically invisible (flat) dysplasia, in addition to biopsy or resection of all visible lesions. In patients with pancolitis, random 4-quadrant biopsies are obtained every 10 cm from the cecum to the rectum, for a minimum of 33 specimens, which is believed to detect non-visible dysplasia with 90% confidence if present in 5% of the colon mucosa.<sup>2,159,176</sup> In patients with less extensive colitis, random surveillance biopsies are limited to the maximally involved segments.<sup>159</sup> Because of an increased frequency of left-sided CRC in UC, consideration may be given to taking 4-quadrant biopsies every 5 cm in the left side of the colon.<sup>159,165</sup>

Raised, endoscopically visible dysplastic lesions, previously referred to as *dysplasia-associated lesions or masses*, are either resected or biopsies are performed, depending on the endoscopic appearance.<sup>158</sup> Lesions that undergo endoscopic resection should have biopsies taken from the mucosa surrounding the resection site to ensure that the margins are free of dysplasia. Surgery is generally recommended for endoscopically unresectable lesions and endoscopically invisible high-grade dysplasia (HGD) or multifocal low-grade dysplasia (LGD), whereas optimal management of unifocal endoscopically invisible LGD has not been established.

Recent studies utilizing image-enhanced endoscopy in IBD surveillance have led to new recommendations by several societies for optimal identification and management of IBD-related dysplasia. It is now believed that most neoplasia is endoscopically visible with high-definition and/or image-enhanced endoscopy (eg, chromoendoscopy). Most dysplasia previously detected during standard white-light endoscopy (WLE) by random biopsy only and deemed invisible is, in fact, visible by enhanced imaging.<sup>177-181</sup> Surface chromoendoscopy allows better characterization of visible lesions as endoscopically resectable or unresectable. Lesions that appear endoscopically resectable generally can be removed safely with favorable long-term outcomes. Any endoscopically resected dysplastic lesions should be closely surveyed. Surgery remains an option, especially for lesions that contain HGD, recur after resection, are multiple, or occur in a young patient.

### Recommended timing of screening colonoscopy and surveillance intervals

The purpose of the screening examination is to re-evaluate IBD extent and to initiate surveillance for neoplasia. The extent of disease should be defined by the

**TABLE 4. American Society for Gastrointestinal Endoscopy 2014 recommendations for screening and surveillance in patients with IBD**

Eligible patients	Screening	Surveillance
UC: Left-sided or extensive colitis CD: Involving at least 1/3 of colon * Ideally, surveillance colonoscopy should be performed when colonic disease is in remission.	All patients at 8 y, with restaging biopsies	<ul style="list-style-type: none"> <li>• Every 1-3 y</li> <li>• Optimal surveillance interval not defined.</li> <li>• Presence of these risk factors merits annual surveillance: active inflammation, anatomic abnormality (stricture, multiple pseudopolyps), history of dysplasia, family history of CRC in first-degree relative, PSC.</li> <li>• In patients with endoscopically and histologically normal mucosa on <math>\geq 2</math> surveillance colonoscopies, the surveillance interval can be lengthened.</li> </ul>

IBD, Inflammatory bowel disease; UC, ulcerative colitis; CD, Crohn's disease; CRC, colorectal carcinoma; PSC, primary sclerosing cholangitis.

greatest extent of endoscopic or histologic involvement.<sup>159,161</sup> Prior guidelines recommended initiating screening at 8 to 10 years after symptom onset or 15 years for patients with isolated left-sided disease. Recent studies of a Dutch nationwide pathology database found that the diagnosis of CRC was delayed or missed in 17% to 35% of patients when screening was delayed until 8 to 10 or even 15 years.<sup>181,182</sup> Therefore, recent guidelines recommend initiating screening no later than 8 years after symptom onset and sooner in patients with histories of primary sclerosing cholangitis<sup>183,184</sup> or a strong family history of CRC (first-degree relative diagnosed before age 50).<sup>49,158,161,185</sup> Screening colonoscopy is recommended even in patients with prior isolated proctitis, because the colitis may have progressed over time. In these patients, it is reasonable to obtain biopsy specimens of the proximal colon to exclude microscopic extension of disease.

Surveillance should be offered to patients with UC with endoscopic or histologic evidence of inflammation within and proximal to the sigmoid colon and to patients with CD with more than one third of colon involvement, although optimal surveillance intervals are uncertain. Whenever possible, surveillance should be undertaken when colitis is in remission, because active colitis can render accurate identification of dysplasia difficult.<sup>186</sup> Two current U.S. guidelines recommend colonoscopy surveillance every 1 to 2 years or 1 to 3 years.<sup>158,160</sup> These recommendations differ from the risk stratified surveillance recommendations put forth by the BSG,<sup>8,173</sup> NICE,<sup>172</sup> ECCO,<sup>48</sup> the Cancer Council of Australia,<sup>161</sup> and the ESGE.<sup>175</sup> Consistent among all risk-stratified guidelines is the recommendation that the highest risk patients, defined

by active extensive disease, prior dysplasia or stricture, primary sclerosing cholangitis, or family history of CRC in a first-degree relative aged <50 years, should undergo annual surveillance. Older age at diagnosis or initiation of surveillance may be associated with an increased risk of CRC.<sup>182,187</sup> Patients in endoscopic and histologic remission without a history of neoplasia or family history of CRC are considered lower risk and can be surveyed at longer intervals. ASGE recommendations for screening and surveillance are summarized in Table 4.

### Recommended surveillance technique to optimize dysplasia detection

Surface chromoendoscopy with resection or targeted biopsy of visible lesions is the preferred surveillance technique, based on the currently available literature. Studies confirm that 58% to 94% of dysplastic lesions are macroscopically visible with standard white-light imaging, and lesion detection is further enhanced with spray chromoendoscopy.<sup>177-180</sup> Guidelines by the BSG, NICE, ECCO, and the Cancer Council of Australia endorse spray chromoendoscopy with targeted biopsies of suspicious lesions by appropriately trained endoscopists.<sup>8,48,49,161,172,173</sup> Retrospective and prospective cohort studies as well as mathematical modeling demonstrate a very small incremental yield of random biopsies when used with chromoendoscopy and a targeted biopsy protocol.<sup>180,188-197</sup> Random surveillance biopsies sample less than 1% of total colon mucosa,<sup>198,199</sup> and one review has estimated detection of only one additional episode of neoplasia for every 1266 random biopsies.<sup>200</sup> For these reasons, the BSG and ECCO no longer recommend random biopsies of



