

# An Atlas of the Nonpolypoid Colorectal Neoplasms in Inflammatory Bowel Disease



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## KEYWORDS

- Inflammatory bowel disease • Nonpolypoid colorectal neoplasms
- Colorectal cancer • Chromoendoscopy • Surveillance colonoscopy

## KEY POINTS

- Patients with inflammatory bowel disease (IBD) have an increased risk of colorectal cancer (CRC).
- Studies suggest that the current standard of colonoscopy surveillance with random biopsies to detect dysplasia in IBD patients is inadequate.
- With the use of current knowledge, technology and techniques most dysplasia in IBD patients is visible during colonoscopy.
- Data and guidelines now support the use of chromoendoscopy with targeted biopsy in the detection of dysplasia and/or colorectal cancer in patients with colitic IBD.

## INTRODUCTION

The role of endoscopy in the management of patients with inflammatory bowel disease (IBD) is well established. However, recent data have shown significant limitations in the effectiveness of the use of colonoscopy to prevent colorectal cancer (CRC) in patients with IBD colitis. The current standard using random biopsy appeared to be largely ineffective in detecting the nonpolypoid colorectal neoplasms (NP-CRN). Data using chromoendoscopy with targeted biopsy, however, showed a significant improvement when used to detect dysplasia, the best predictor of colorectal cancer risk. The purpose of this monograph is to provide the medical profession with a useful and organized series of images showing the superficial elevated, flat, and depressed colorectal neoplasms and their appearance after the application of the technique of chromoendoscopy.

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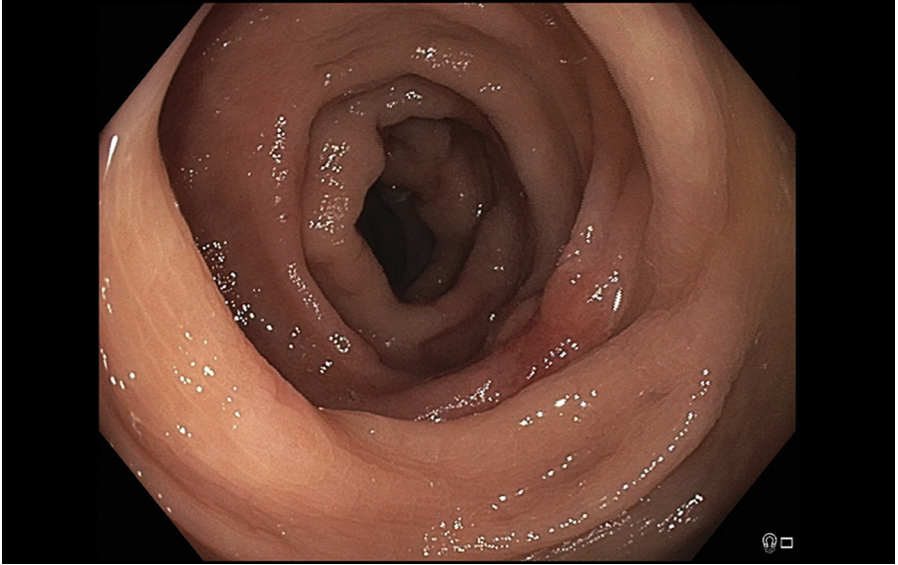


Fig. 1. Endoscopic view of nonpolypoid colorectal neoplasm.

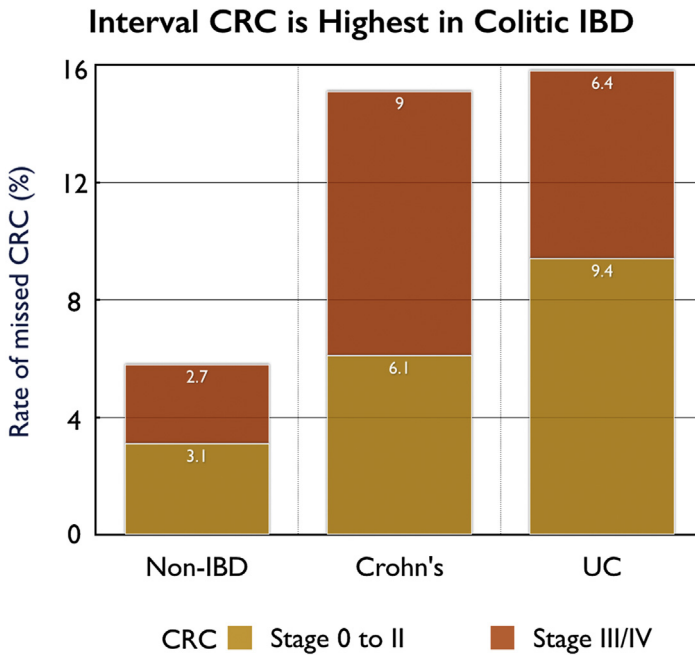
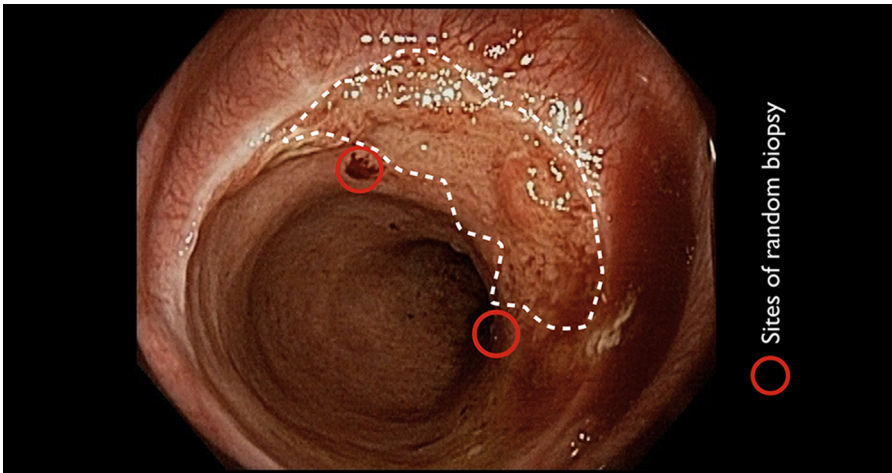
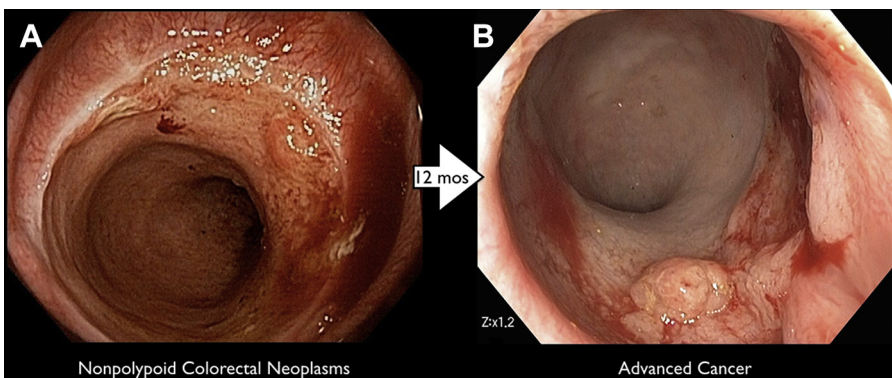


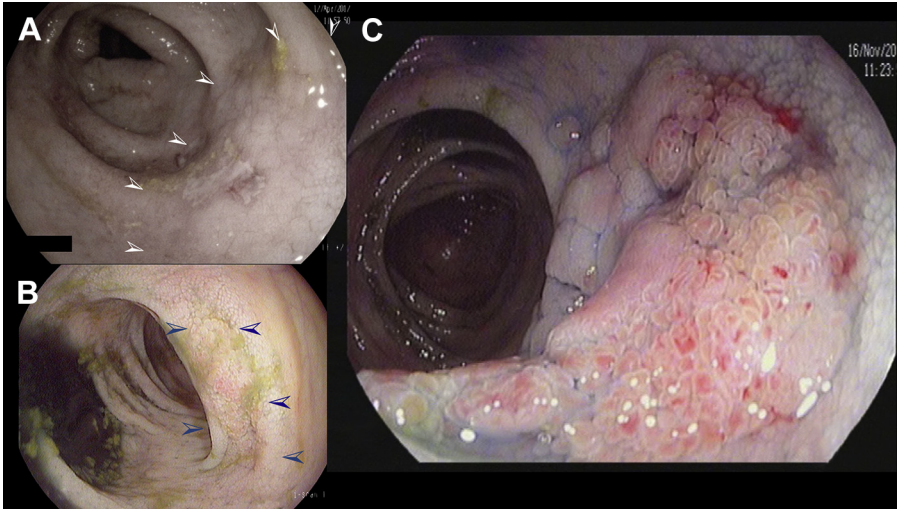
Fig. 2. Current surveillance against CRC is associated with a high risk of interval cancer. In a study of 55,000 Medicare patients diagnosed with CRC, patients with IBD were 3 times more likely to have had a recent colonoscopy than patients without IBD. A significant fraction (15%) of the IBD patients who were diagnosed with CRC had undergone surveillance colonoscopy in the prior 3 years. Note that many of these cancers were advanced. These data indicate that the standard method used during surveillance colonoscopy, namely the random biopsy technique, is inadequate.<sup>1</sup>



**Fig. 3.** Random biopsy without interpreting what is being viewed is not effective. This example shows that random biopsy of the colon to detect and diagnose dysplasia has a high miss rate.<sup>2</sup> In this patient, random biopsies were taken from the circled areas, as shown by the blood. Unfortunately the neoplasia (*encircled by the dashed line*) was not biopsied. Note that the high-definition adult colonoscope was used, and the lesion was not detected. High definition increases the resolution of the image. For example, high definition captures at least 720 pixels from top to bottom (with most capturing 1080 pixels), whereas standard definition captures 480 pixels. What is needed, however, is not only increased resolution, but also improved contrast between dysplastic and nondysplastic mucosa. If the dysplasia can be highlighted or colored distinctly, its detection and diagnosis may be easier.

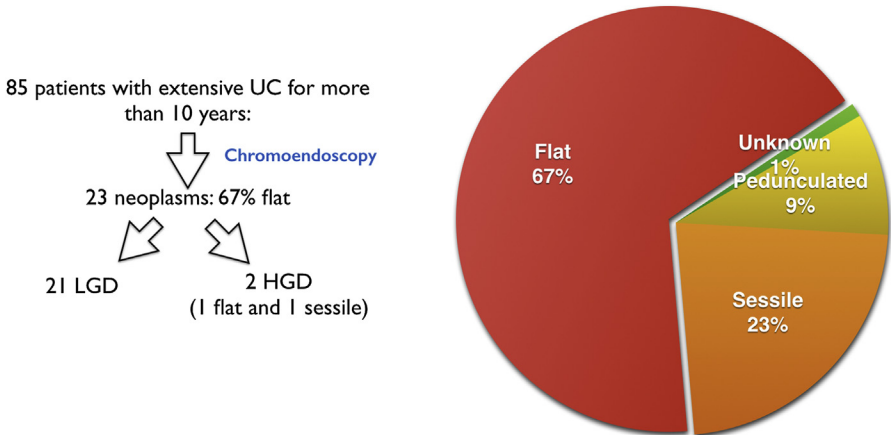


**Fig. 4.** An example of an interval cancer in a patient with ulcerative colitis. This patient was referred to the authors 1 year after image (A) was taken. He presented for staging endoscopic ultrasonography after a repeat surveillance showed an ulcerated mass lesion (B). The lesion had become an advanced cancer. He underwent a total proctocolectomy. T2, N2 poorly differentiated carcinoma was found.

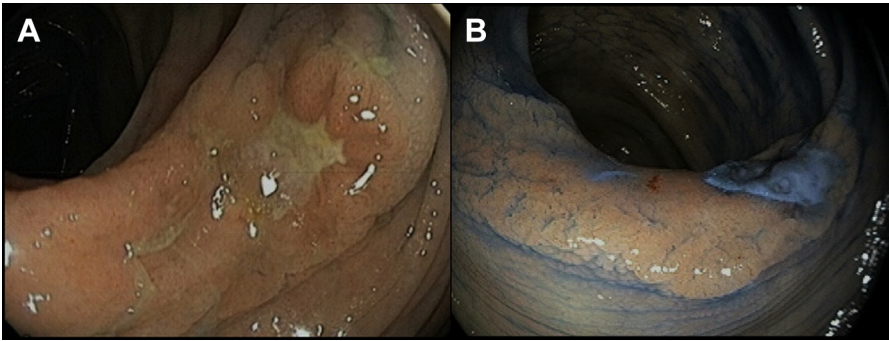


**Fig. 5.** Chromoendoscopy facilitates visualization of NP-CRN. (A) The lesion was difficult to appreciate with high-definition white-light endoscopy. A possible flat lesion was noted retrospectively, as shown by the white arrowheads. (B) The patient presented for follow-up 6 months later. A possible superficial elevated lesion was noted (*blue arrowheads*). (C) After application of dilute indigo carmine, the lesion and its borders were easily detected.

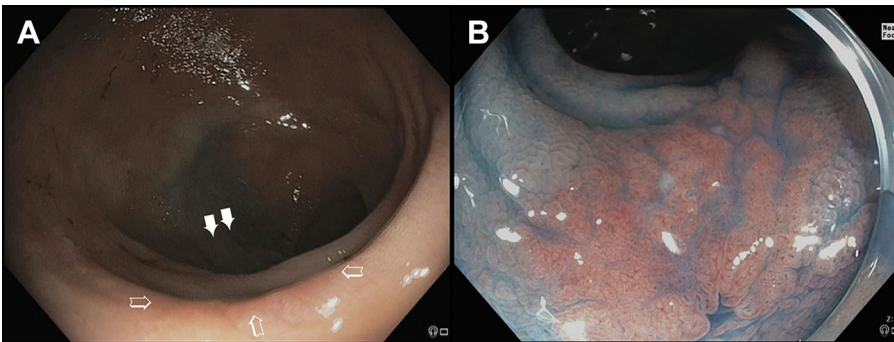
### Nonpolypoid Colorectal Neoplasms Are Common in Colitic IBD



**Fig. 6.** NP-CRN are relatively common in patients with long-standing ulcerative colitis. Jaramillo and colleagues studied the yield of performing chromoendoscopy in patients with extensive and long-standing ulcerative colitis, and found that most neoplasms were flat. The detection of these superficial elevated, flat, or depressed neoplasms, however, poses a special challenge because the background mucosa is often scarred or inflamed.<sup>3</sup> HGD, high-grade dysplasia; LGD, low-grade dysplasia; UC, ulcerative colitis.