TABLE 4. Continued

Recommended technique	Nomenclature for detected dysplasia	Comments
<p>Chromoendoscopy with pancolonic dye spraying and targeted biopsies is sufficient for surveillance in IBD; consider 2 biopsies from each colon segment for histologic staging.</p> <p>or</p> <p>Random biopsies with targeted biopsies of any suspicious lesions is a reasonable alternative if chromoendoscopy is not available or if the yield of chromoendoscopy is reduced by significant underlying inflammation, pseudopolyposis, or poor preparation.</p> <ul style="list-style-type: none"> <li>• Pancolitis: 4-quadrant biopsies every 10 cm from cecum to rectum, for minimum of 33 biopsies.</li> <li>• No pancolitis: 4 quadrant biopsies every 10 cm limited to greatest extent of endoscopic or histologic involvement documented by any colonoscopy.</li> </ul>	<ul style="list-style-type: none"> <li>• Location: Within or outside an area of known colitis</li> <li>• Borders: Distinct or indistinct</li> <li>• Morphology: Polypoid or non-polypoid</li> <li>• Ulceration</li> <li>• Features of submucosal invasion</li> </ul>	<ul style="list-style-type: none"> <li>• Extent of colonic involvement should be defined by greatest extent of endoscopic or histologic involvement documented by any colonoscopy.</li> <li>• Isolated proctitis does not confer increased risk of IBD-related CRC.</li> <li>• Patients with PSC should begin surveillance colonoscopy at the time of diagnosis, then yearly.</li> </ul>

normal appearing colonic mucosa for dysplasia detection if chromoendoscopy is performed.<sup>8,49,173</sup>

The benefits of chromoendoscopy surveillance in IBD include increased sensitivity and specificity for dysplastic and malignant lesions. Randomized, back-to-back trials and case-control studies demonstrate a 2-fold to 3-fold increase in per-patient dysplasia detection and a 4-fold to 5-fold increase in per-lesion dysplasia detection with surface chromoendoscopy.<sup>155,158,177,182,192,194,196,198,201</sup>

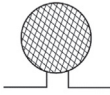
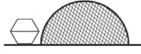



A meta-analysis of prospective studies comparing surface chromoendoscopy to standard definition WLE demonstrated a 7% (95% CI, 3.3%-10.3%) incremental yield of chromoendoscopy with targeted biopsies over WLE with random biopsies for dysplasia detection and calculated a number needed to treat of 14.3 (95% CI, 9.7-30.3) to detect one additional patient with dysplasia or cancer.<sup>202</sup>

A recent cost-effectiveness analysis of surveillance strategies in UC determined that chromoendoscopy is both more effective and less costly than WLE.<sup>203</sup>

Commonly used topical contrast agents for chromoendoscopy include 0.1% methylene blue or 0.03% to 0.5% indigo carmine. The bowel preparation should be excellent to allow for detailed mucosal evaluation. The colonoscope is inserted to the cecum by using WLE. On withdrawal, the colon mucosa is segmentally sprayed with a topical contrast agent. Studies have divided the colon segments anatomically<sup>190,194,196,204</sup> or into 30-cm segment intervals.<sup>192,193</sup> Most studies used spray catheters for application of the contrast agent, whereas recent publications describe application through the forward water-jet channel by using an automated pump.<sup>202,203,205</sup> Excess fluid is aspirated, and the mucosa is carefully evaluated.

Surface chromoendoscopy enhances and highlights areas of mucosal nodularity and topographic abnormalities, such as elevations or depressions, which may be missed on standard definition WLE.<sup>202,206</sup> Once a lesion is identified, surface chromoendoscopy helps to delineate the lesion morphology, size, and border and evaluate for endoscopic features of submucosal invasion. Lesions deemed endoscopically resectable should undergo resection or tattoo and referral to an endoscopist with expertise in endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD). Targeted biopsies should be obtained from lesions that are not believed to be endoscopically resectable as well as lesions of uncertain significance. Even if no lesions are detected, consideration should be given to doing at least 2 histologic staging biopsies from each colon segment to determine the histologic extent and severity of disease, which affect the risk of dysplasia.<sup>48,161-163,207-211</sup> When chromoendoscopy is used for IBD surveillance, random biopsies for dysplasia detection are unnecessary.<sup>8,49,173,180,188-197</sup> Random biopsies plus targeted biopsies of any suspicious appearing lesions remain a reasonable alternative where chromoendoscopy is not available or if the yield of chromoendoscopy is reduced by significant underlying inflammation, significant pseudopolyposis, poor preparation, or in any area of poorly visualized mucosa.<sup>161,206</sup> Other technical considerations of surface chromoendoscopy are reviewed separately.<sup>212</sup>

Pancolonic chromoendoscopy has been prospectively compared with high definition endoscopy in one tandem study evaluating the implementation of a chromoendoscopy-based surveillance program in 3 U.S. centers.<sup>204</sup> Dysplasia detection with chromoendoscopy

Endoscopic appearance		Description**	Definition	Paris class***
Polypoid lesion protruding from mucosa into the lumen ≥ 2.5 mm*		Pedunculated	Lesion attached to mucosa by a stalk	Ip
		Sessile	Lesion not attached to mucosa by a stalk: entire base is contiguous with mucosa	Is
Non-polypoid lesion with little (<2.5mm) or no protrusion above mucosa		Slightly elevated	Lesion with protrusion but < 2.5 mm above mucosa	Ila
		Flat	Lesion without protrusion above mucosa	Ilb
		Depressed	Lesion with at least a portion depressed below the level of mucosa	Ilc

**Figure 1.** Description of endoscopically visible lesions (Paris Classification)<sup>219,222</sup>

\*2.5 mm = size of closed cup of biopsy forceps.

\*\*Also include location (within or outside an area of known colitis), borders (distinct or indistinct), and presence of ulceration and/or other features of submucosal invasion.

\*\*\*Morphological combinations of lesions can occur.

was 21.3% versus 9.3% with high-definition WLE, resulting in a relative incremental yield for chromoendoscopy of 120% ( $P = .004$ ), with the highest relative incremental yield for flat lesion detection.<sup>204</sup> Although high-definition WLE appears to be superior to standard WLE,<sup>213</sup> additional prospective studies are needed to determine whether dysplasia detection by high-definition endoscopy with targeted biopsies is comparable to surface chromoendoscopy with targeted biopsies.