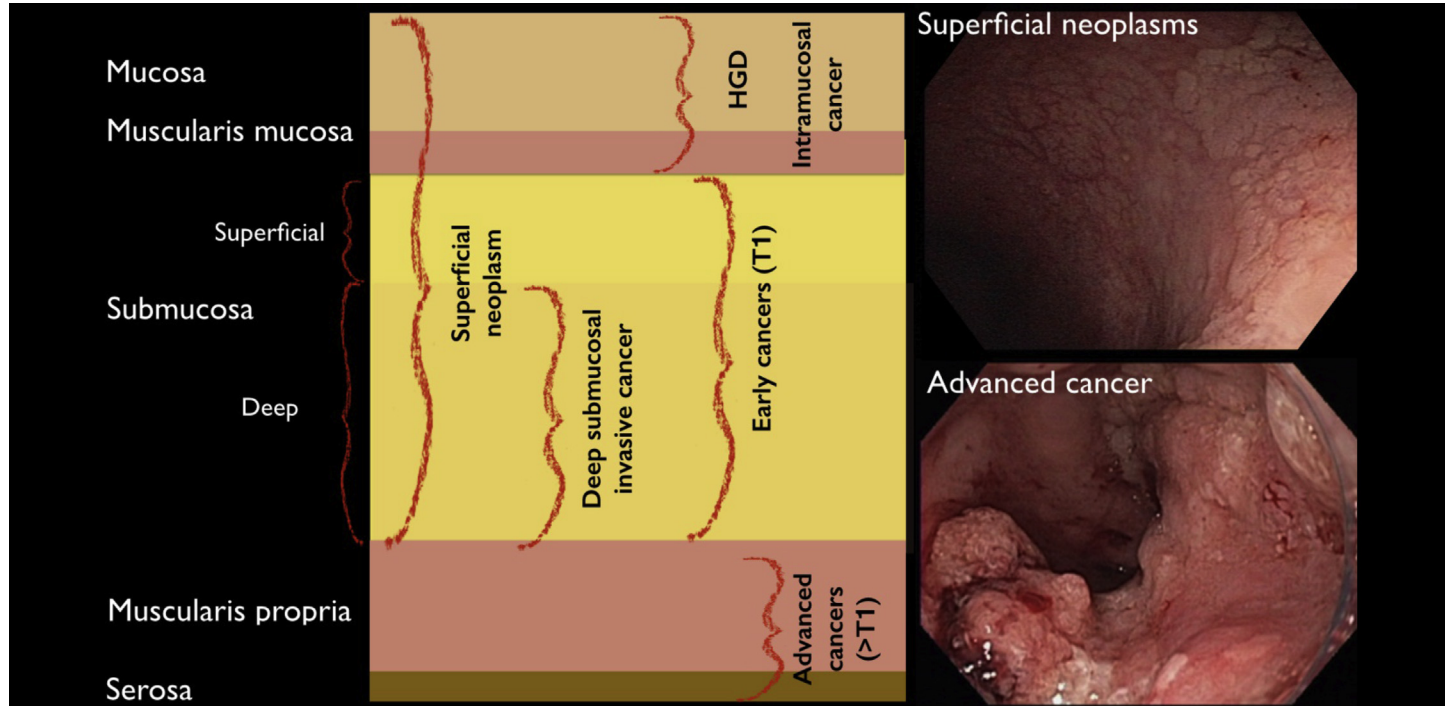


**Fig. 7.** Most colorectal neoplasms in colitic IBD are believed to be visible. A lesion might be considered an “invisible” neoplasm because it was not recognized during the examination.<sup>4</sup> The lesion shown in (A), despite being photographed en face, was not recognized as a superficial elevated lesion with an ulcer. The endoscopist missed the lesion again during a repeat surveillance colonoscopy 5 months later, which was performed to survey a pedunculated polyp resection site. The patient, who has long-standing Crohn’s colitis, presented to the authors 14 months later for surveillance colonoscopy. A similar-appearing lesion was easily detected using chromoendoscopy (B). Understanding the appearance of the NP-CRN and the signs of its presence are critical to performing an efficacious colonoscopy.



**Fig. 8.** Understanding the techniques useful to visualize NP-CRN is important, as NP-CRN in patients with colitic IBD can be very difficult to detect. This patient with Crohn’s colitis had endoscopic mucosal resection (EMR) of a superficial elevated NP-CRN. The pathology of the lesion showed low-grade dysplasia (LGD). However, the biopsies of the surrounding mucosa also showed LGD. Thus, he was referred for further evaluation. In (A), a slightly more reddish mucosa was seen (open arrows). Chromoendoscopy with indigo carmine was used to delineate the border of the lesion (B). The lesion had a distinct border. It was completely endoscopically resected and found to be LGD. Note that a distal attachment cap was required to push the fold (double solid arrows) to examine the area proximal to the fold.<sup>5</sup>

## NOMENCLATURE



**Fig. 9.** Understanding the nomenclature of superficial neoplasms is important. The term superficial is used when the tumor is either noninvasive appearing or small. Superficial includes noncancer neoplasms, and mucosal and submucosal invasive cancers. A subset of superficial cancers that appear to have a significant invasion into the submucosa is called massive submucosal invasive cancer. Matsuda and colleagues suggested that the presence of redness, firm consistency, expansion, and deep depression are important findings of deeply submucosal invasive cancer.<sup>6</sup> In the upper image, the neoplastic lesion appeared benign and limited to the mucosa. It has none of the findings of deeply submucosal invasion. In the lower image, the lesion was large, and invaded deeply into the wall. The lesion was red, firm appearing, full, and had deep depression. The lesion in the upper image may be removable by endoscopy, whereas surgery would be required for the lesion in the lower image.

## Macroscopic Classification of Superficial Colorectal Neoplasms (Type 0)

Type 0-I (Polypoid or P-CRN)



Pedunculated (Ip)



Sessile (Is)

Type 0-II (Nonpolypoid or NP-CRN)



Superficial Elevated (IIa)



Superficial Elevated (IIa)



Flat (IIb)

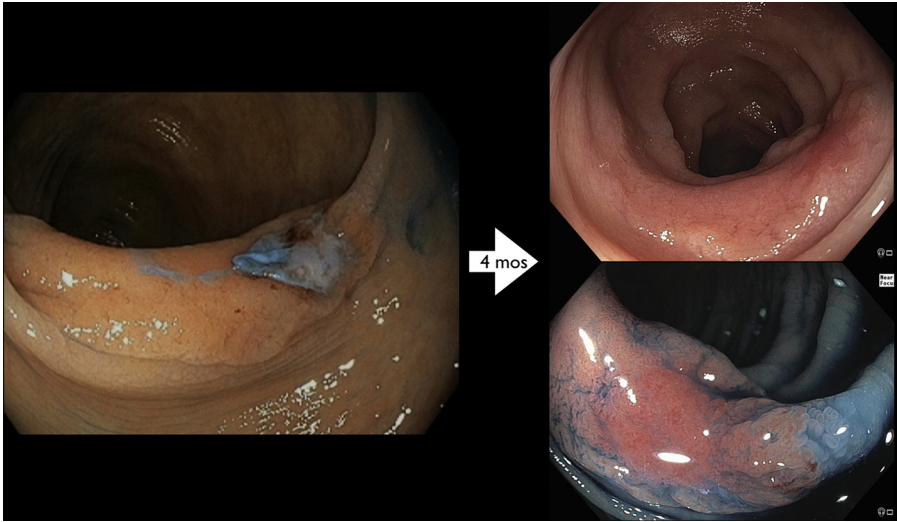


Depressed (IIc)

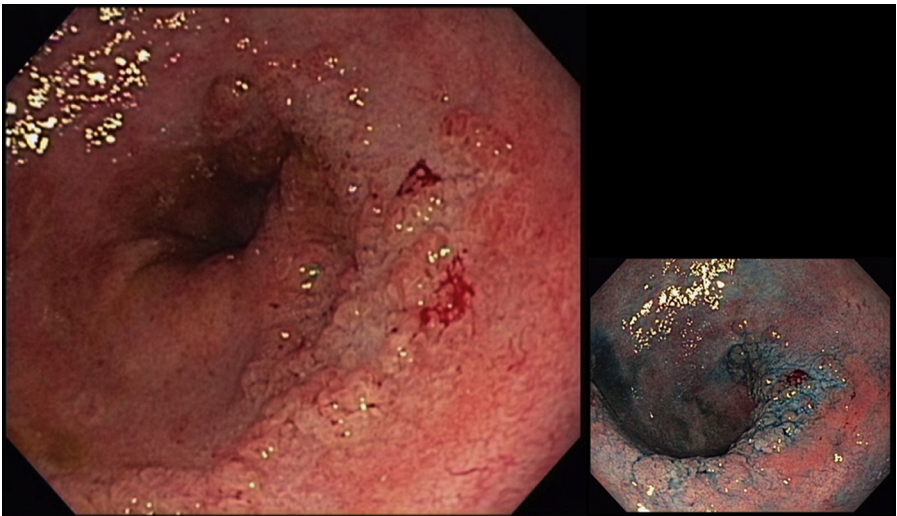


Depressed (IIc)

**Fig. 10.** The major variants of superficial neoplastic lesions in the colon and rectum. Superficial colorectal neoplasms in patients with IBD can be described.<sup>7,8</sup> Lesions are classified as protruding (polypoid) and nonprotruding (nonpolypoid). Polypoid neoplasms may be further divided into pedunculated (0-Ip) or sessile (0-Is). Nonpolypoid lesions can be divided into slightly elevated/table top (IIa), depressed (IIc), or completely flat (IIb). An international group of IBD experts, endoscopists, pathologists, and methodologists who gathered in San Francisco in March 2014 (SCENIC Consensus) suggested that the current classifications for IBD patients should also include: (1) description of an ulcer, if present, within the lesion; and (2) description of the border of the lesion, especially if it cannot be recognized.<sup>9</sup>



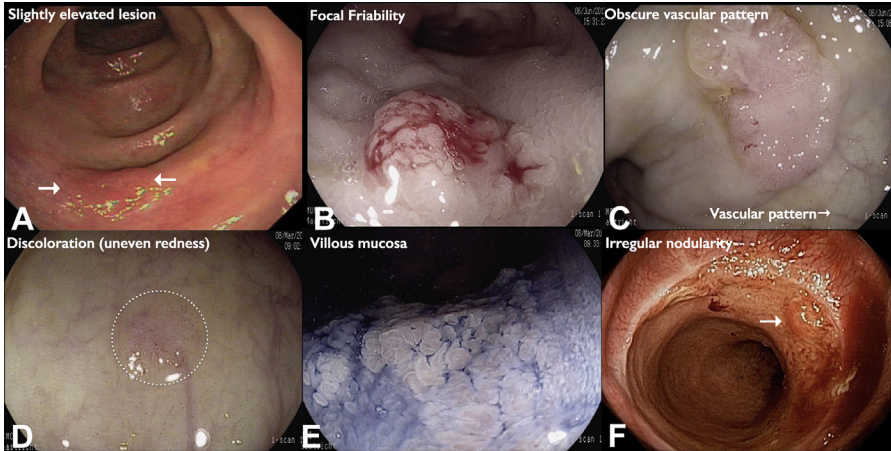
**Fig. 11.** The presence of an ulcer within a lesion needs to be characterized. A 4-cm superficial elevated neoplasm in a patient with long-standing Crohn's colitis with a 7-mm ulcer is shown. The ulcer appeared benign; its edge was not full and its base did not appear deep or nodular. The patient elected to have a slightly delayed endoscopic resection, rather than an immediate surgery. He was treated with a short course (2 months) of oral steroids. The ulcer resolved following escalation of medical therapy, and the circumscribed superficial elevated lesion was treated with endoscopic resection. The pathology indicated LGD. The presence of an ulcer within a lesion, however, may indicate carcinomatous degeneration.



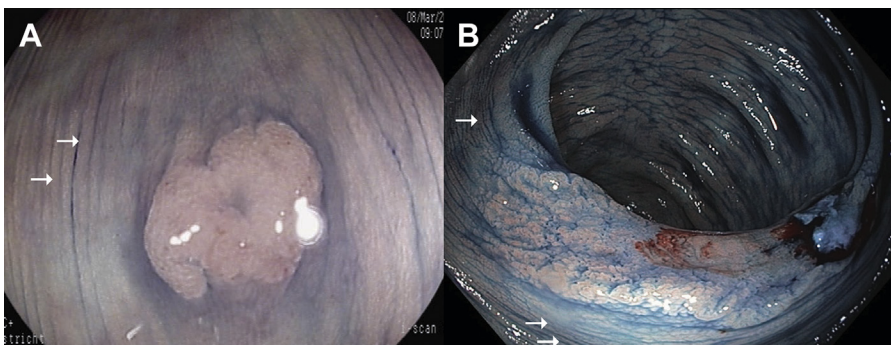
**Fig. 12.** The absence of the border of the lesion needs to be characterized. This ill-defined nodular, friable, irregular surface was seen in the rectum during surveillance examination. Even following the application of chromoendoscopy, the border remained unable to be visualized. Such a lesion is not amenable to endoscopic resection, and targeted biopsy should be performed. A tattoo of the area for marking was made, and the patient was referred for surgical evaluation.



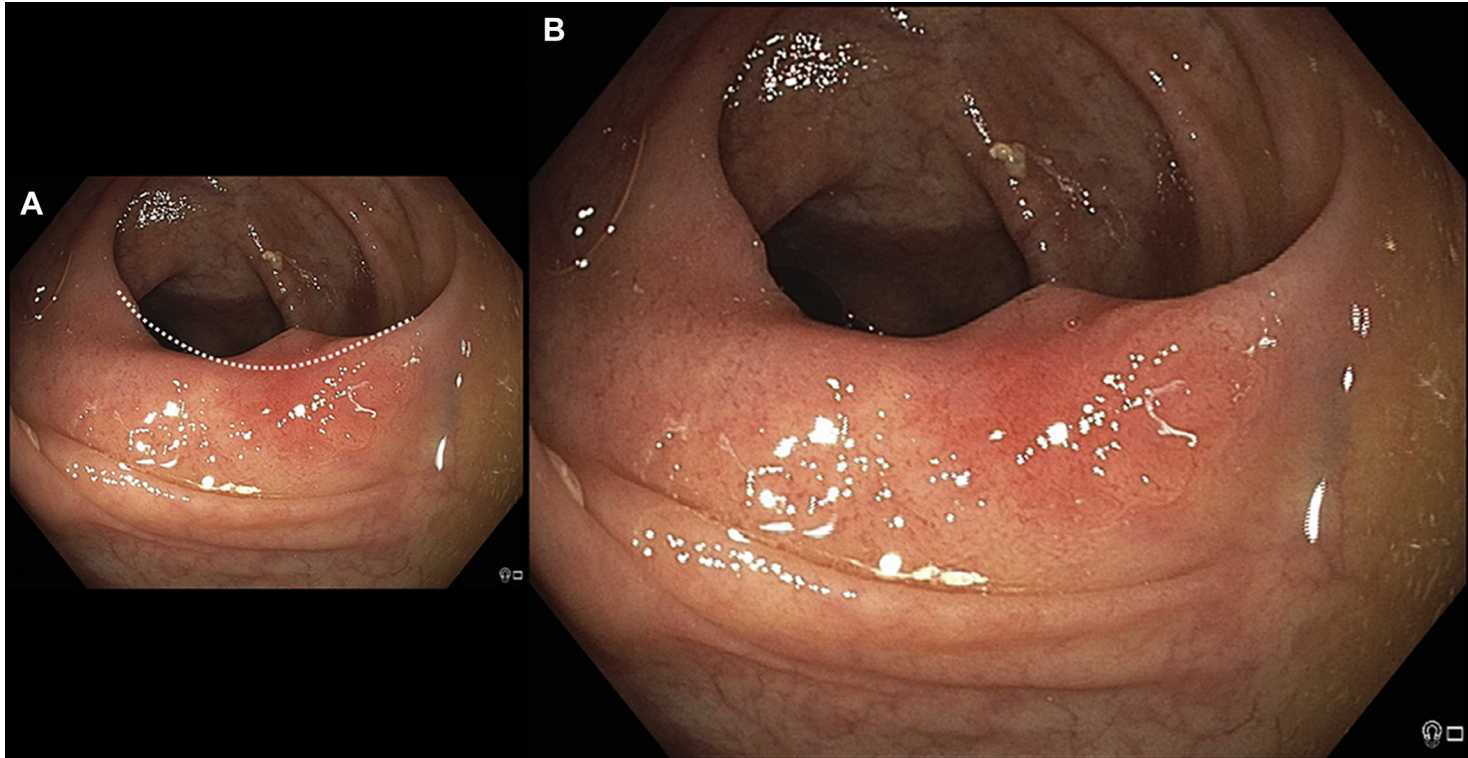
## SIGNS OF NONPOLYPOID COLORECTAL NEOPLASMS IN IBD



**Fig. 13.** Signs of NP-CRN in colitic IBD. The detection of flat and depressed neoplasms in colitic IBD, unlike the detection of polypoid neoplasms, relies primarily on the recognition of subtle changes in the mucosa. The subtle findings require constant awareness by the endoscopist for areas that appear to be slightly different than the background in color, pattern, or level. (A) Nonpolypoid lesions typically have a slightly elevated appearance that can often be recognized by a deformity on the colon wall (*arrows*). (B) Occasionally there may be spontaneous hemorrhage on the surface. The surface may be friable. (C) Obscure vascular pattern or (D) increased erythema (*within circle*) may suggest a lesion is present, in that these lesions may disturb the mucosal vascular network. The surface pattern may show (E) villous features or (F) irregular nodularity (*arrow*).