In contrast to surface chromoendoscopy, narrow-band imaging (NBI), an optical chromoendoscopy technology that uses filters to enhance the contrast of the mucosa and the vasculature, has not demonstrated increased yield for dysplasia detection during surveillance examinations. Three randomized studies comparing narrow-band imaging to standard-definition WLE<sup>189</sup> and to high-definition WLE<sup>214,215</sup> failed to demonstrate improved dysplasia detection with narrow-band imaging. Furthermore, a randomized, crossover study comparing targeted biopsies by narrow-band imaging to chromoendoscopy reported a numerically higher detection rate with chromoendoscopy, although the differences were not statistically significant.<sup>216</sup> Other advanced imaging techniques are under study, but they require substantial training, and current data do not support their routine use.<sup>217,218</sup>

### Management of endoscopically visible lesions

Targeted biopsies of strictures, mass lesions, and macroscopic abnormalities should be obtained. The Paris Classification<sup>219</sup> represents a simplified approach to the classification of endoscopically visible lesions, and some have recommended that the use of the term *dysplasia-associated lesions or masses* be abandoned<sup>49,202,206,219,220</sup> in favor of more clinically relevant descriptors of the Paris Classification (Fig. 1).<sup>222</sup> Lesion location should be identified as within or outside an area of known colitis. Lesion morphology should be described as polypoid (pedunculated or sessile) or non-polypoid (slightly elevated, flat, or depressed), and lesion borders should be classified as distinct or indistinct.<sup>175,222</sup> Specific attention should be given to evaluating for the presence of overlying ulceration and for features of submucosal invasion, which include depressions or failure to lift with attempted submucosal injection.<sup>202,205,221,222</sup>

Lesions detected in segments of the colon that are uninvolved with colitis can be treated as sporadic adenomas, with standard post-polypectomy surveillance recommendations.<sup>158,223,224</sup> Lesions identified in an area of known colitis during surveillance colonoscopy should be evaluated for endoscopic resectability, recognizing that endoscopic resection of lesions in this mucosa can be technically more difficult because of inflammation, friability, and scarring.<sup>221</sup> Clearly demarcated lesions without

endoscopic features of submucosal invasion should be considered for endoscopic resection when the expertise is available. The specific technique used will depend on the nature of the lesion and the skill of the endoscopist (Fig. 2).<sup>205-208</sup> En bloc resection is preferred, because this allows for histologic evaluation of completeness of resection. This may necessitate referral to a center with expertise in advanced polypectomy techniques.<sup>221</sup> After endoscopic resection is complete, biopsies of the flat mucosa surrounding the resection site should be done to ensure that the lateral margins are free of dysplasia.<sup>49,158,159</sup> A depressed or ulcerated lesion may be indicative of an underlying malignancy.<sup>202</sup> Adjunctive imaging techniques such as high-magnification chromoscopic colonoscopy, high frequency mini-probe EUS, and confocal endomicroscopy have been used to determine resectability and to guide endoscopic therapy of advanced lesions.<sup>225-227</sup>

Chronic inflammation can cause significant mucosal and submucosal fibrosis even in the absence of invasive neoplasia. Endoscopic resection may be feasible in this setting, with high cure rates in the short term.<sup>227</sup> The most important principle is to maximize potential for complete eradication on the initial resection attempt; hence referral to a center with expertise in advanced polypectomy should be pursued when necessary.<sup>228,229</sup> Tattooing and photodocumentation should be considered to aid subsequent surveillance or resection. In all cases, colectomy remains an option for the management of neoplastic lesions, and risk and benefits regarding endoscopic resection and surveillance versus colectomy must be carefully discussed with patients.

An endoscopically detected dysplastic lesion that is not amenable to endoscopic resection is an indication for colectomy. Endoscopic features associated with unresectability include ill-defined margins, features of submucosal invasion, asymmetrical lift not attributable to fibrosis from colitis, ulceration or large depressions, and flat neoplastic change adjacent to the lesion.<sup>158,202</sup> Other cases may not be technically feasible because of location.<sup>202</sup>

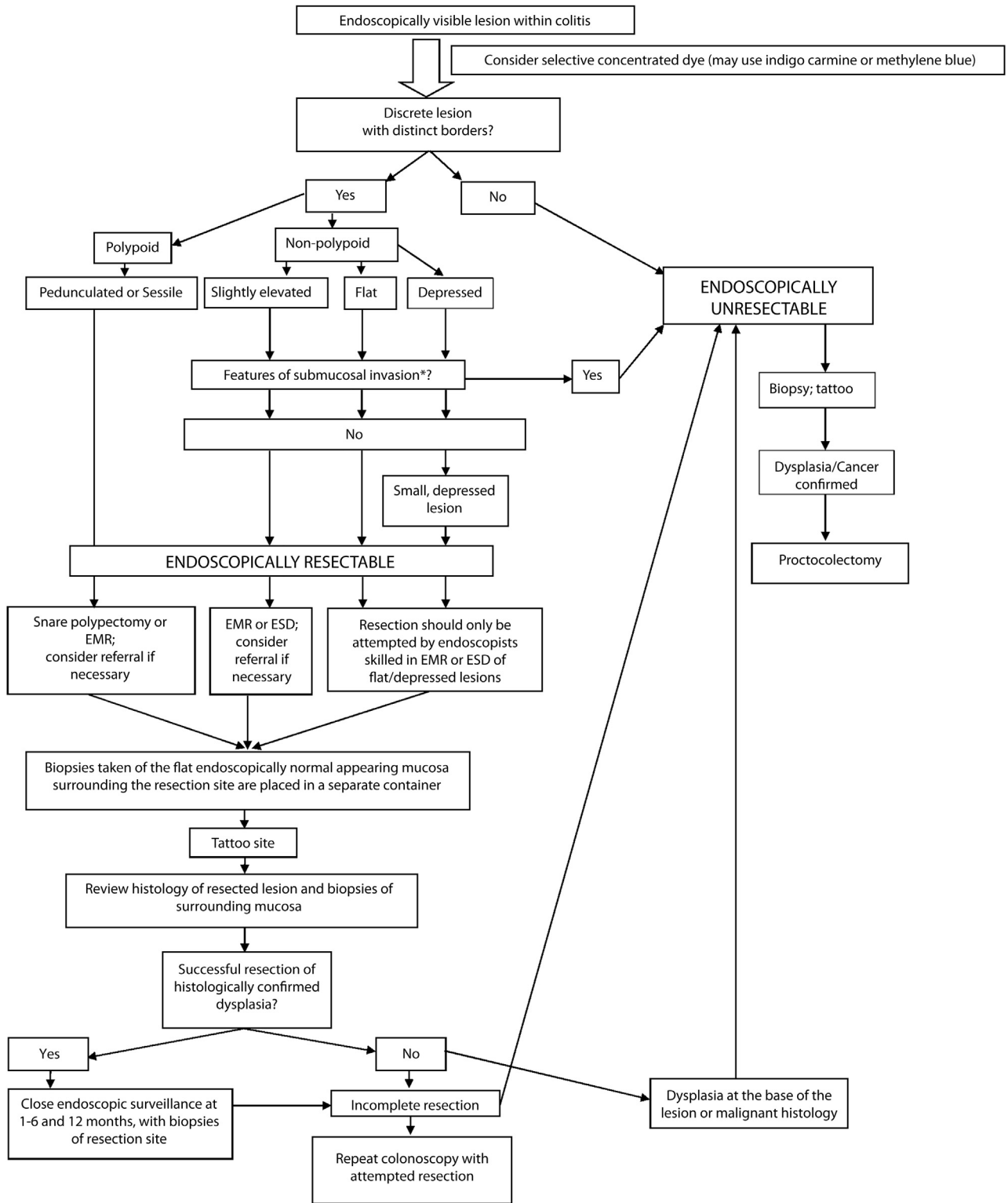
## Management of dysplasia

Dysplasia is classified as an endoscopically visible dysplastic lesion, detected via resection or targeted biopsies, or endoscopically invisible dysplasia detected by random biopsies. Provided no endoscopically invisible (flat) dysplasia is found elsewhere in the colon, a dysplastic lesion that endoscopically and histologically appears to be completely resected can undergo close endoscopic surveillance.<sup>49,158</sup> The presence of endoscopically invisible dysplasia detected by random biopsies alone during WLE should be confirmed by a second GI pathologist<sup>49,159</sup> and should prompt a repeat evaluation with surface chromoendoscopy by an experienced endoscopist.<sup>49,222</sup> During this chromoendoscopy examination, random biopsies should be considered in addition to any targeted

biopsies to assess for the presence of endoscopically invisible dysplasia. Endoscopically invisible HGD or multifocal LGD is an indication for colectomy, given the high risk of synchronous and metachronous CRC.<sup>49,230</sup> It is controversial whether colectomy or enhanced surveillance should be performed if unifocal, flat, endoscopically invisible LGD is identified, and the decision should be individualized. A meta-analysis of older studies, conducted before the chromoendoscopy era, demonstrated a positive predictive value of flat (invisible) LGD of 22% for concurrent CRC and 36% for concurrent HGD ± CRC,<sup>231</sup> whereas more recent studies demonstrate the majority of patients with LGD will not progress to higher grades of dysplasia during approximately 3 to 4 years of follow-up.<sup>230,232,233</sup>

Long-term follow-up studies of endoscopically resectable polypoid lesions are reassuring, demonstrating no significant increased risk of cancer development compared with IBD surveillance patients or patients without IBD after sporadic adenoma polypectomy.<sup>234-238</sup> However, long-term follow-up of non-polypoid lesions is lacking. Two studies demonstrate that follow-up of more advanced lesions, such as resection of circumscribed lateral spreading lesions and lesions with HGD, have demonstrated high cure rates and may be amenable to surveillance if complete resection is achieved.<sup>227,240</sup> If a lesion is not endoscopically resectable, if there is evidence of dysplasia at the base of the lesion, or if endoscopically invisible HGD or multifocal LGD is found elsewhere in the colon, proctocolectomy is indicated.<sup>49,158,161</sup> A pathology finding that is indefinite for dysplasia should prompt aggressive treatment of underlying active inflammation and repeat endoscopic evaluation, preferably with chromoendoscopy.<sup>232,241</sup> The presence of HGD in a completely resected dysplastic lesion necessitates discussion with the patient about the risks and benefits of close endoscopic surveillance versus colectomy, and decisions should be made on a case-by-case basis. Colectomy remains an option for definitive treatment of colitis-associated dysplasia.

A recent meta-analysis found that the risk of CRC after endoscopic resection of polypoid dysplasia is low, with a pooled incidence of 5.3 cases/1000 years (95% CI, 2.7-10.1) of patient follow-up. However, the risk of development of any dysplasia is increased 10-fold with a pooled rate of any dysplasia of 65 cases/1000 patient years (95% CI, 54-78).<sup>239</sup> Thus, close endoscopic surveillance is warranted in this situation. Optimal surveillance intervals after endoscopic resection of polypoid and nonpolypoid dysplasia in colitis have not been defined. Studies have variably used 1-month to 6-month intervals for surveillance after index resection (Supplemental Table G, available online at [www.giejournal.org](http://www.giejournal.org)).<sup>226,227,236,237</sup> To ensure complete resection, surveillance colonoscopy should be performed within 1 to 6 months as well as at 12 months after the index resection, and biopsy specimens should be obtained of



**Figure 2.** Recommended management of lesion detected during endoscopic surveillance. *EMR*, endoscopic mucosal resection; *ESD*, endoscopic submucosal dissection.

\*Features of submucosal invasion include: depressions, failure to lift with attempted submucosal injection, or presence of overlying ulceration.

the resection site to document eradication of dysplastic tissue; at least annual surveillance should be performed thereafter.

### Pouch surveillance

The incidence of pouch carcinoma in patients with IBD with ileal pouch anal anastomosis appears to be low,



and the benefit of pouch surveillance is uncertain. No consensus exists on optimal patient selection for surveillance, surveillance intervals, or surveillance technique.

Retrospective studies have identified potential risk factors for the development of dysplasia after restorative proctocolectomy with ileal pouch anal anastomosis and include a history of dysplasia or CRC, primary sclerosing cholangitis, refractory pouchitis, and atrophic mucosa with severe inflammation (type C pouch mucosa).<sup>242</sup> In a recent case-control, population-based study of 1200 patients with IBD with ileal pouch anal anastomosis, a history of colorectal dysplasia or carcinoma was the only risk factor associated with pouch neoplasia (hazard ratio [HR] 3.8, 95% CI, 1.4-10.2 for prior dysplasia; HR 24.7, 95% CI, 9.6-63.4 for prior carcinoma), and 63% of pouch carcinomas in this cohort developed at the anal transition zone.<sup>243</sup> Patients without histories of colorectal neoplasia had a very low incidence of pouch neoplasia (2.2% after 15 years). Thus, the highest risk patients with pouch neoplasia that should be considered for annual endoscopic pouchoscopy examinations are those with histories of dysplasia or cancer. During surveillance, biopsy samples should be taken proximally (within the pouch) and distally (within the anal transition zone). Patients with histories of primary sclerosing cholangitis, refractory pouchitis, and type C pouch mucosa may be considered for annual surveillance. There are no data on the yield of image-enhanced endoscopy in pouch surveillance.