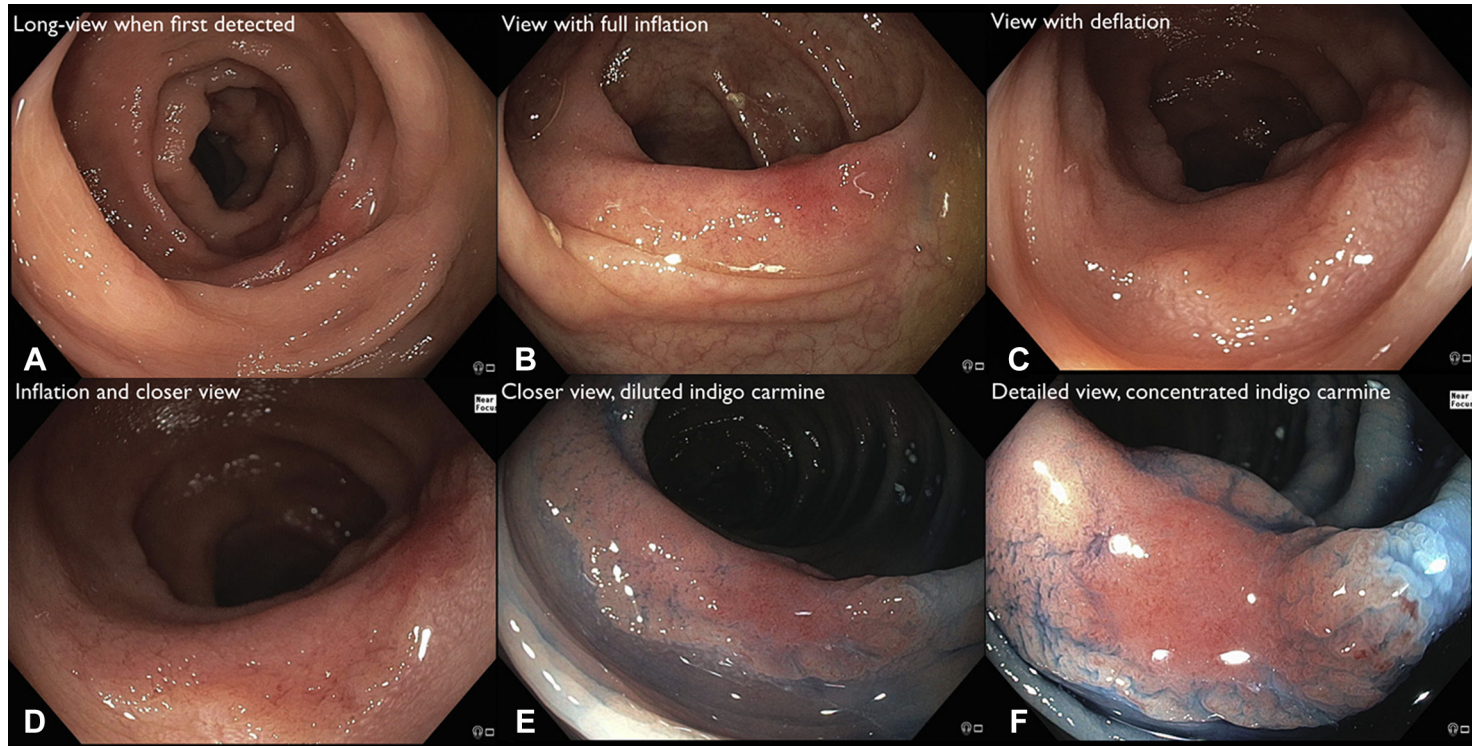


**Fig. 14.** Interruption of the innominate grooves can alert the endoscopist to the presence of NP-CRN. Innominate grooves, on histology, are mucosal areas where several crypts open into one central crypt. (A) On endoscopy, they are visible in normal colonic mucosa and nonneoplastic lesions (*arrows*), whereas they are interrupted in neoplastic lesions. (B) These areas can be better observed following the application of dye, such as indigo carmine, as the dye pools into the grooves and makes them appear as blue lines (*arrows*).

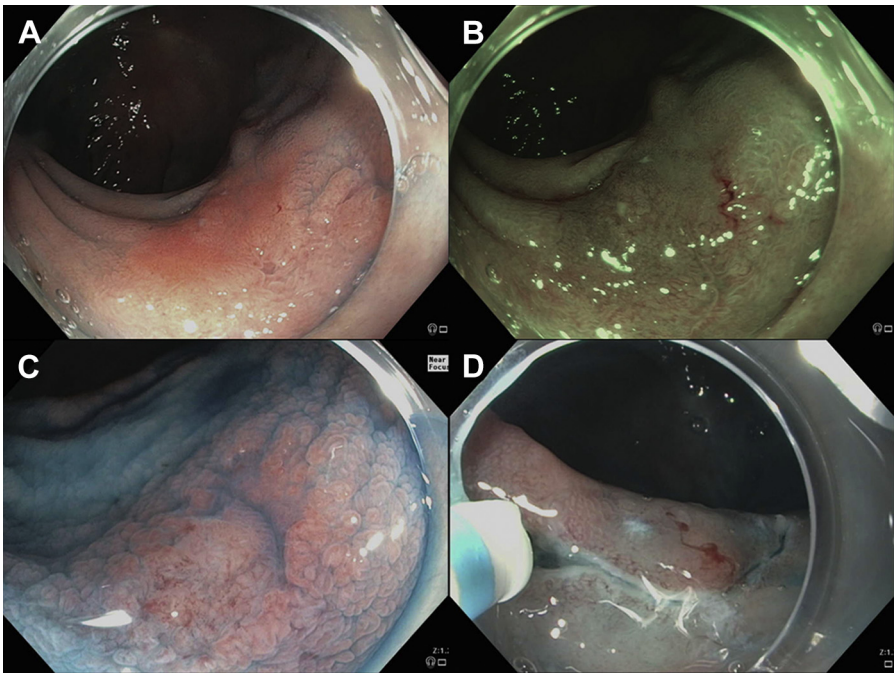


**Fig. 15.** (A, B) Wall deformity is another sign of the presence of NP-CRN. The expected natural curve of the fold is shown in A (dotted line). In this case, the wall was deformed. A large superficial flat neoplasm was the cause of this deformity.

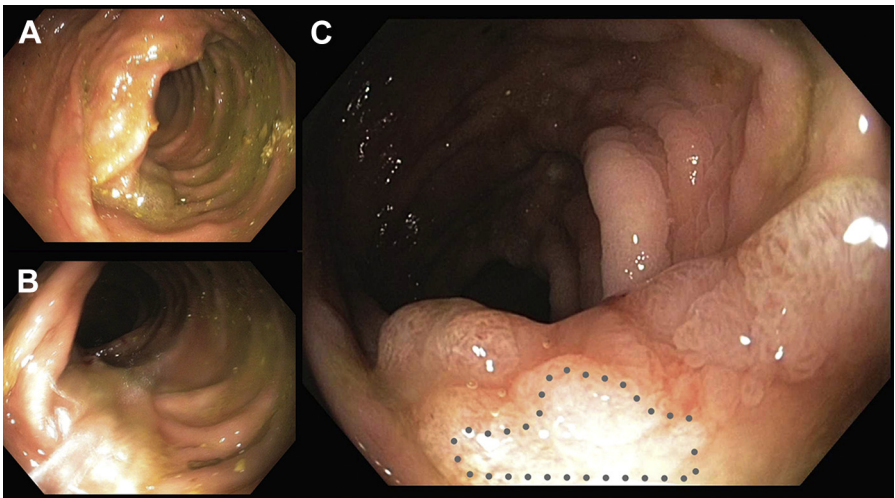
## PHOTODOCUMENTATION



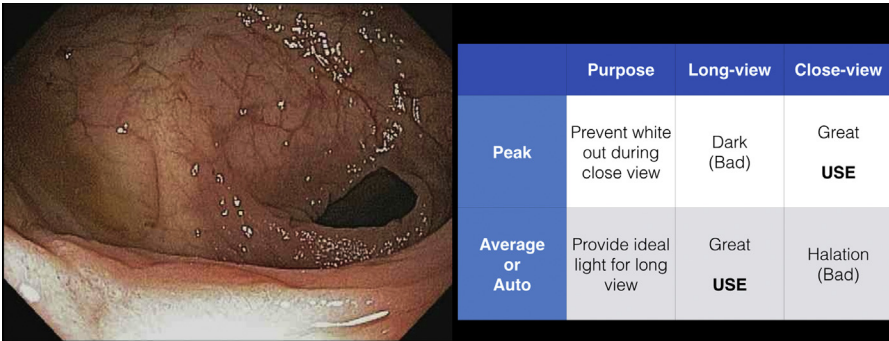
**Fig. 16.** General to detailed visualization of a superficial elevated neoplasm and its imaging documentation. Examination of a lesion to understand the significance of its detail is a fluid stepwise process. For example, (A) on detection, the lesion is first viewed in a long view, to understand and evaluate its relative size, shape, and location. The lesion is then examined with varying expansion of the colon. Increasing (B) or decreasing (C) air insufflation may help improve visualization of a flat or depressed lesion. (D) Closer view permits detailed examination of the vessel and surface pattern. (E, F) Application of indigo carmine dye further enhances the borders of the lesion and the details of the morphology and surface pattern.



**Fig. 17.** General to detailed visualization of a flat neoplasm and its imaging documentation, illustrating the use of a translucent distal attachment device (cap) in the detailed view and understanding of the lesion. Documentation of the lesion is best performed by taking an overview (long-shot) picture, before close-up pictures are taken (A, B, C). In (A), the lesion is inspected using high definition white light. In (B), narrow-band imaging (NBI) was used to visualize the surface and microvessel patterns. In (C), indigo carmine was used to determine the margin of the lesion. Pit-pattern characterization of the lesion using either NBI or indigo carmine is generally not useful. Detailed imaging of the lesion is critical for its complete resection. (D) A circumferential cut was performed to isolate the lesion before its snaring.

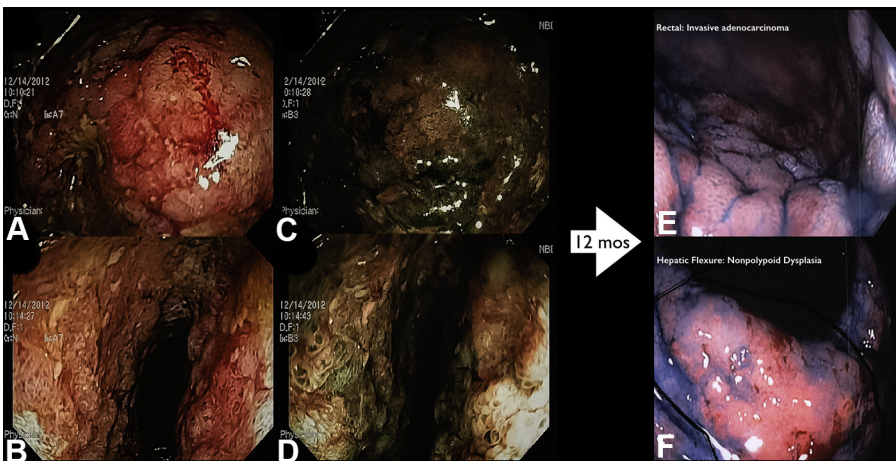


**Fig. 18.** (A–C) White-out (halation) can impair adequate viewing and interpretation. There is a blurred effect around the edges of the area highlighted caused by reflection and scattering of light.



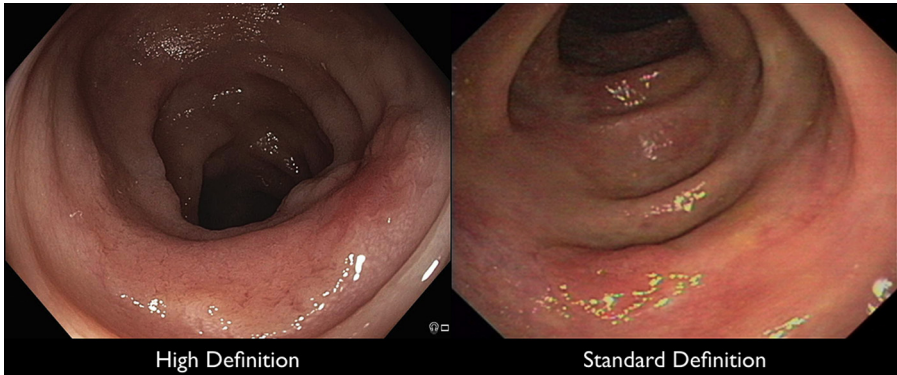
**Fig. 19.** Appropriate setting of the iris is important. The iris function on endoscope processors adjusts the distribution of light, and is generally sufficient to adjust brightness.

- Auto: The brightness is adjusted based on the brightest part of the central part and the average brightness of the periphery part.
- Peak: The brightness is adjusted based on the brightest part of the endoscopic image.



**Fig. 20.** Inadequate documentation and preparation, and inappropriate use of, image-enhanced endoscopy. A picture is worth a thousand words, except when the picture is not adequate. In this case, only close-up images were taken (A–F). In addition, surveillance for IBD dysplasia must be performed in patients with inactive disease, with bowel preparation of adequate quality and the appropriate imaging and tools. A surveillance colonoscopy with random biopsies was performed with the aid of NBI in this 41-year-old patient with long-standing Crohn's colitis and primary sclerosing cholangitis (A, B). Importantly the images show severe disease inactivity and inadequate bowel preparation. NBI, which has not been shown to provide any benefit for detection of dysplasia when compared with white light or chromoendoscopy, was used (C, D). Random biopsies were performed, which showed severe chronic active colitis with focal LGD in the right colon, and moderate chronic active colitis in the transverse and left colon. No biopsies were taken of the rectum. One year later, a repeat colonoscopy was performed in the setting of less active disease using chromoendoscopy with targeted biopsy. Targeted biopsy showed (E) an invasive low-grade adenocarcinoma in the rectum and (F) a nonpolypoid dysplastic lesion in the hepatic flexure.

## GENERAL PRINCIPLES

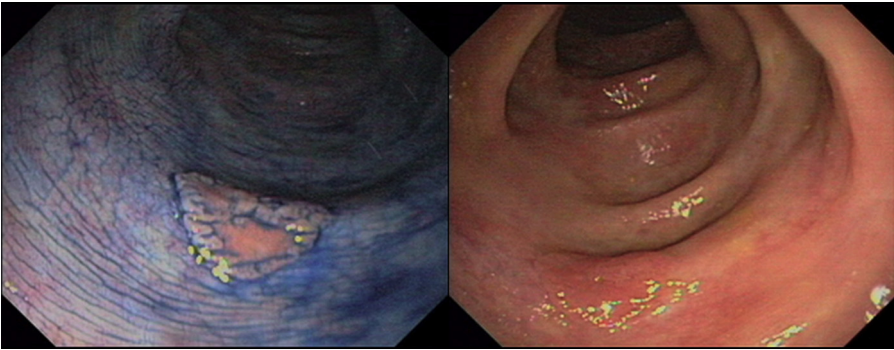


**Fig. 21.** High-definition white-light imaging is superior to standard-definition white-light imaging for surveillance of dysplasia in the detection of dysplasia and/or CRC in patients with colitic IBD. Surveillance using high-definition colonoscopy detected significantly more patients with dysplasia (prevalence ratio 2.3, 95% confidence interval [CI] 1.03–5.11) and detected significantly more endoscopically visible dysplasia (risk ratio 3.4, 95% CI 1.3–8.9).<sup>10</sup>

### Chromoendoscopy with targeted biopsy leads to increased efficacy compared to white light colonoscopy

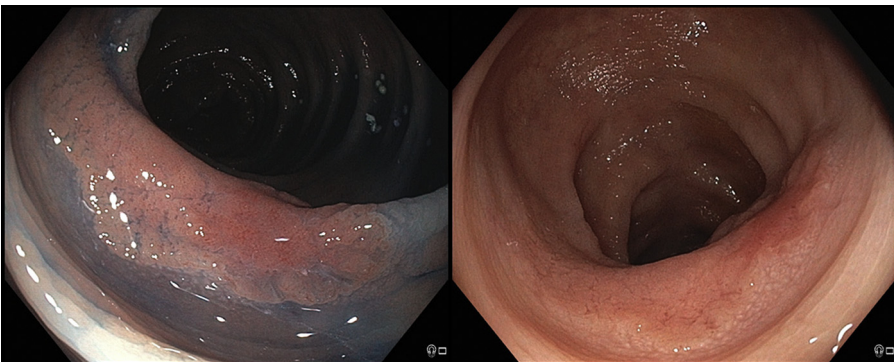
- Leads to 7% (95% CI: 3.3 to 10.3%) increase in the detection of dysplasia/patient
- NNT to find another patient with at least one dysplasia: 14.3 (range 9.7 to 30.3)
- Likelihood to find any dysplasia: Odds ratio: 8.9 (95% CI: 3.4 to 23)
- Likelihood to find flat dysplasia: Odds ratio 5.2 (95% CI: 1.7 to 15.9)

**Box. 1.** Chromoendoscopy with targeted biopsy leads to increased efficacy of surveillance. In a meta-analysis of 6 clinical trials comparing chromoendoscopy with white-light endoscopy, chromoendoscopy detected additional dysplasia in 7% of patients in comparison with white-light endoscopy. The number needed to treat (NNT) to find another patient with at least 1 dysplasia was 14. Chromoendoscopy with targeted biopsy increased the likelihood of detecting any dysplasia by 9 times when compared with white light, and the likelihood of detecting nonpolypoid dysplasia was 5 times higher. (Data from Soetikno R, Subramanian V, Kaltenbach T, et al. The detection of nonpolypoid (flat and depressed) colorectal neoplasms in patients with inflammatory bowel disease. *Gastroenterology* 2013;144(7):1349–52.)