## STRICTURE EVALUATION AND DILATION

In patients with CD, strictures typically are found in the terminal ileum and colon as well as at the site of ileocolonic surgical anastomosis.<sup>244,245</sup> Endoscopy allows assessment of the stricture, biopsy to exclude possible malignancy, and therapy in select cases. In the setting of UC, a colon stricture should be considered malignant until proven otherwise, and surgery should be considered, especially if a stricture cannot be thoroughly examined and biopsy specimens cannot be obtained.<sup>246-248</sup>

Endoscopic balloon dilation has been investigated in patients with symptomatic CD strictures of the small bowel, colon, and anastomosis. The majority of these studies are retrospective, and the main outcome measurement is symptom relief and avoidance of surgery. In one systematic review of 13 studies enrolling a total of 347 patients with CD, endoscopic dilation had a durable clinical response in 58% of patients who otherwise would have undergone surgical intervention during a mean follow-up of 33 months.<sup>249</sup> The majority of strictures were located at the ileocolonic anastomosis (66%). On multivariate analysis, the only predictor of surgery-free follow-up was a stricture length <4 cm (odds ratio 4.01, CI, 1.16-13.8). The mean rate of major adverse events was 2%. Adverse events included perforation and

bleeding.<sup>249</sup> Two additional retrospective series found technical success rates of 89% to 97% and serious adverse events in 5%.<sup>250,251</sup> Up to 50% will require repeat dilation, and 25% will require surgery within 5 to 6 years. Dilating balloons >20 mm appear to be associated with more adverse events.<sup>250,251</sup>

The data regarding the role of corticosteroid injections into CD strictures at the time of balloon dilation are conflicting.<sup>252-256</sup> In one small, randomized, controlled study of 13 patients, steroid injection within strictures resulted in a trend toward a worse outcome, with more patients in the steroid-treated arm requiring repeat dilation.<sup>254</sup> More recently, a randomized, double-blind, controlled trial of 29 pediatric patients with CD demonstrated that intralesional steroid injection after balloon dilation resulted in a statistically significant reduction in need for redilation and surgery.<sup>253</sup>

The role for fully covered self-expandable metal stents (SEMSs) in the treatment of refractory IBD strictures is not defined. In one small series of 25 SEMSs placed in 17 patients with medically and/or endoscopically refractory strictures (59% anastomotic, stricture length 2-6 cm), the technical success rate of stent placement was 92%, and stents were maintained for an average of 4 weeks. In this study, treatment success rate, defined as no major procedure-related adverse events and at least 1 year of symptom-free follow-up, was 65%.<sup>257</sup> However, a separate prospective pilot study of SEMSs in 11 patients with CD with obstructive symptoms from strictures <5 cm in length found a high rate of stent migration and other adverse events.<sup>258</sup>

## SUMMARY

1. We recommend colonoscopy with ileoscopy for the initial evaluation of IBD and for differentiating IBD subtypes. (⊕⊕⊕⊕)
2. We recommend mucosal biopsy specimens from multiple sites during the initial endoscopic evaluation of IBD. (⊕⊕⊕⊕)
3. We recommend flexible sigmoidoscopy in patients with IBD when colonoscopy is contraindicated and to evaluate for other inflammatory etiologies before escalating therapies in patients with refractory disease. (⊕⊕⊕⊕)
4. We recommend that EGD be performed in pediatric patients with suspected IBD at the time of ileocolonoscopy. (⊕⊕⊕⊕)
5. We recommend CE to evaluate the small intestine in patients with suspected CD who have no obstructive symptoms and negative ileocolonoscopy results. (⊕⊕⊕⊕)
6. We recommend that a patency capsule, small-bowel follow-through, CT enterography, or magnetic resonance enterography be performed before CE in

- patients with known small-bowel CD involvement. (⊕⊕⊕○)
7. We recommend CE in patients with known CD and unexplained symptoms only when abnormalities detected with CE will alter management. (⊕⊕⊕○)
  8. We suggest enteroscopy in patients with IBD who have abnormalities within reach of the enteroscope seen on other imaging studies to facilitate endoscopic and histologic evaluation and the potential for therapeutic interventions. (⊕⊕⊕○)
  9. We suggest EUS for characterizing and managing fistulous perianal CD in conjunction with other imaging modalities. (⊕⊕○○)
  10. We recommend the Montreal Classification System<sup>26</sup> be used to standardize reporting of disease extent and IBD phenotypes for both UC and CD. (⊕⊕⊕○)
  11. We recommend endoscopic and histologic assessment of the pouch and afferent limb in symptomatic patients. (⊕⊕⊕⊕)
  12. We suggest endoscopic evaluation of the neoterminal ileum 6 to 12 months after surgery in order to risk-stratify patients whose medical management may be affected by endoscopic recurrence. (⊕⊕⊕○)
  13. We recommend that all patients with UC or CD colitis undergo a screening colonoscopy 8 years after disease onset to (1) re-evaluate extent of disease and (2) initiate surveillance for colorectal neoplasia. (⊕⊕⊕○)
  14. We recommend surveillance colonoscopy be performed every 1 to 3 years beginning after 8 years of disease in patients with UC with macroscopic or histologic evidence of inflammation proximal to and including the sigmoid colon and for patients with Crohn's colitis with greater than one-third of colon involvement. (⊕⊕⊕○)
  15. We recommend chromoendoscopy with targeted biopsies as the preferred surveillance technique to maximize dysplasia detection. (⊕⊕⊕○)
  16. We suggest that chromoendoscopy-targeted biopsies are sufficient for dysplasia surveillance in patients with IBD and that consideration should be given to taking two biopsies from each colon segment for histologic staging to assess extent and severity of inflammation. (⊕⊕○○)
  17. We suggest that random biopsies with targeted biopsies of any suspicious appearing lesions remain a reasonable alternative for dysplasia surveillance if the yield of chromoendoscopy is reduced by significant underlying inflammation, significant pseudopolyposis, or poor preparation or if chromoendoscopy is not available. (⊕⊕○○)
  18. We recommend that patients with IBD whose polypoid dysplastic lesions have been removed completely receive endoscopic surveillance at 1 to 6 months and at 12 months, with yearly surveillance thereafter. (⊕⊕⊕○)
  19. We suggest that patients with IBD whose non-polypoid dysplastic lesions have been removed completely receive endoscopic surveillance at 1 to 6 months and at 12 months, with yearly surveillance thereafter. (⊕⊕○○)
  20. We recommend proctocolectomy in patients with IBD if a detected lesion is not endoscopically resectable, if there is evidence of dysplasia at the base of the lesion, or if endoscopically invisible HGD or multifocal LGD is found in the colon during a high-quality chromoendoscopy examination. (⊕⊕⊕○)
  21. We recommend IBD-associated benign strictures <4 cm in length manifesting obstructive symptoms be managed with endoscopic balloon dilation when feasible. (⊕⊕○○)

## DISCLOSURES

*K. Chathadi is a speaker for Boston Scientific. R. Fanelli is the owner and director of New Wave Surgical and is an advisor to Via Surgical. J. Hwang is a speaker for Novartis and a consultant to US Endoscopy and received a research grant, equipment support, and a loan from Olympus. M. Khashab is a consultant for Boston Scientific. All other authors disclosed no financial relationships relevant to this publication.*

*Abbreviations: ASGE, American Society for Gastrointestinal Endoscopy; BSG, British Society of Gastroenterology; CD, Crohn's disease; CE, capsule endoscopy; CRC, colorectal cancer; ECCO, European Crohn's and Colitis Organization; HGD, high-grade dysplasia; IBD, inflammatory bowel disease; IBD-U, IBD, type unclassified; LGD, low-grade dysplasia; MRI, magnetic resonance imaging; NICE, National Institute for Health and Clinical Excellence; NSAID, nonsteroidal anti-inflammatory drug; SEMS, self-expandable metal stent; UC, ulcerative colitis; WLE, white-light endoscopy.*

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**SUPPLEMENTAL TABLE A. Capsule Endoscopy Crohn's Disease Activity Index<sup>110</sup>**

Score type	0	1	2	3	4	5	Segmental score	
							Proximal	Distal
A. Inflammation	None	Mild to moderate edema/hyperemia/denudation	Severe edema/hyperemia/denudation	Bleeding, exudate, aphthae, erosion, small ulcer (<0.5 cm)	Moderate ulcer (0.5-2 cm), pseudo polyp	Large ulcer (>2 cm)		
B. Extent of disease	No disease, normal examination	Focal disease (single segment involved)	Patchy disease, 2-3 segments involved	Diffuse disease (>3 segments involved)				
C. Stricture	None	Single-passed	Multiple-passed	Obstruction (no passage)				
							Segmental score = (A × B) + C	
							Total score = proximal segmental score + distal segmental score	

SUPPLEMENTAL TABLE B. Endoscopic scores for ulcerative colitis

Scale	0	1	2	3	4
Mayo <sup>141</sup> (0-3)	Normal or inactive disease	Mild: erythema, decreased vascular pattern, mild friability	Moderate: marked erythema, absent vascular pattern, friability, erosions	Severe: spontaneous bleeding, ulcerations	–
Baron <sup>137</sup> (0-3)	Normal: matte mucosa, ramifying vascular pattern clearly visible, no bleeding on light touch or spontaneously	Abnormal but non-hemorrhagic: appearances between 0 and 2	Moderately hemorrhagic: bleeding to light touch but no spontaneous bleeding ahead of instrument on initial inspection	Severely hemorrhagic: spontaneous bleeding ahead of instrument at initial inspection, bleeding to light touch	–
Powell-Tuck <sup>139</sup> (0-2)	Non-hemorrhagic: no bleeding on light touch or spontaneously	Hemorrhagic: bleeding on light touch but no spontaneous bleeding ahead of instrument	Hemorrhagic: spontaneous bleeding ahead of instrument on initial inspection, bleeding to light touch	–	–
Sutherland <sup>142</sup> (0-3)	Normal	Mild friability	Moderate friability	Exudation, spontaneous hemorrhage	–
Feagan/Modified Baron Score <sup>138</sup> (0-4)	Normal, smooth, glistening mucosa with vascular pattern visible; not friable	Granular mucosa; vascular pattern not visible; not friable; hyperemia	As 1, with a friable mucosa but not spontaneously bleeding	As 2, but mucosa spontaneously bleeding	As 3, but clear ulceration; denuded mucosa
Ulcerative Colitis Index of Severity (UCEIS) <sup>144</sup>	See separate table/worksheet				
Ulcerative Colitis Colonoscopic Index of Severity (UCCIS) <sup>140</sup>	See separate table/worksheet				

**SUPPLEMENTAL TABLE C. Ulcerative colitis endoscopic index of severity (UCEIS)**

<b>Most severely affected area at flexible sigmoidoscopy</b>	<b>SCORE</b>
<b>Vascular Pattern</b> 0 = Normal 1 = Patchy obliteration 2 = Obliterated	
<b>Bleeding</b> 0 = None 1 = Mucosal 2 = Luminal mild 3 = Luminal moderate or severe	
<b>Erosions and Ulcers</b> 0 = None 1 = Erosions 2 = Superficial ulcer 3 = Deep ulcer	
<b>UCEIS = Simple SUM:</b>	



**SUPPLEMENTAL TABLE D. UCCIS<sup>40</sup>**

UCCIS	Rectum	Sigmoid colon	Descending colon	Transverse colon	Cecum/ascending colon	Total sum	Weighted factor	
<b>Vascular pattern</b> 0 = Normal, clear vascular pattern 1 = Partially visible vascular pattern 2 = Complete loss of vascular pattern							×3.1	
<b>Granularity</b> 0 = Normal, smooth and glistening 1 = Fine 2 = Coarse							×3.6	
<b>Ulceration</b> 0 = Normal, no erosion or ulcer 1 = Erosions or pinpoint ulcerations 2 = Numerous shallow ulcers with mucopus 3 = Deep, excavated ulcerations 4 = Diffusely ulcerated with >30% involvement							×3.5	
<b>Bleeding/friability</b> 0 = Normal, no bleeding, no friability 1 = Friable, bleeding to light touch 2 = Spontaneous bleeding							×2.5	
<b>UCCIS = Weighted sum</b>								
<b>Segmental assessment of endoscopic severity</b> 0 = Normal/quiescent 1 = Mild: erythema, decreased or loss of vascular pattern, fine granularity but no friability or spontaneous bleeding 2 = Moderate: friability with bleeding to light touch, coarse granularity, erosions, or pinpoint ulcerations 3 = Severe: spontaneous bleeding or gross ulcers							Global assessment of severity	
<b>Global assessment of endoscopic severity: VAS, 10-cm scale</b>	----- ----- ----- ----- ----- ----- ----- -----							
	Normal						Extremely severe	

UCCIS, Ulcerative Colitis Colonoscopic Index of Severity; VAS, visual analogue scale.

**SUPPLEMENTAL TABLE E. Simple Endoscopic Scoring System for Crohn's Disease<sup>149</sup>**

<b>Simple Endoscopic Scoring System-Crohn's Disease</b>	<b>Ileum</b>	<b>Right colon</b>	<b>Transverse colon</b>	<b>Left colon</b>	<b>Rectum</b>	<b>Total</b>
<b>Size of ulcers, cm</b>						
0 = None						
1 = Aphthous ulcers (diameter 0.1-0.5)						
2 = Large ulcers (diameter 0.5-2)						
3 = Very large ulcers (diameter >2)						
<b>Ulcerated surface, %</b>						
0 = None						
1 = <10						
2 = 10-30						
3 = >30						
<b>Affected surface, %</b>						
0 = Unaffected segment						
1 = <50						
2 = 50-75						
3 = >75						
<b>Presence of narrowing</b>						
0 = None						
1 = Single, can be passed						
2 = Multiple, can be passed						
3 = Cannot be passed						
					SES-CD =	

SES-CD, Simple Endoscopic Scoring System for Crohn's Disease.