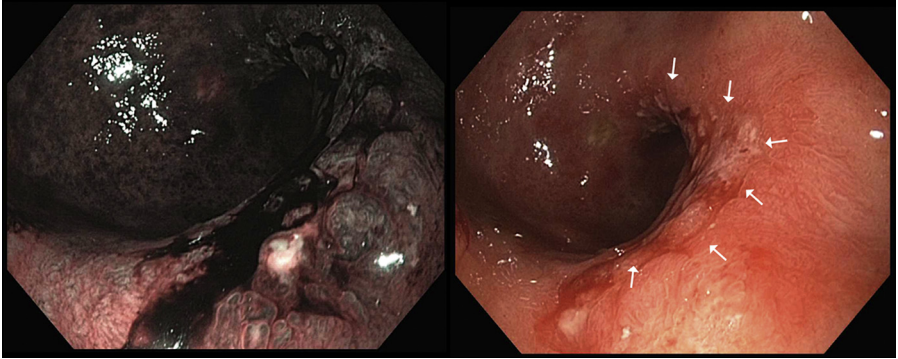
**Fig. 22.** Standard definition chromoendoscopy is superior to standard definition white light imaging in the detection of dysplasia and/or CRC in patients with colitic IBD. A meta-analysis of 8 studies that included a total of 785 patients with IBD, 82 (10.4%) of whom were later found to have dysplasia and 7, cancer (0.89%), showed superiority in the use of chromoendoscopy (*left*) when compared with white light (*right*):

1. Detected significantly more patients with dysplasia: incremental yield 6%, 95% CI 2.8% to 9.2%
2. Detected significantly more patients with endoscopically visible dysplasia: incremental yield 7%, 95% CI 3.0% to 10.0%
3. Detected significantly more dysplasia: incremental yield 15%, 95% CI 5.0% to 24.0%.

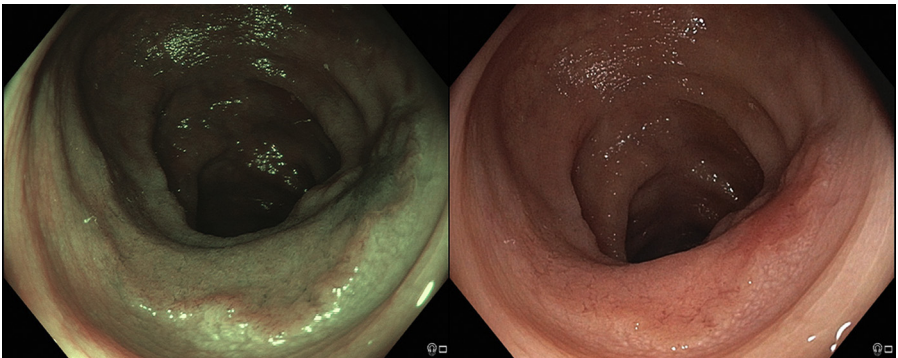


**Fig. 23.** High definition with indigo carmine is superior to high definition white light in the detection of dysplasia and/or colorectal cancer in patients with colitic IBD.

1. Detected significantly more patients with dysplasia, 21.3% (16/75) versus 9.3% (7/75), incremental yield 12% ( $P = .007$ )
2. Detected significantly more endoscopically visible dysplasia, 100% (22/22) versus 45.4% (10/22), incremental yield 16% ( $P = .004$ )
3. Detected significantly more patients with nonpolypoid dysplastic lesions, 9.3% versus 1.3%, incremental yield 8% ( $P = .011$ ).<sup>11</sup>

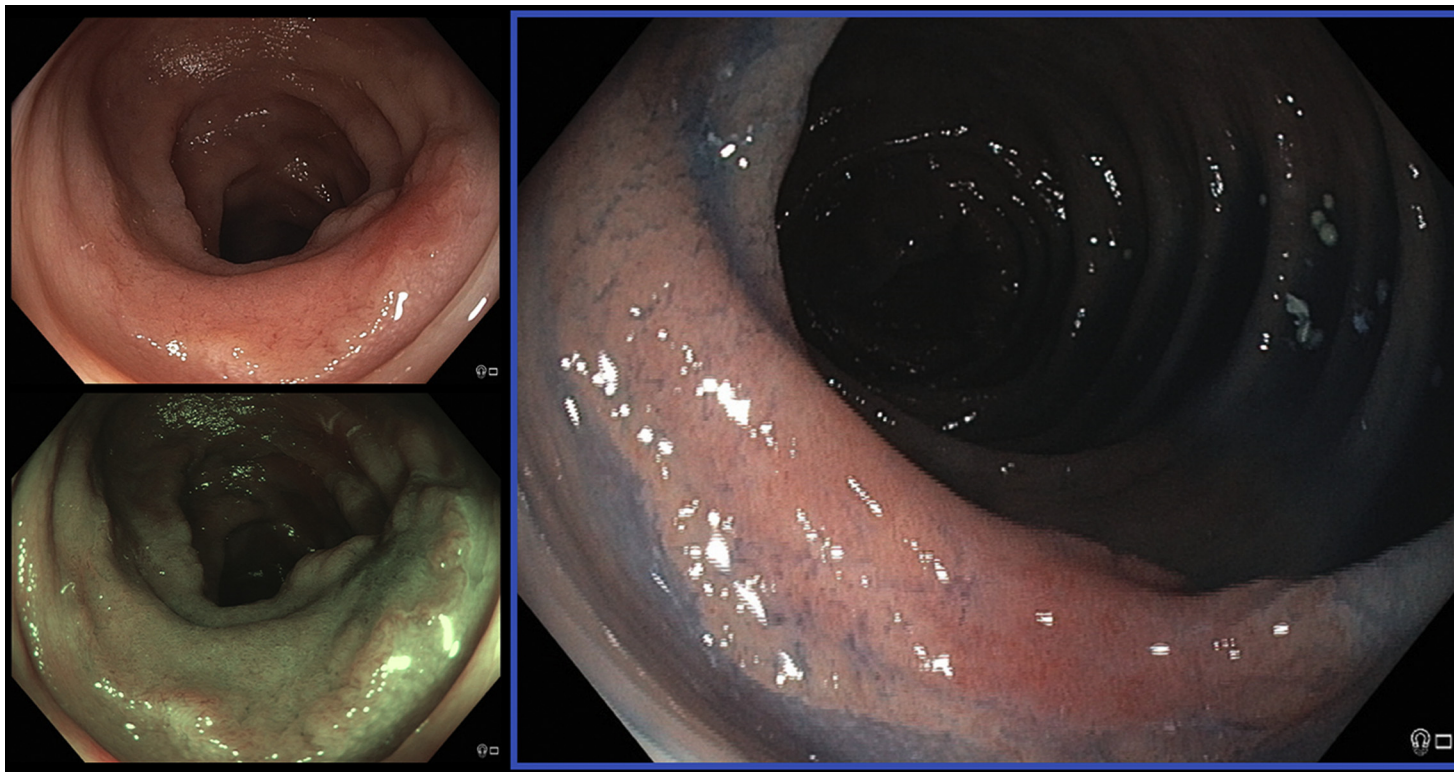


**Fig. 24.** High definition NBI is not superior to high-definition white light in the detection of dysplasia in IBD patients. Two studies on the performance of surveillance colonoscopy with a high definition colonoscope were performed to compare NBI with white light. A total of 160 patients with IBD, 21 (13.1%) of whom were later found to have dysplasia and none, cancer, were studied. The use of NBI, compared with white light, did not lead to significant differences in the number of patients who were found to have any dysplasia. In fact, the use of NBI led to decreased detection of dysplastic lesions.<sup>12,13</sup> The first generation of NBI was used in the studies and in this image. Note that the use of NBI caused the image to become quite dark. On biopsy of the depressed area (arrows), high-grade dysplasia (HGD) was found.



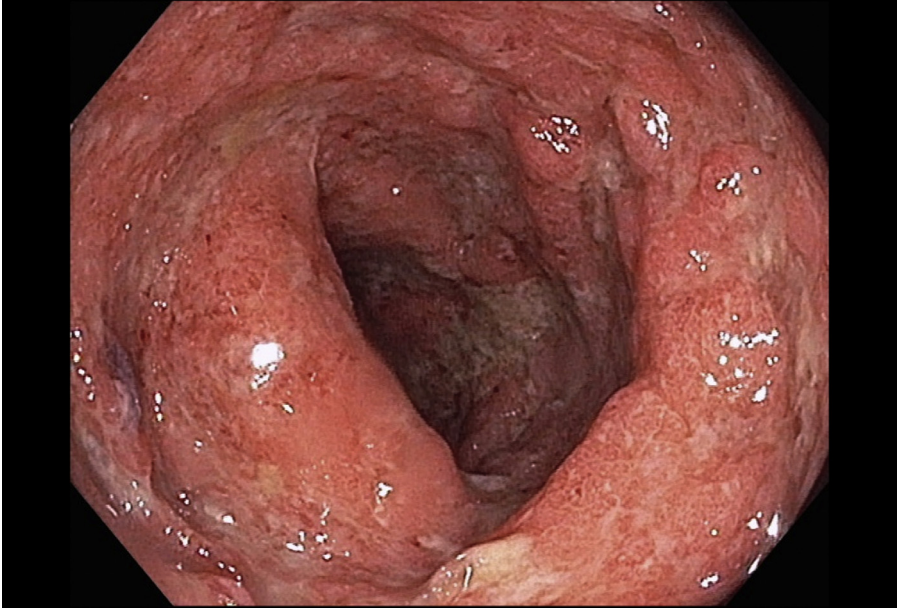
**Fig. 25.** A large, superficial, elevated lesion was imaged using the latest generation of NBI. The image was still somewhat dark.



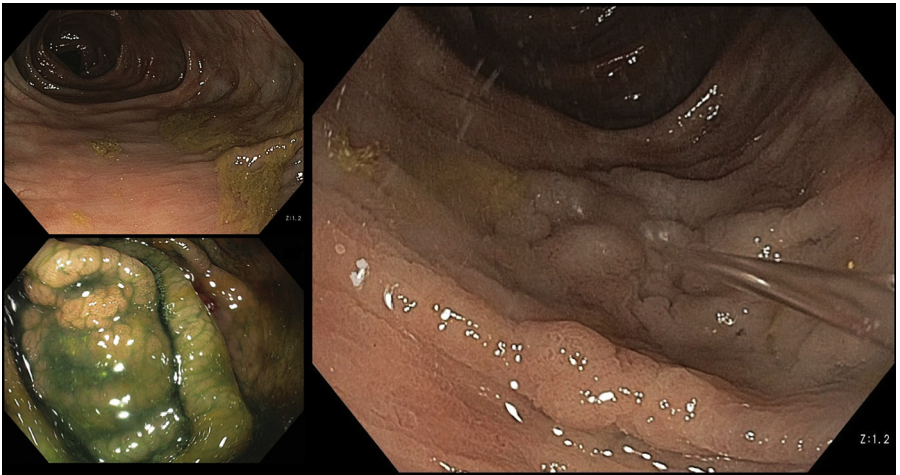


**Fig. 26.** High-definition NBI is not superior to high-definition chromoendoscopy. There has been interest to use NBI in lieu of chromoendoscopy in IBD surveillance. Four studies on surveillance colonoscopy with high-definition colonoscopy have been performed to compare chromoendoscopy with NBI. NBI was not shown to be advantageous. In fact, surveillance with chromoendoscopy showed a 6% (95% CI –1.4% to 14.2%) higher yield in the detection of patients with dysplasia in comparison with NBI, although the difference did not reach statistical significance.

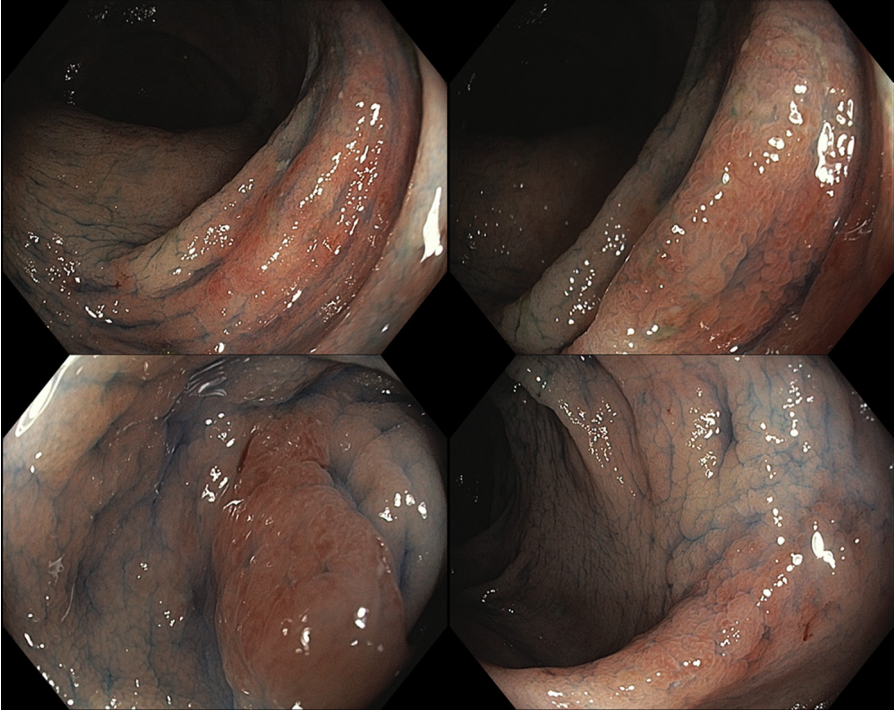
## TECHNIQUE OF CHROMOENDOSCOPY WITH TARGETED BIOPSY



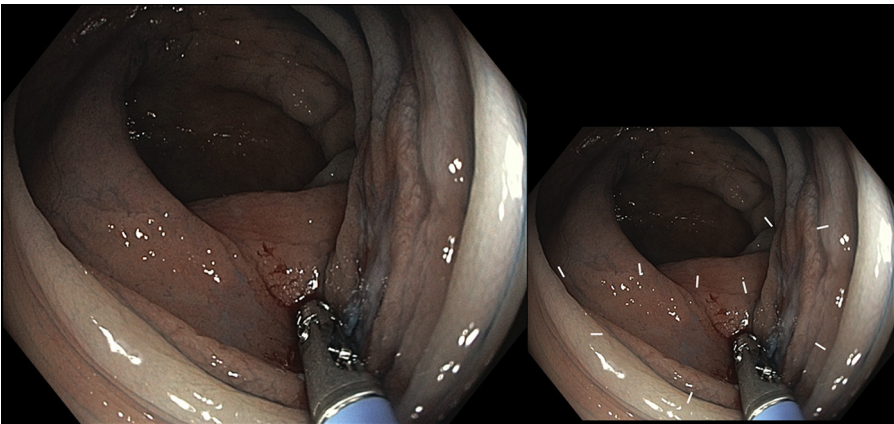
**Fig. 27.** The disease should be in remission before surveillance is undertaken. Active colitis causes changes in mucosal color, texture, and vascularity that can be extremely difficult to distinguish from nonpolypoid neoplasia. Furthermore, mucosal inflammation and regeneration can cause cytologic changes that can mimic dysplasia.



**Fig. 28.** Wash residue during insertion. When performing a chromoendoscopy with targeted biopsy, irrigate the colon of debris with water while intubating to the cecum. Any remaining residue should be meticulously washed and suctioned before the application of chromoendoscopy. Chromoendoscopy begins once one reaches the cecum and the colonoscope is withdrawn. Performing chromoendoscopy when the colon is dirty is very difficult: when the blue dye mixes with the bilious stool, it turns green.