SUPPLEMENTAL TABLE F. Summary of society recommendations

Society	Eligible patients	Screening	Surveillance	Recommended technique	Comments
CCFA 2005	UC: Left-sided or extensive colitis CD: Involving at least 1/3 of colon	All patients at 8-10 y after symptom onset, to reassess disease extent	<ul style="list-style-type: none"> <li>• Every 1-2 y</li> <li>• After 2 negative examinations, surveillance recommended every 1-3 y until colitis has been present for 20 years.</li> <li>• After 20 years, every 1-2 y</li> </ul>	<ul style="list-style-type: none"> <li>• Random biopsy technique: In patients with extensive disease, a minimum of 33 biopsies should be performed (4-quadrant biopsies every 10 cm throughout the colon). In patients with less extensive microscopic disease found at screening, 4-quadrant biopsies should be taken from the proximal extent of disease and every 10 cm distally.</li> <li>• Particularly in UC, consider taking 4-quadrant biopsies every 5 cm in the lower sigmoid colon and rectum.</li> <li>• Endorses the incorporation of chromoendoscopy into surveillance colonoscopy for appropriately trained endoscopists.</li> </ul>	
ACG UC: 2010 CD: 2009	UC: Left-sided or extensive colitis CD: Despite expanding evidence of the carcinogenic potential of long-standing CD, surveillance guidelines have yet to be defined.	8-10 y with UC	Every 1-2 y	Multiple biopsies at 10-cm intervals	<ul style="list-style-type: none"> <li>• Patients with proctitis or proctosigmoiditis are not at increased cancer risk.</li> <li>• Cancer risk should be assumed to correlate with greatest macroscopic or microscopic extent of disease.</li> <li>• Start surveillance at time of diagnosis of PSC.</li> <li>• Patients with UC with family history of CRC are at increased risk.</li> </ul>

SUPPLEMENTAL TABLE F. Continued

Society	Eligible patients	Screening	Surveillance	Recommended technique	Comments
AGA 2010	<p>UC: Left-sided or extensive colitis</p> <p>CD: Involving at least 1/3 of colon</p> <p>* Ideally, surveillance colonoscopy should be performed when colon disease is in remission.</p>	All patients at 8 y, with multiple biopsy specimens obtained throughout the entire colon to assess the true microscopic extent of inflammation	<ul style="list-style-type: none"> <li>Optimal surveillance interval not defined.</li> <li>After 2 negative examinations, surveillance recommended every 1-3 y.</li> <li>Patients with histories of CRC in first-degree relative, active inflammation, or anatomic abnormalities (foreshortened colon, stricture, or multiple inflammatory pseudopolyps) may benefit from more frequent surveillance examinations.</li> </ul>	<ul style="list-style-type: none"> <li>Random biopsy technique: No prospective studies have determined the optimal number of biopsy specimens needed to detect dysplasia reliably. Representative biopsy specimens from each anatomic section of the colon are recommended. One study recommended that a minimum of 33 biopsy specimens be taken in patients with pancolitis.</li> <li>Chromoendoscopy with targeted biopsies is considered an acceptable alternative to white light endoscopy for endoscopists who have experience with this technique.</li> </ul>	<ul style="list-style-type: none"> <li>Patients with ulcerative proctitis or ulcerative proctosigmoiditis are not considered at increased risk for IBD-related CRC and may be managed with average-risk recommendations.</li> <li>Patients with PSC should begin surveillance colonoscopy at the time of diagnosis, then yearly.</li> </ul>



SUPPLEMENTAL TABLE F. Continued

Society	Eligible patients	Screening	Surveillance	Recommended technique	Comments
BSG 2010	<p>Extensive colitis</p> <p>UC: Extending proximal to the splenic flexure</p> <p>CD: Affecting at least 50% of surface area of colon</p> <p>* Ideally performed when disease is in remission</p>	<p>10 y after onset of disease symptoms to reassess disease extent</p>	<ul style="list-style-type: none"> <li>• Every year: Patients with moderate or severe endoscopic/histologic active inflammation on the previous surveillance colonoscopy, a stricture within previous 5 years, confirmed dysplasia within previous 5 years in a patient who declines surgery, PSC/post-orthotopic liver transplant for PSC or family history of CRC in a first-degree relative aged &lt;50 y.</li> <li>• Every 3 y: Patients with mild endoscopic/histologic active inflammation on the previous surveillance colonoscopy, presence of post-inflammatory polyps, family history of CRC in a first-degree relative aged <math>\geq</math> 50 y.</li> <li>• Every 5 y: Patients with no endoscopic/histologic active inflammation on the previous colonoscopy (histologic chronic or quiescent changes acceptable), left-sided colitis (any grade of inflammation) or Crohn's disease colitis affecting &lt;50% surface area of the colon (any grade of inflammation).</li> </ul>	<p>Pancolonic dye spraying, with targeted biopsy of abnormal areas is recommended, otherwise 2-4 random biopsies from every 10 cm of the colorectum should be taken.</p>	

SUPPLEMENTAL TABLE F. Continued

Society	Eligible patients	Screening	Surveillance	Recommended technique	Comments
Cancer Council of Australia 2011	UC: Extending beyond sigmoid colon CD: Involving more than 1/3 of colon	No later than 8 y after symptom onset	<ul style="list-style-type: none"> <li>• Every y: Patients with active disease, PSC, family history of CRC in a first-degree relative aged &lt;50 y, colon stricture, patients with multiple inflammatory polyps or shortened colon, previous dysplasia</li> <li>• Every 3 y: Patients with inactive ulcerative colitis extending proximal to the sigmoid colon without any of the above risk factors, patients with Crohn's colitis affecting &gt;1/3 of colon without any of above risk factors, patients with IBD with family history of colorectal cancer in a first-degree relative aged ≥50 y</li> <li>• Every 5 y: Patients who have had 2 previous colonoscopies that were macroscopically and histologically normal</li> </ul>	<ul style="list-style-type: none"> <li>• Chromoendoscopy: If available, the use of chromoendoscopy/dye spraying where targeted biopsies are obtained from visibly abnormal lesions or strictures is the preferred means to conduct colonoscopic surveillance in IBD. This is especially true for patients at high risk of CRC. Random biopsies are required from each colon segment to establish histologic extent and severity of disease.</li> <li>• If chromoendoscopy is unavailable or if an endoscopist lacks sufficient expertise with this technique or if the presence of inflammation interferes with the interpretation of chromoendoscopy, an acceptable alternative is using standard white-light endoscopy with random, non-targeted biopsies from each colon segment and from raised lesions.</li> </ul>	<ul style="list-style-type: none"> <li>• PSC: Start at time of diagnosis. Positive family history: start earlier.</li> </ul>

SUPPLEMENTAL TABLE F. Continued

Society	Eligible patients	Screening	Surveillance	Recommended technique	Comments
NICE 2011	UC: Excluding patients with isolated proctitis CD: Involving >1 segment of colon	10 y after symptom onset	<ul style="list-style-type: none"> <li>• Every year: Extensive ulcerative or Crohn's colitis with moderate or severe active inflammation (confirmed endoscopically or histologically), PSC, colon stricture in previous 5 y, any grade of dysplasia in previous 5 y, family history of CRC in a first-degree relative aged &lt;50 y.</li> <li>• Every 3 y: Extensive ulcerative or Crohn's colitis with mild active inflammation (confirmed endoscopically or histologically), post-inflammatory polyps, family history of CRC in a first-degree relative aged &lt;50 y.</li> <li>• Every 5 y: Left-sided ulcerative colitis (but not proctitis alone) or Crohn's colitis of a similar extent, extensive but quiescent ulcerative colitis, extensive but quiescent Crohn's colitis</li> </ul>	Chromoscopy and targeted biopsy of any abnormal areas, 4 mapping biopsies to determine the extent of inflammation	<ul style="list-style-type: none"> <li>• Offer a repeat colonoscopy with chromoscopy if any colonoscopy is incomplete.</li> <li>• Consider whether a more experienced colonoscopist is needed.</li> </ul>
ECCO UC: 2012	UC: Left-sided or extensive colitis	All patients 6-8 y after onset of symptoms to reassess disease extent	<p>Risk-stratify by 4 criteria (1 point for each): pancolitis, endoscopic or histologic evidence of active inflammation, pseudopolyps, and family history of CRC.</p> <ul style="list-style-type: none"> <li>• Every 1-2 y: High-risk patients (3-4 points)</li> <li>• Every 3-4 y: Low-risk patients (0-2 points) Increase interval if no evidence of intraepithelial neoplasia or endoscopic and/or histologic inflammation in 2 consecutive surveillance colonoscopies (eg, from every 1-2 y to every 3-4 y).</li> </ul>	<ul style="list-style-type: none"> <li>• Chromoendoscopy with targeted biopsies is the surveillance procedure of choice for appropriately trained endoscopists.</li> <li>• Alternatively, random biopsies (4-quadrant biopsies every 10 cm) and targeted biopsies of any visible lesion should be performed if white light endoscopy is used.</li> </ul>	<ul style="list-style-type: none"> <li>• PSC: Annual surveillance at time of diagnosis</li> <li>• Proctitis does not require regular monitoring.</li> <li>• Good bowel preparation is essential for effective surveillance. If fecal residue present, consider repeat colonoscopy.</li> </ul>

SUPPLEMENTAL TABLE F. Continued

Society	Eligible patients	Screening	Surveillance	Recommended technique	Comments
NASPGHN 2012	UC/CD involving a substantial portion of colon	7-10 y after initial diagnosis	Every 1-2 y		Children with concomitant PSC should undergo surveillance colonoscopy every 1-2 y, beginning at the time of diagnosis.
ECCO 2013	UC, except those with isolated proctitis CD, except those whose disease involves only 1 segment of colon	8 y after symptom onset to reassess disease extent	<ul style="list-style-type: none"> <li>• Every year: High-risk features (stricture or dysplasia detected within previous 5 y, PSC, extensive colitis with severe active inflammation, or family history of CRC in a first-degree relative aged &lt; 50 y.</li> <li>• Every 2-3 y: Intermediate risk factors (extensive colitis with mild or moderate active inflammation, post-inflammatory polyps or family history of CRC in a first-degree relative aged ≥ 50 y.</li> <li>• Every 5 y: Neither intermediate nor high-risk features</li> </ul>	<ul style="list-style-type: none"> <li>• Chromoendoscopy with targeted biopsies</li> <li>• Random biopsies (4 every 10 cm) if chromoendoscopy expertise is not available, but this is inferior to chromoendoscopy for dysplasia detection</li> </ul>	Attention to patient preparation (effective bowel preparation) and technique (meticulous withdrawal, use of high-resolution endoscopic equipment)
ESGE 2014	UC: Long-standing left-sided or extensive colitis CD: Extensive colitis			<ul style="list-style-type: none"> <li>• 0.1% Methylene blue or 0.1%-0.5% indigo carmine pancolonoscopic chromoendoscopy with targeted biopsies</li> <li>• Can abandon random biopsies during examinations of colitis with quiescent disease activity with adequate bowel preparation, performed by appropriately trained endoscopists.</li> </ul>	



SUPPLEMENTAL TABLE F. Continued

Society	Eligible patients	Screening	Surveillance	Recommended technique	Comments
ASGE 2015	UC: Left-sided or extensive colitis  CD: Involving at least 1/3 of colon * Ideally, surveillance colonoscopy should be performed when colon disease is in remission.	All patients at 8 y, with restaging biopsies	<ul style="list-style-type: none"> <li>Every 1-3 y: Optimal surveillance interval not defined. Presence of these risk factors merits annual surveillance: active inflammation, anatomic abnormality (stricture, multiple pseudopolyps), history of dysplasia, family history of CRC in first-degree relative, PSC.</li> </ul>	<ul style="list-style-type: none"> <li>Chromoendoscopy with pancolonic dye spraying and targeted biopsies is sufficient for surveillance in IBD; consider 2 biopsies from each colon segment for histologic staging. or</li> <li>Random biopsies with targeted biopsies of any suspicious lesions is a reasonable alternative if chromoendoscopy is not available or if the yield of chromoendoscopy is reduced by significant underlying inflammation, pseudopolyposis, or poor preparation. Pancolitis: 4-quadrant biopsies every 10 cm from cecum to rectum, for minimum of 33 biopsies. No pancolitis: 4-quadrant biopsies every 10 cm limited to greatest extent of endoscopic or histologic involvement documented by any colonoscopy</li> </ul>	Extent of colon involvement should be defined by greatest extent of endoscopic or histologic involvement documented by any colonoscopy. Isolated proctitis does not confer increased risk of IBD-related CRC. Patients with PSC should begin surveillance colonoscopy at the time of diagnosis, then yearly.

ASGE, American Society for Gastrointestinal Endoscopy; UC, ulcerative colitis; CD, Crohn's disease; CRC, colorectal cancer; PSC, primary sclerosing cholangitis; IBD, inflammatory bowel disease; AGA, American Gastroenterological Association; ACG, American College of Gastroenterology; CCFA, Crohn's & Colitis Foundation of America; BSG, British Society of Gastroenterology; NICE, National Institute for Health and Clinical Excellence; ECCO, European Crohn's and Colitis Organization; NASPGHN, North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition; ESGE, European Society of Gastrointestinal Endoscopy.

**SUPPLEMENTAL TABLE G. Post-polypectomy surveillance after index resection**

<b>Study</b>	<b>Initial surveillance after index resection</b>	<b>Subsequent surveillance recommendation</b>
Rubin <sup>236</sup>	2-6 mo until no dysplastic polyps detected	Yearly
Hurlstone <sup>226</sup>	1, 3, and 6 mo	Biannually
Smith <sup>227</sup>	3 and 6 mo	Biannually