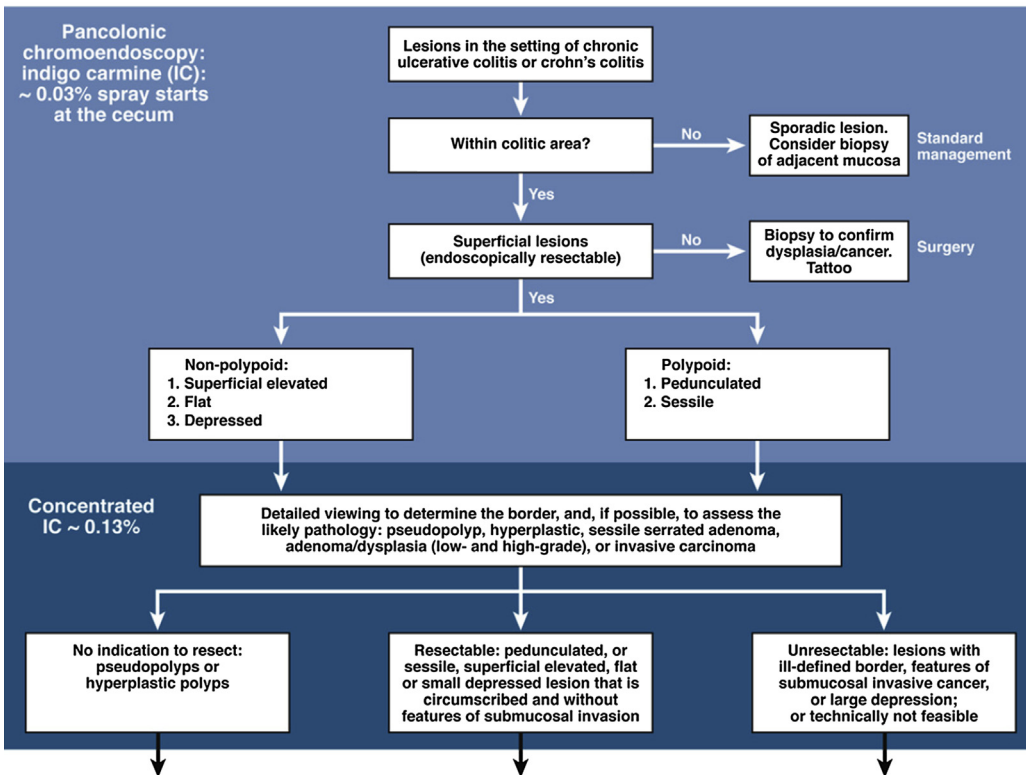
**Fig. 29.** Target biopsies of abnormal or suspicious areas. Most dysplasia is visible and, thus, biopsies should be targeted. Rather than taking random biopsies, the endoscopist compares the color, pattern of the pits, glands, and, when visible, the microvessels to the background mucosa to target biopsies to abnormal-appearing areas.

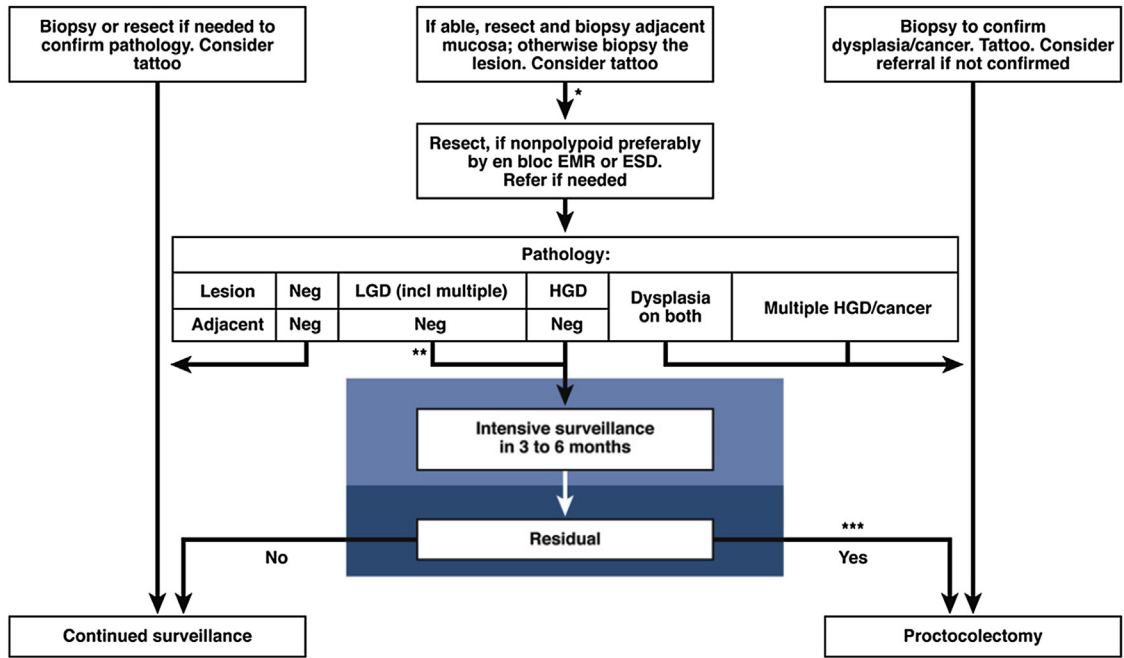


**Fig. 30.** Evaluate lesions thoroughly. A biopsy forceps was used to investigate part of the large, superficial, elevated lesion that lay behind the fold. The colon was slightly deflated as the forceps was used to expose the proximal side of the lesion.

### Algorithm of pancolonoscopic chromoendoscopy and targeted biopsy, and management of detected superficial colorectal lesions

The disease should be in remission. Excellent bowel preparation is a prerequisite. Residual debris and fluid should be washed and suctioned. White-light is used for insertion to the cecum.





Mucosal inflammation and multiple pseudopolyps may affect the interpretation of chromoendoscopy. Random biopsy is still justified in these circumstances.

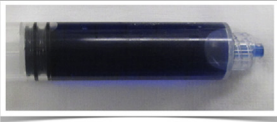
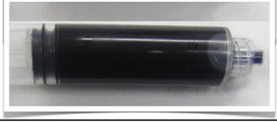

\* The resection of circumscribed nonpolypoid lesion is colonic IBD requires a high level of expertise - referral may be necessary.

\*\* The pathology of LGD may require confirmation by a gastrointestinal pathologist.

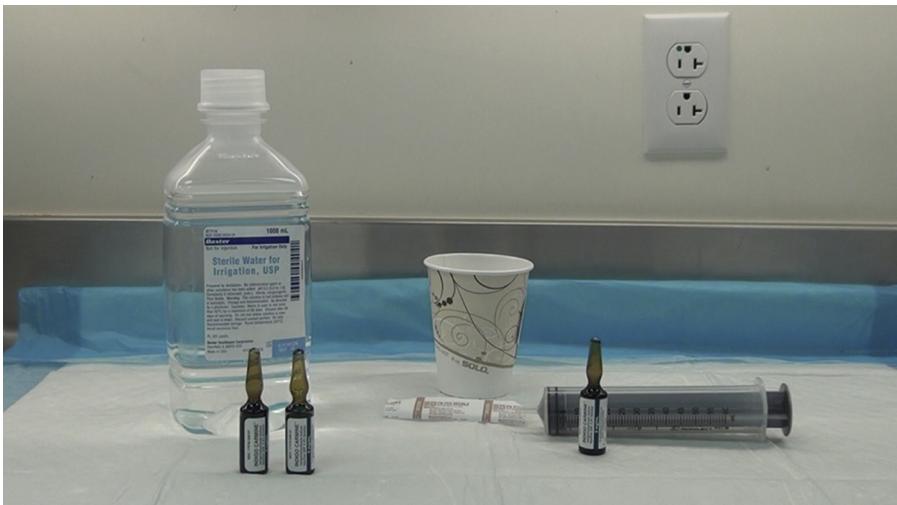
\*\*\* Repeat resection may be considered for small residual lesions.

**Fig. 31.** An algorithm to detect, diagnose, and treat colorectal neoplasms in patients with colitic IBD using chromoendoscopy and targeted biopsy. (From Soetikno R, Subramanian V, Kaltenbach T, et al. The detection of nonpolypoid (flat and depressed) colorectal neoplasms in patients with inflammatory bowel disease. *Gastroenterology* 2013;144(7):1349–52; with permission.)

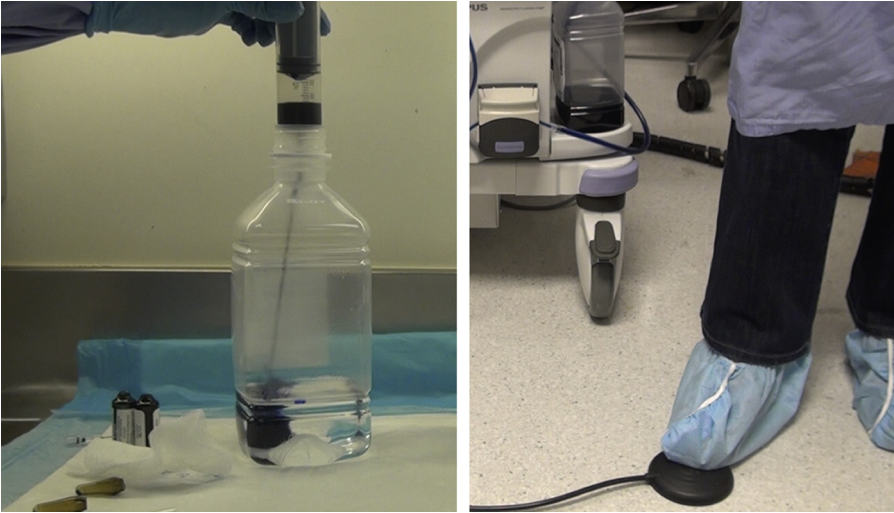
## Concentration of Indigo Carmine used in IBD patients

Purpose of IEE	Mixture	Depth of blue
Detection	2 Ampules with 250 mL of water	
Detailed Viewing	1 Ampule with 25 mL of water	
Submucosal Injection	10 Drops with 100 mL of saline	

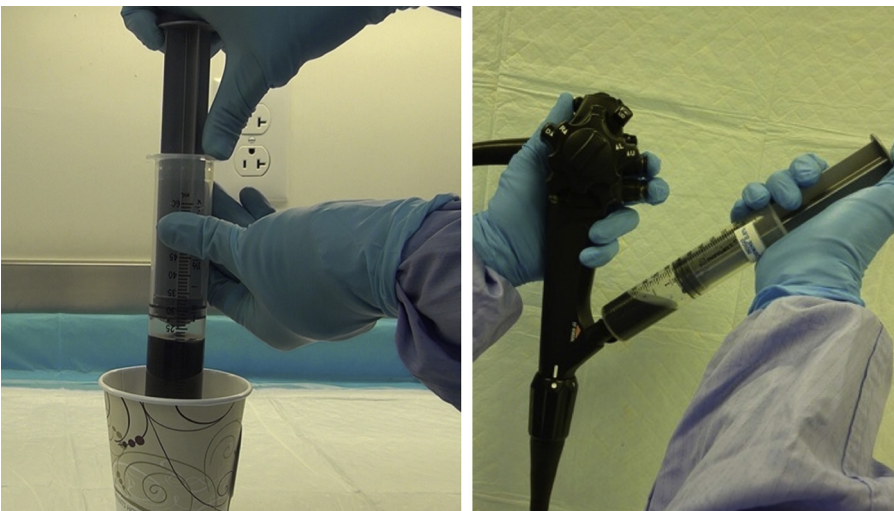
**Fig. 32.** Using high-definition instruments, image-enhanced endoscopy (IEE) is performed with indigo carmine using 3 different concentrations. Varying the concentration is important, depending on the indication. For example, if the solution is too concentrated when spraying the entire colon, it can make the colon dark and impair inspection. The corollary is when selectively spraying indigo carmine on a lesion for detailed inspection the solution is too weak, in which case it does not enhance visualization or contrast. When resecting a lesion, the authors perform submucosal injection using a dilution of indigo carmine and saline (10 drops of indigo carmine with 100 mL of normal saline). (*From Soetikno R, Subramanian V, Kaltenbach T, et al. The detection of nonpolypoid (flat and depressed) colorectal neoplasms in patients with inflammatory bowel disease. Gastroenterology 2013;144(7):1349–52; with permission.*)



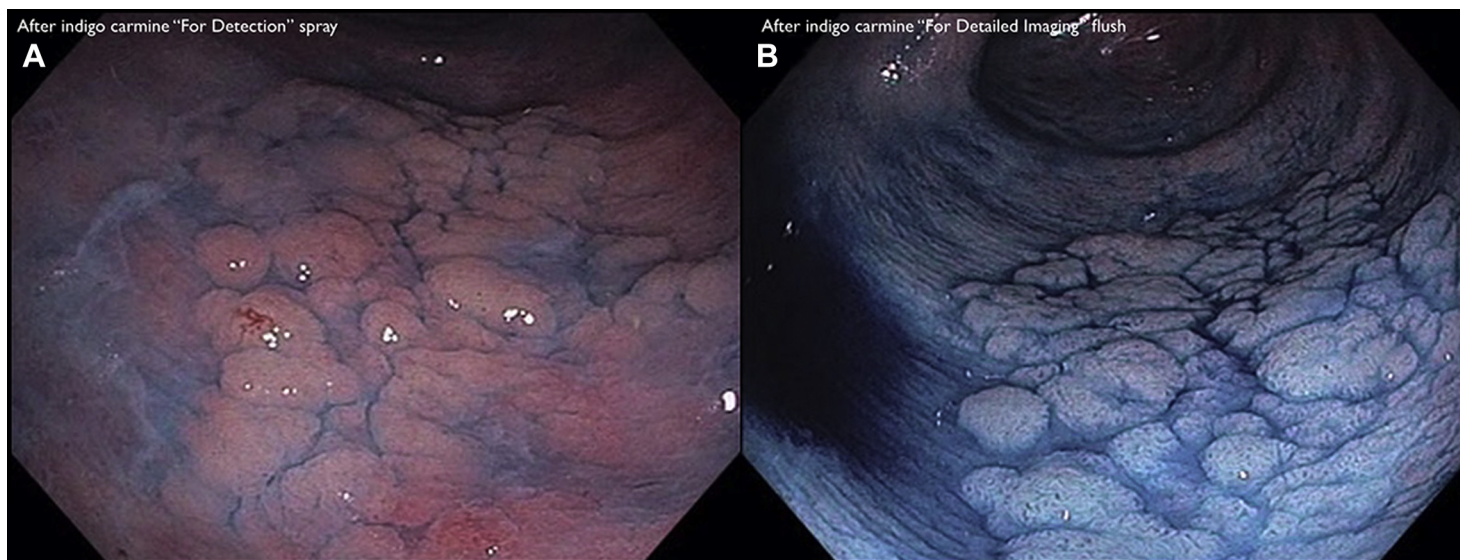
**Fig. 33.** Mixing of indigo carmine for chromoendoscopy throughout the colon. The forward wash jet solution is made combining 2 ampules of 5 mL of 0.8% indigo carmine with 250 mL of water.



**Fig. 34.** Equipment for detection of NP-CRN in IBD. After complete insertion of the colonoscope, examination with chromoendoscopy begins in the cecum and proceeds methodically. During withdrawal, each segment is sprayed and carefully inspected. Indigo carmine is spray diluted ( $\sim 0.03\%$ ) through the forward wash jet. For optimal application and efficiency, the foot wash pump is used for spraying, and the spray is targeted to the antigravity wall of the colon. Any excess dye that pools is suctioned so that a thin layer remains and the mucosa is not obscured by blue pools. The lumen is expanded and collapsed with air insufflation and suctioning during chromoendoscopy examination.



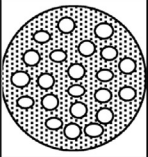
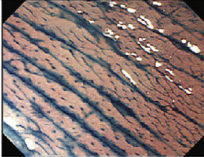
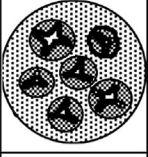

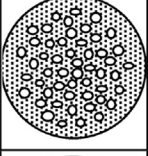
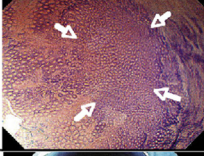

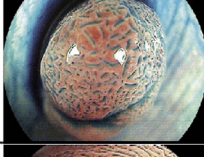



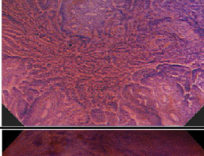
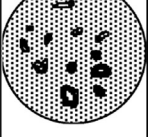
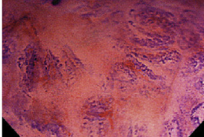
**Fig. 35.** Detailed viewing. When lesions or possible lesions are identified, more concentrated indigo carmine (0.13%, 5 mL ampule of indigo carmine with 25 mL water) is applied with a syringe via the biopsy channel to better delineate the lesion extent and the mucosal detail.



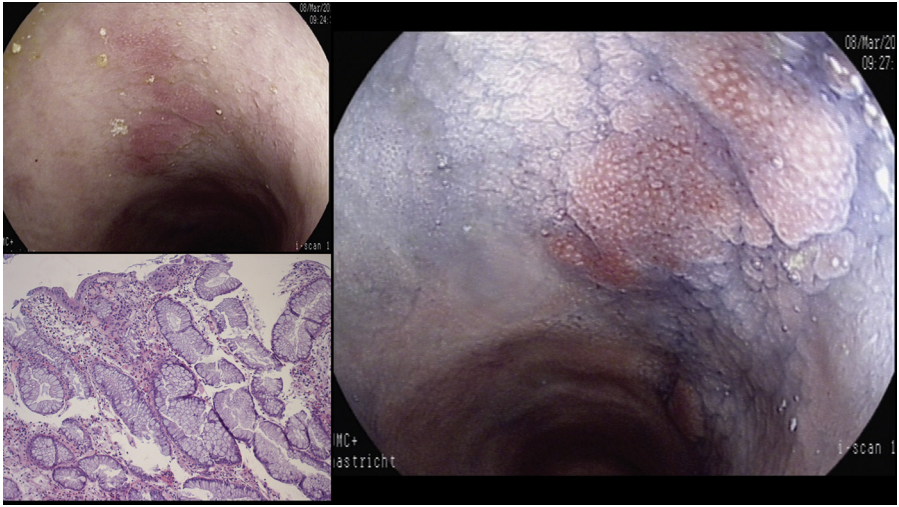
**Fig. 36.** Lesion identification technique of chromoendoscopy. (A) Using a high definition colonoscope, dilute indigo carmine is applied using the forward wash jet. (B) When lesions are identified, more concentrated indigo carmine is applied via the biopsy channel to better delineate the lesion extent and the mucosal detail. Targeted biopsies are then taken of the lesion. Biopsies are also taken around the lesion to exclude flat, invisible dysplasia, which would render it endoscopically unresectable.



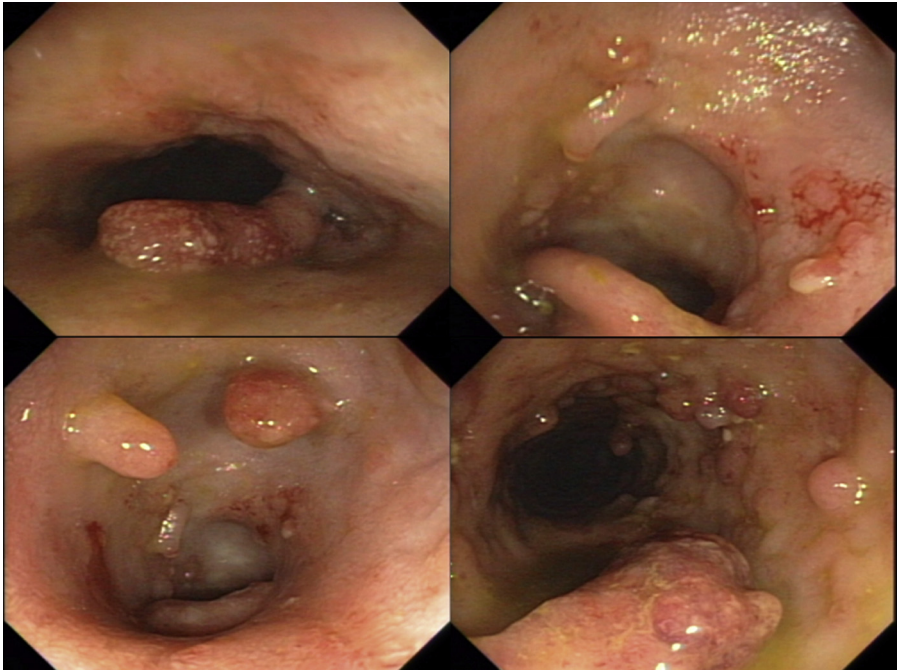
## Pit-pattern classification

Type	Schematic	Endoscopic	Description	Suggested Pathology	Ideal Treatment
I			Round pits.	Non-neoplastic.	Endoscopic or none.
II			Stellar or papillary pits.	Non-neoplastic.	Endoscopic or none.
III <sub>s</sub>			Small tubular or round pits that are smaller than the normal pit	Neoplastic.	Endoscopic.
III <sub>L</sub>			Tubular or roundish pits that are larger than the normal pits.	Neoplastic.	Endoscopic.
IV			Branch-like or gyrus-like pits.	Neoplastic.	Endoscopic.
VI			Irregularly arranged pits with type III <sub>s</sub> , III <sub>L</sub> , IV type pit patterns.	Neoplastic (invasive).	Endoscopic or surgical.
V <sub>N</sub>			Non-structural pits.	Neoplastic (massive submucosal invasive).	Surgical.

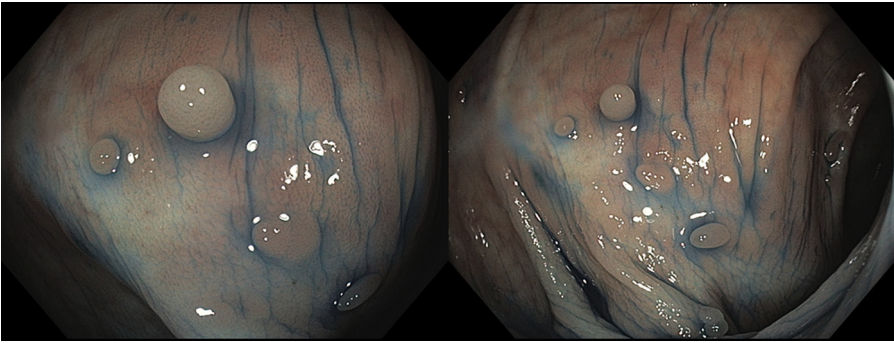
**Fig. 37.** Current pit-pattern classification of colorectal neoplasms may not be applicable in colitic IBD. The analysis of pit patterns of possible NP-CRN in patients with colitic IBD is difficult for many reasons. Inflammatory activity may mimic neoplasia. The regenerative hyperplastic villous mucosa is difficult to distinguish from neoplastic pit patterns. (From Tanaka S, Kaltenbach T, Chayama K, et al. High magnification colonoscopy (with videos). *Gastrointest Endosc* 2006;64:604–13; with permission.)



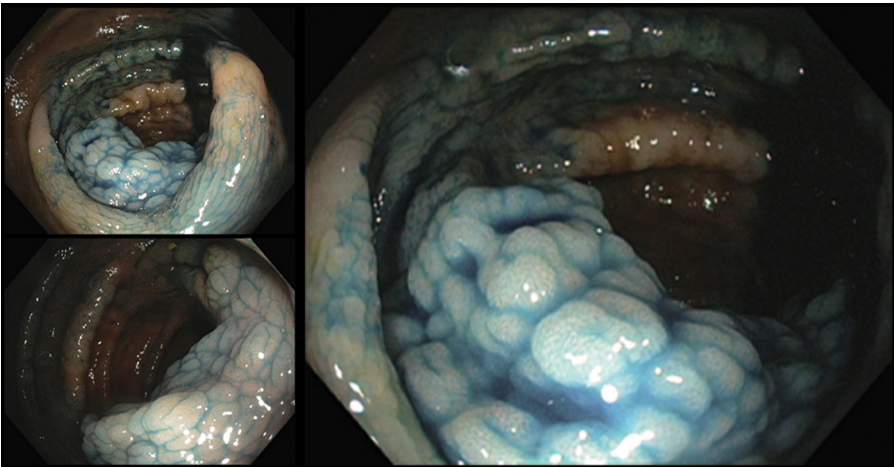
**Fig. 38.** Inflammatory polyp. High definition imaging enables the endoscopist to discriminate between inflammatory polyps, serrated lesions, and lesions with LGD, HGD, or invasive cancer. It is unnecessary to biopsy or remove obvious inflammatory polyps or lesions, such as seen here.



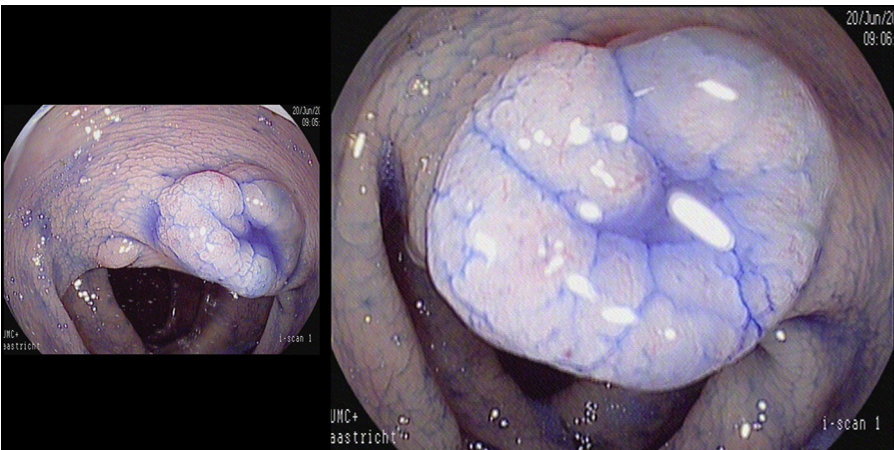
**Fig. 39.** Biopsies of all suspicious lesions are recommended to exclude dysplasia. This 35-year-old man with an indeterminate colitis had a 1-cm inflammatory-appearing polypoid lesion within a colitic area. Biopsies excluded dysplasia and confirmed chronic inflammation.



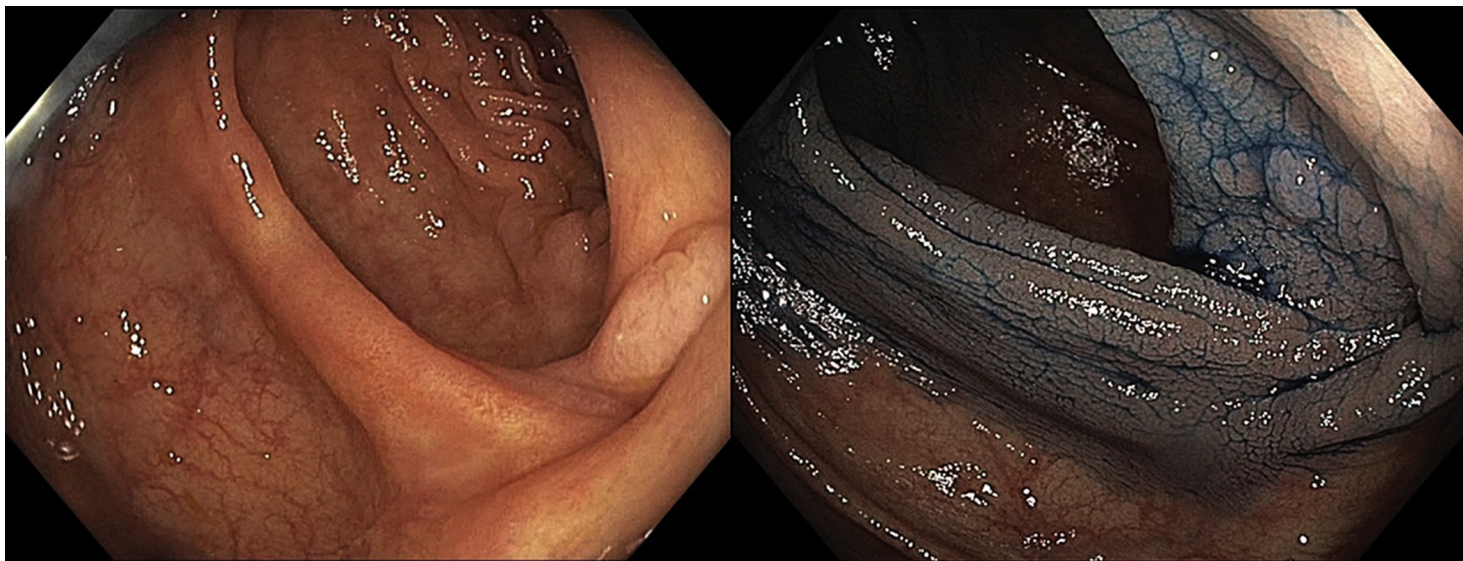
**Fig. 40.** Inflammatory polyps. In addition to enhancing the border, chromoendoscopy makes it easier to examine the mucosal surface of lesions and facilitates the recognition of inflammatory patterns. Below, a few examples of hyperplastic polyps and sessile serrated adenomas/ polyps are presented.



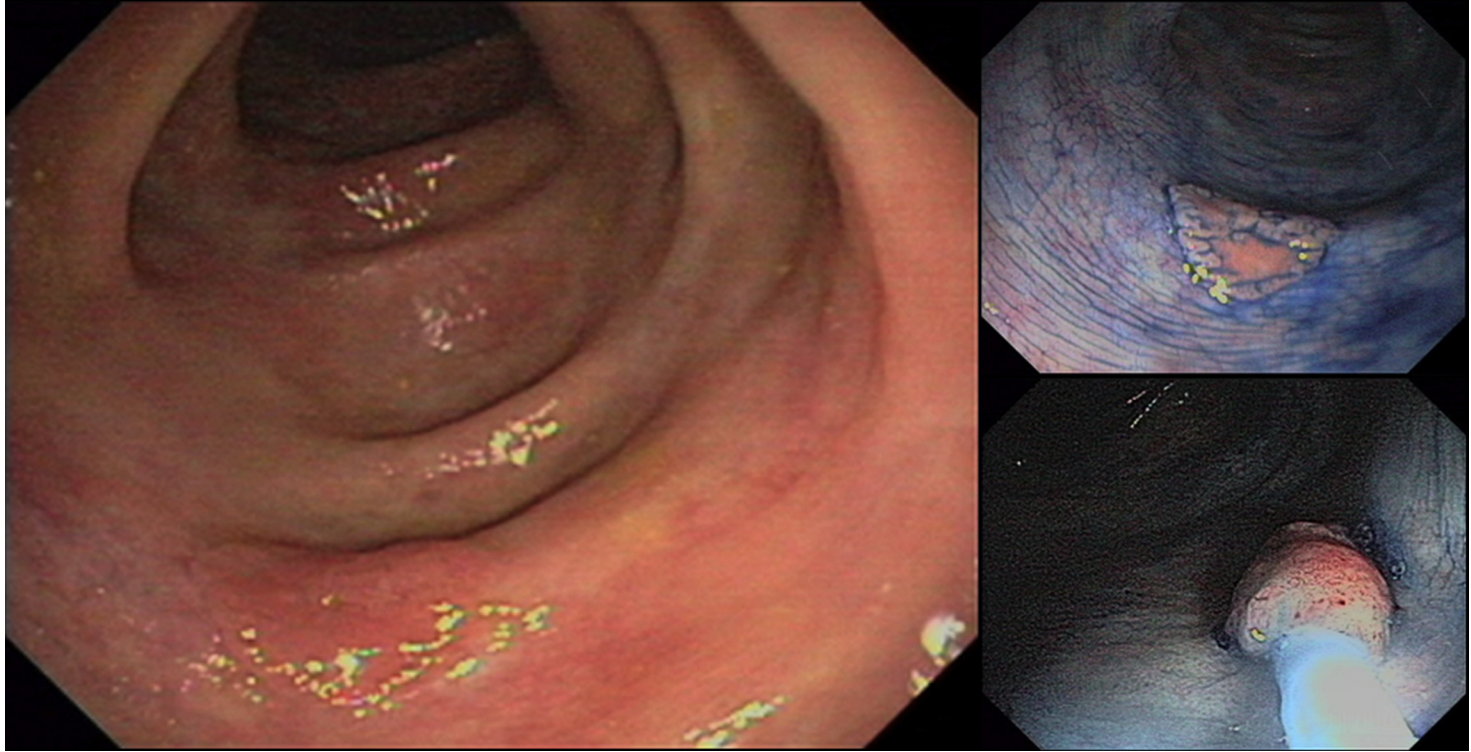
**Fig. 41.** Hyperplastic polyp.



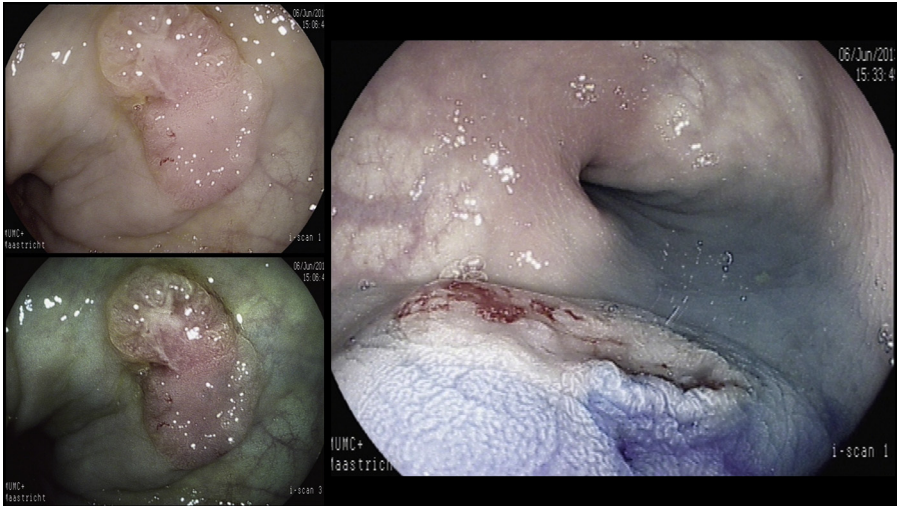
**Fig. 42.** Sessile serrated adenoma/polyp.



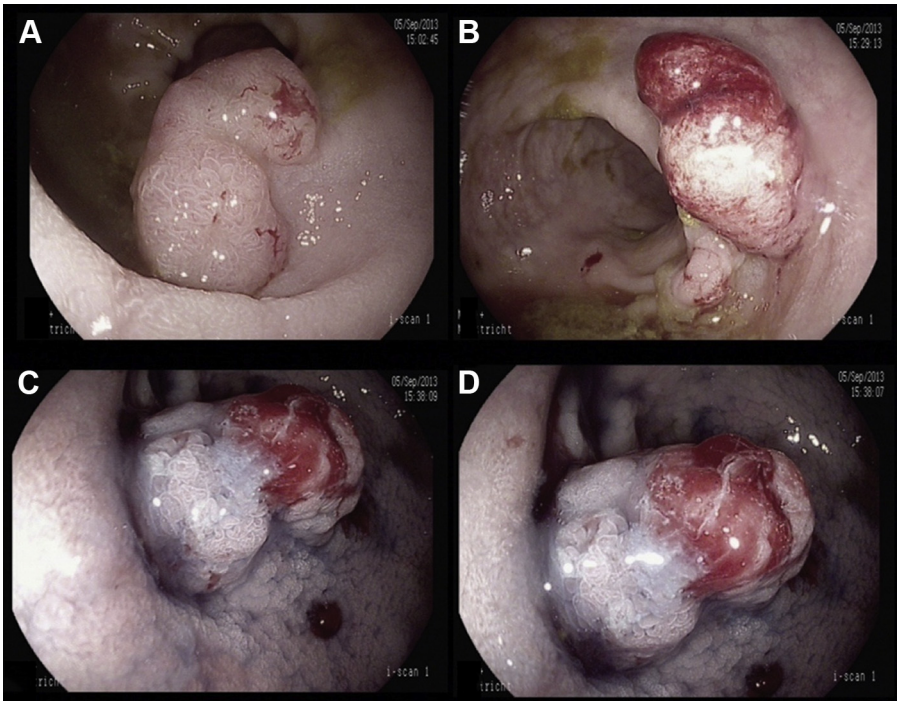
**Fig. 43.** Sessile serrated adenoma/polyp.



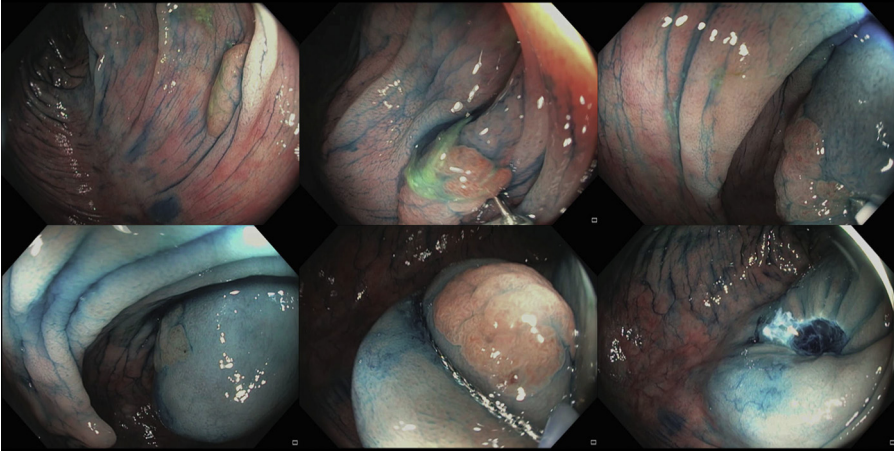
**Fig. 44.** Depressed neoplasm. Visualization of the depressed morphology required the application of chromoendoscopy. The depressed center of this nonpolypoid (0-IIc) lesion with LGD can only be shown by spraying indigo carmine to show it pooling in the depressed part.



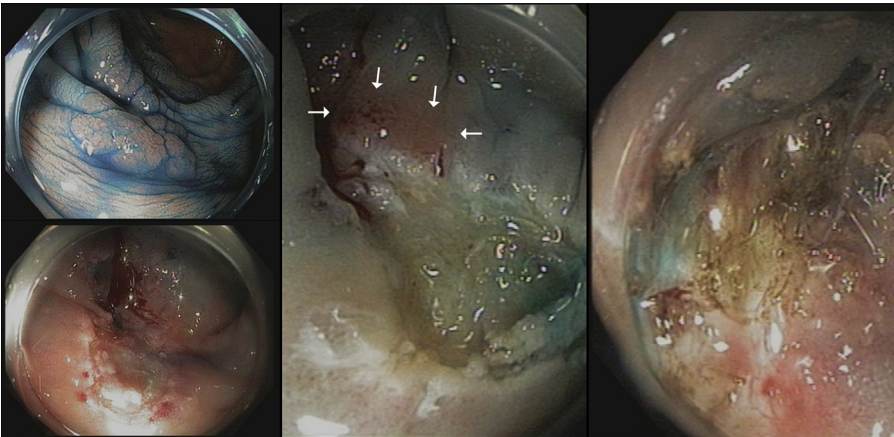
**Fig. 45.** See above (**Fig. 44**). Visualization of the depressed morphology required the application of chromoendoscopy. It is important to understand that the depressed area likely contains the most advanced histology. Thus, both biopsy can be targeted and removal can be optimized.



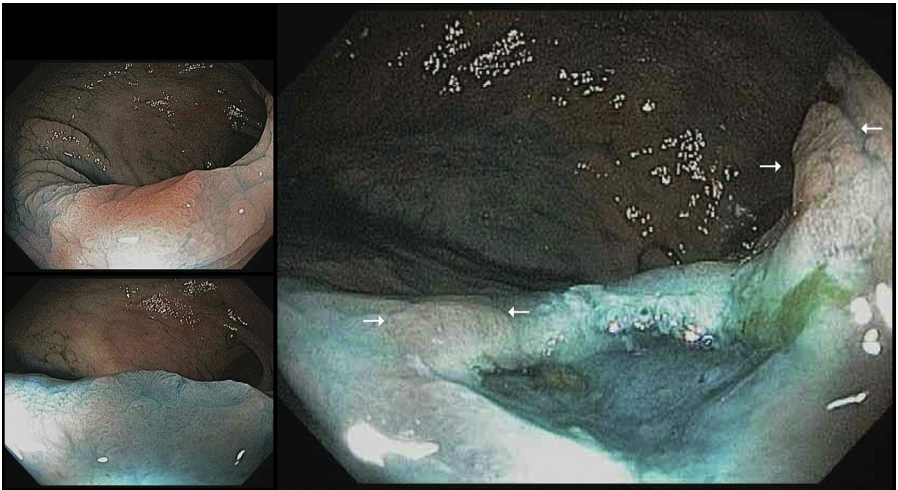
**Fig. 46.** (A–D) Polypoid neoplasms can be endoscopically resected. Whenever possible, lesions less than 2 cm in size should be resected in one piece (ie, en bloc) using EMR. The use of chromoendoscopy can facilitate delineation of the neoplastic borders and ensure complete resection. Following resection, the mucosa around the site should be biopsied to exclude the presence of invisible dysplasia.



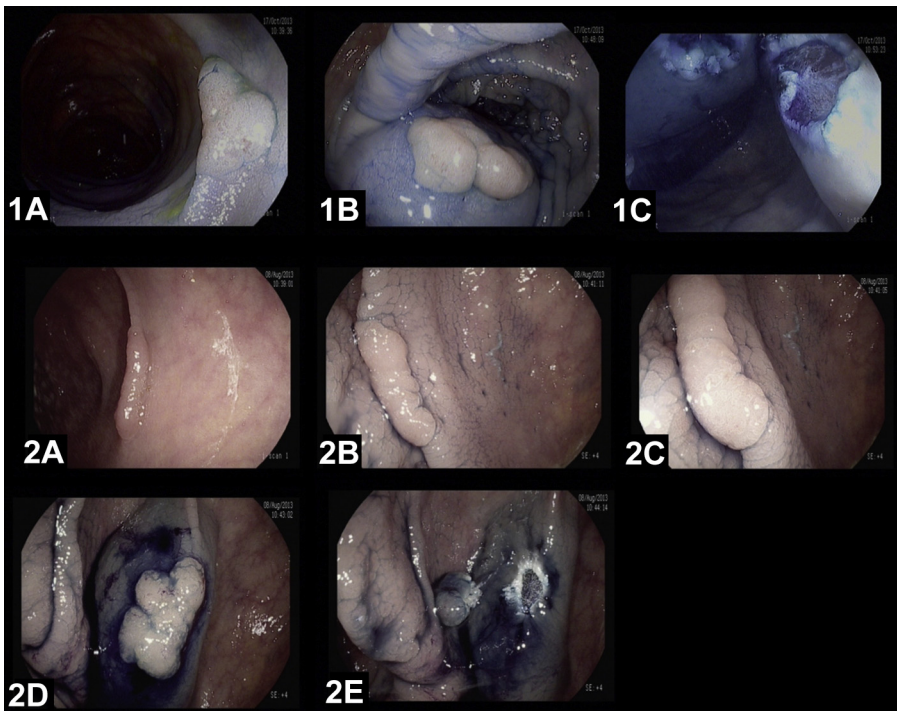
**Fig. 47.** Dynamic injection can be useful in IBD. Sessile and non-polypoid colorectal lesions in patients with IBD may be best cut after injection. Using the dynamic injection technique the injection is directed into the lumen, to mold the fluid bleb formation. Using slight upward tip deflection, the lumen is suctioned and the needle catheter nominally pulled back while directing the injection into the lumen. In this case, the lesion lifted nicely to form a large bleb. EMR is performed, placing a snare at the normal surrounding edges for en bloc resection. In nonlifting cases, because of underlying fibrosis endoscopic submucosal dissection may be necessary for complete resection.<sup>14</sup>



**Fig. 48.** Ensuring complete resection. Close endoscopic visualization of the surroundings of the resection area to ensure complete resection cannot be overemphasized. In this case, indigo carmine is applied to delineate its borders. EMR is performed, showing significant fibrosis. However, close inspection of the defect borders shows residual lesion (arrows). Repeat snare of the site is immediately performed to achieve complete resection. Argon plasma coagulation is then used to coagulate the base and edges of the resection.

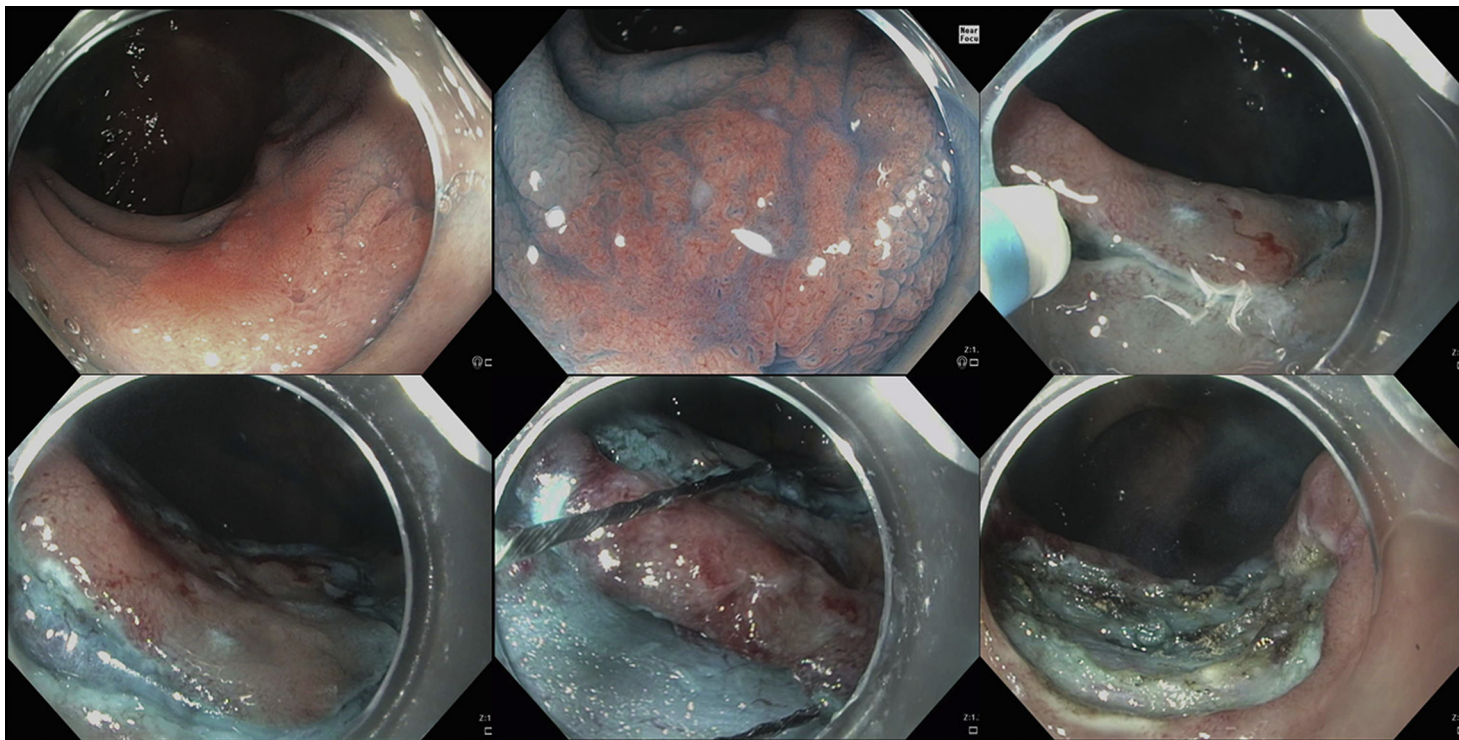


**Fig. 49.** Evaluation of the surroundings is critical. Following resection, close inspection of the resection defect borders should be performed, and any residual neoplasia removed. In addition, the mucosa around the site should be biopsied to exclude the presence of invisible dysplasia.

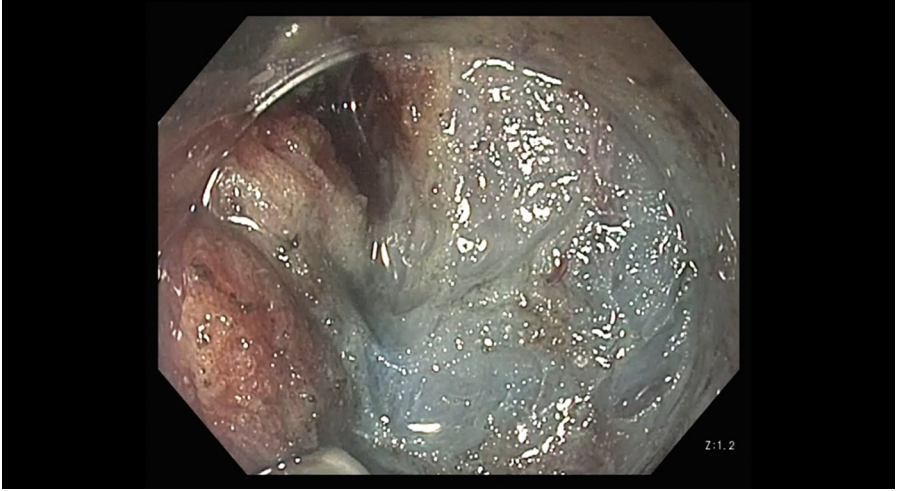


**Fig. 50.** Multiple nonpolypoid neoplasms can be endoscopically resected during a single procedure. A 62-year-old patient with long-standing Crohn's colitis underwent surveillance colonoscopy that showed multiple neoplasms distributed throughout the colon. (1A to 1C) and (2A to 2E) illustrate details of diagnosis and resection of the lesions. Chromoendoscopy using indigo carmine 0.4% was used for delineation of the borders and examination of the epithelial surface. En bloc EMR resections were performed (1C, 2E). Histopathology showed LGD within chronic colitis.

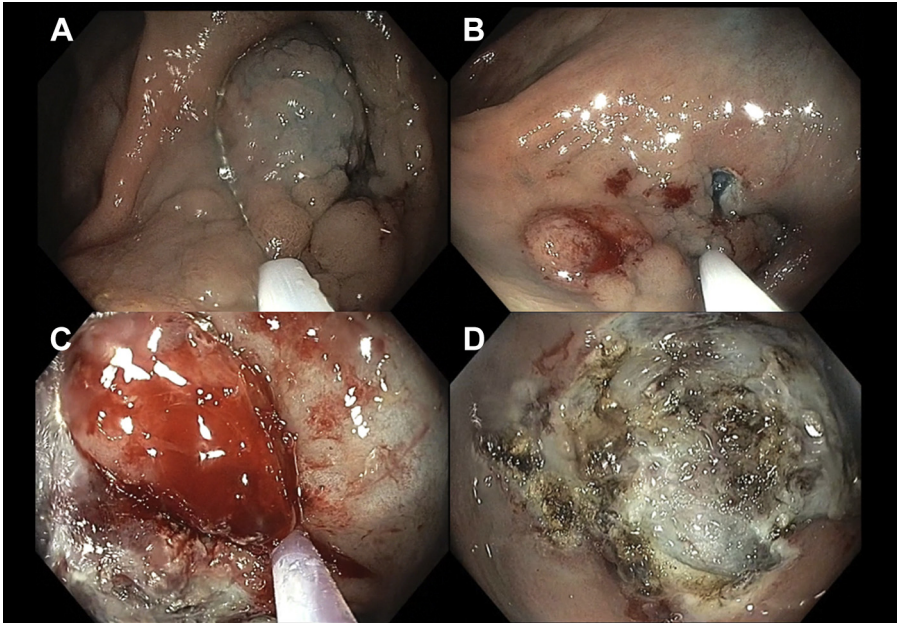




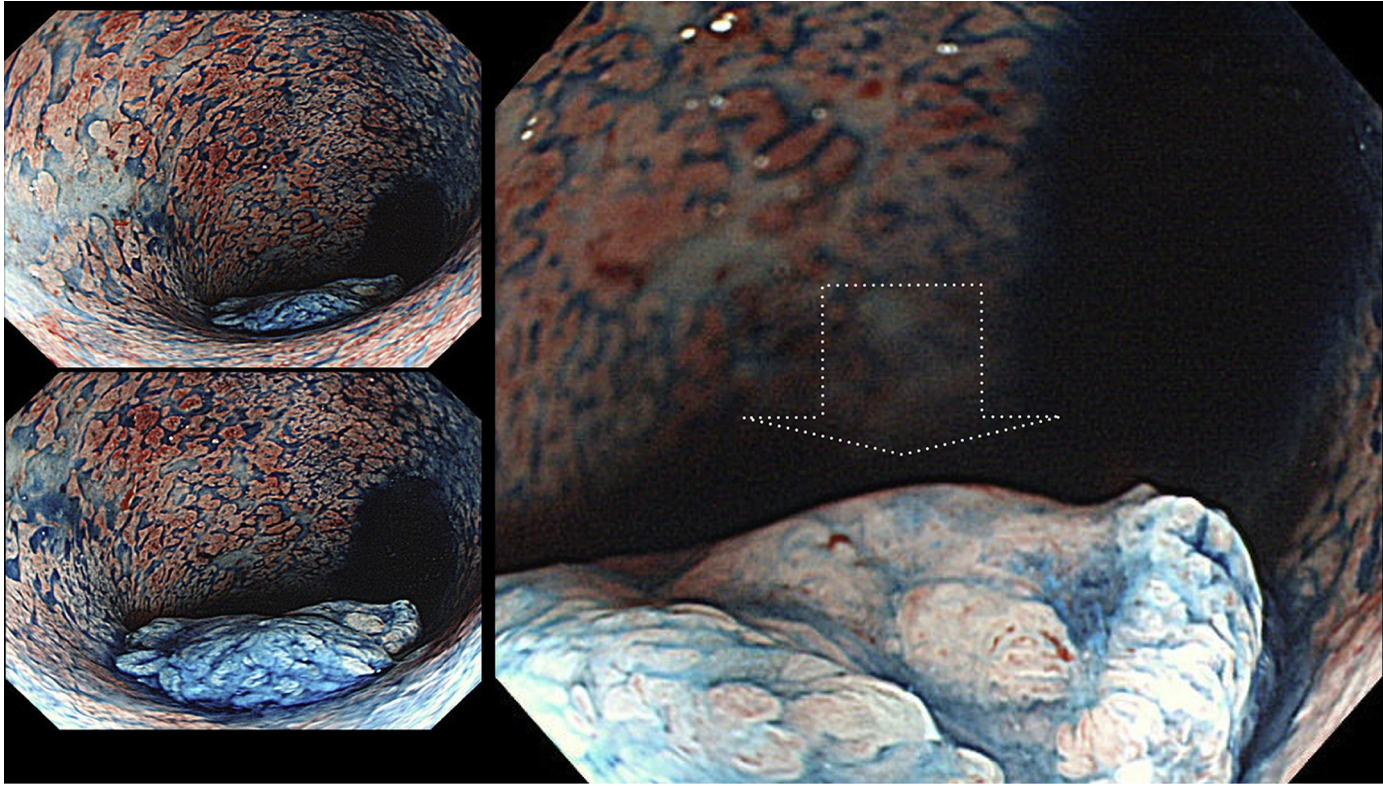
**Fig. 51.** Endoscopic resection in patients with Crohn's or ulcerative colitis can be very difficult because of underlying thickened mucosa and fibrosis. Multiple biopsies for removal of such lesions must be avoided. EMR is usually the most appropriate endoscopic therapy, noting still the high level of difficulty and risk in endoscopic resection of IBD lesions. Endoscopic submucosal dissection may be necessary for complete resection in some cases, such as shown here. Following injection of the submucosa, there is minimal lifting. Thus, a dual knife is used to make a circumferential incision around the lesion border and dissect the fibrosis submucosally, after which a snare is used to remove the lesion in one piece.



**Fig. 52.** Severe fibrosis in Crohn's or ulcerative colitis can make endoscopic removal technically difficult. The marked fibrosis of the submucosa of a dysplastic lesion, as shown here during endoscopic submucosal dissection, can lead to the lesion not rising up during endoscopic resection.

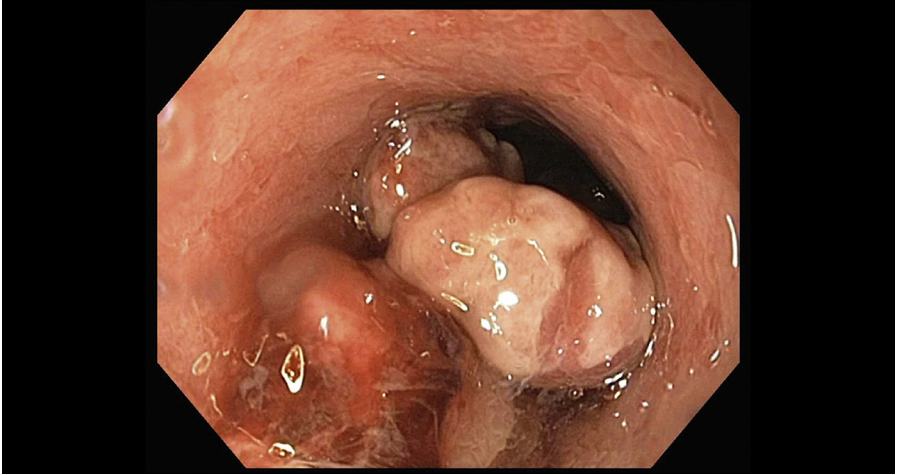


**Fig. 53.** EMR in the setting of submucosal fibrosis. Resection in this setting is exceedingly difficult and risky. (A) The lesion did not lift adequately despite a large amount of injection medium. (B) The lesion could not be captured by a snare. (C) The cuts were small. (D) The underlying fibrosis was exposed.

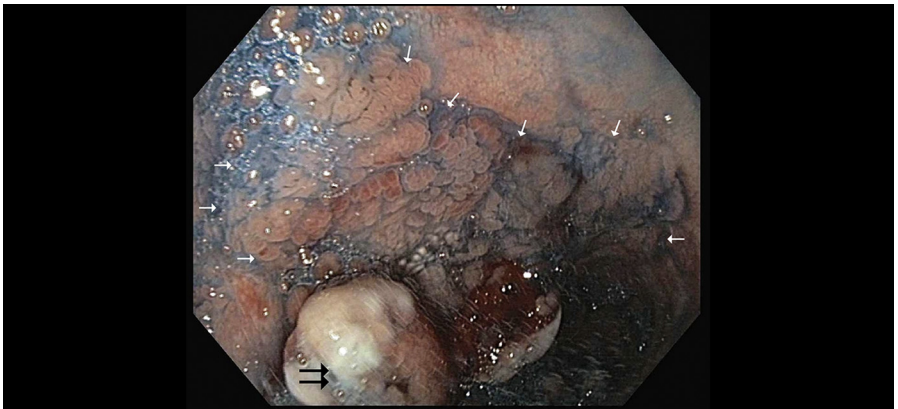


**Fig. 54.** A lesion should be examined closely to facilitate assessment of its amenability to curative endoscopic resection. On closer inspection, this sessile lesion was considered to have features suspicious for invasive malignancy; that is, the center of the lesion is depressed and the surface is amorphous with loss of mucosal detail. Hence, decisions pertaining to endoscopic versus surgical resection were deferred pending biopsy results. Biopsies should be targeted to the most concerning area of the lesion, as shown here (*arrow*), which confirmed invasive cancer. Surgical resection demonstrated a T1, N0 lesion. (Images courtesy of Professor Shinji Tanaka, Hiroshima University.)

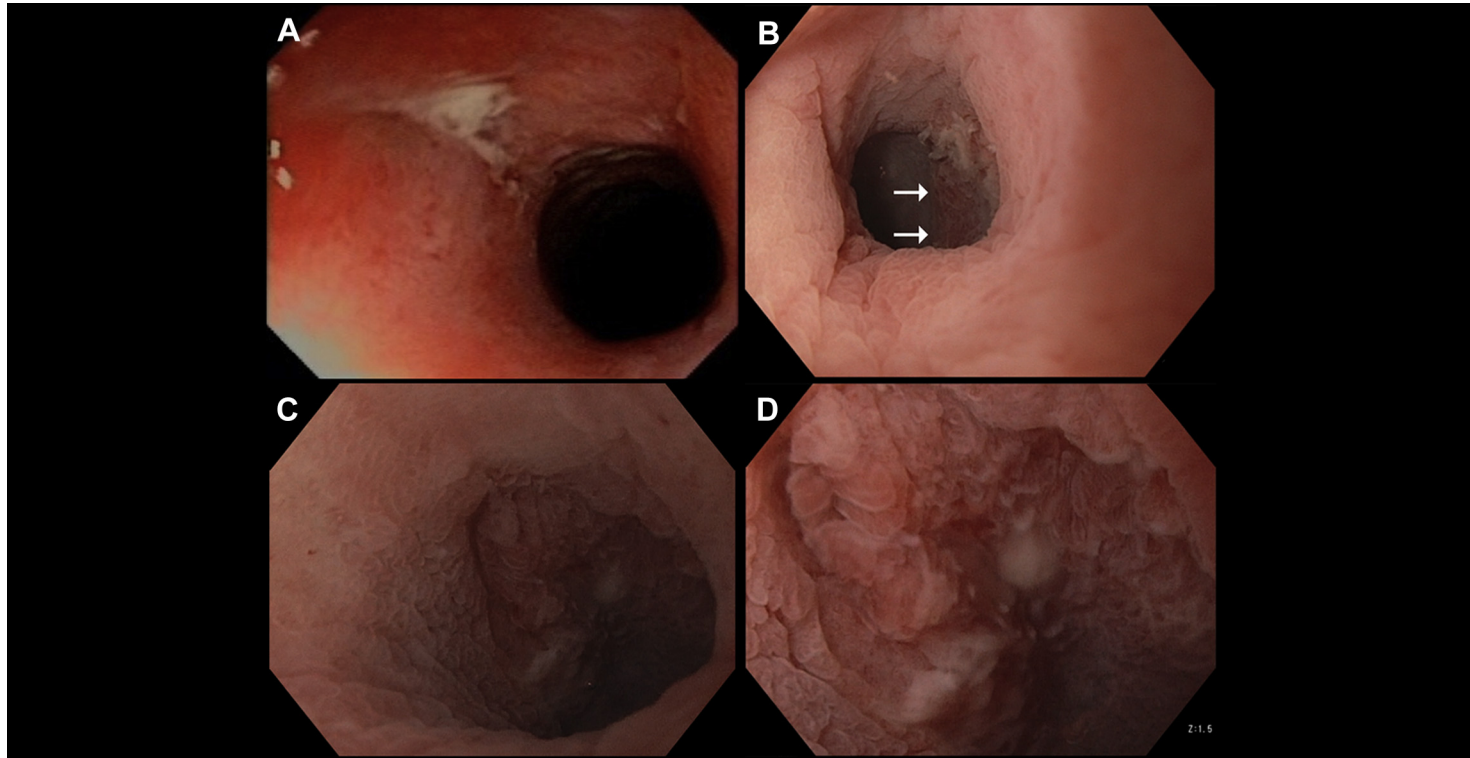
## LIMITATIONS OF CHROMOENDOSCOPY



**Fig. 55.** Random biopsy is still indicated when a large number of pseudopolyps are present. The presence of a large number of postinflammatory polyps may complicate surveillance colonoscopy with chromoendoscopy and targeted biopsy. It is difficult to examine the pseudopolyps and the underlying mucosa when the lumen is filled with the polyps. In such cases, random biopsies are indicated to maximize dysplasia detection.<sup>15</sup>



**Fig. 56.** Dysplasia in the setting of large pseudopolyps. In addition to random biopsy, chromoendoscopy was used in this case. Note the appearance of a superficial elevated lesion (*white arrows*), which on biopsy proved to be HGD, surrounding the polypoid lesion (*double black arrows*).



**Fig. 57.** Examination of a stricture can be difficult because of poor lighting within it, which occurred because of the narrowed lumen. A 79-year-old patient with long-standing ulcerative colitis presented for reevaluation of a stricture in the sigmoid colon. The patient was diagnosed to have the stricture 6 years earlier, but he declined surgery. Over the years, he underwent multiple colonoscopies with biopsies that did not show malignancy (A). The appearance of a cancer within the stricture was finally seen when the stricture was well illuminated (arrows, B). The lumen was kept distended using water infusion. On close-up, the lesion appeared neoplastic (C). The center of the lesion (D) was suspicious for invasive cancer. Biopsy showed invasive adenocarcinoma. Patients with ulcerative colitis are recommended to have surgery when a colonic stricture is found.

## ACKNOWLEDGEMENTS

The authors thank Drs. Shinji Tanaka, Ronald Yeh, and Hazem Hammad for their generous contributions.

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