Endoscopic evaluation of surgically altered bowel in inflammatory bowel disease: a consensus guideline from the Global Interventional Inflammatory Bowel Disease Group

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The majority of patients with Crohn's disease and a proportion of patients with ulcerative colitis will ultimately require surgical treatment despite advances in diagnosis, therapy, and endoscopic interventions. The surgical procedures that are most commonly done include bowel resection with anastomosis, strictureplasty, faecal diversion, and ileal pouch. These surgical treatment modalities result in substantial alterations in bowel anatomy. In patients with inflammatory bowel disease, endoscopy plays a key role in the assessment of disease activity, disease recurrence, treatment response, dysplasia surveillance, and delivery of endoscopic therapy. Endoscopic evaluation and management of surgically altered bowel can be challenging. This consensus guideline delineates anatomical landmarks and endoscopic assessment of these landmarks in diseased and surgically altered bowel.

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Introduction

Despite advances in medical therapy in inflammatory bowel disease (IBD), the majority of patients with Crohn's disease and a subset of patients with ulcerative colitis will eventually require surgical intervention for medically refractory disease, disease-associated complications (such as strictures, fistulas, and abscesses), or colitis-associated neoplasia. Some of those patients might need surgical reintervention for recurrent disease or surgery-associated complications. Commonly done surgical procedures for Crohn's disease include ileocolonic resection with ileocolonic or ileorectal anastomosis, strictureplasty, diverting ostomy, and bowel bypass. The surgical treatment of choice for patients with ulcerative colitis is staged restorative proctocolectomy with ileal pouch–anal anastomosis.[1] These complex surgical procedures result in substantial alterations in bowel anatomy and can give rise to various complications and disease conditions (table 1).[2]

In most patients with Crohn's disease, surgery does not offer a cure and disease recurrence is common. Diagnostic and therapeutic endoscopy plays a key role in disease monitoring, assessment of treatment response, dysplasia surveillance, and therapeutic intervention. However, endoscopic evaluation of surgically altered bowel is often challenging due to loss of bowel reserve, changes in bowel anatomy, intrinsic or extrinsic partial obstruction, and patients' poor nutritional status and use of immunosuppressive medications. The complexities in the diagnosis and management of IBD in patients with

	Anatomical landmarks on endoscopy	Configurations	Examples of disease
Resection with anastomosis	Small bowel; small and large bowel; large bowel	End-to-side anastomosis; side-to-side anastomosis; sutured anastomosis; stapled anastomosis; small bowel–small bowel anastomosis; ileocolonic anastomosis; ileorectal anastomosis	Anastomotic stricture from ischaemia; recurrent Crohn's disease in neo-terminal ileum
Ostomy*	Stoma; jejunum; ileum; colon	Loop; loop-end; end; blowhole (loop)	Stomal stenosis; stomal fistula; peristomal pyoderma gangrenosum; recurrent Crohn's disease of the neo-small bowel
Ileal pouch	Afferent limb (neo-terminal ileum); inlet; pouch body; tip of the J cuff; anal transitional zone	J pouch; S pouch; continent ileostomies (Kock pouch, Barnett continent ileal reservoir)	Pouchitis; Crohn's disease of the pouch; cuffitis
Diverted bowel	Diverted colon or rectum; diverted ileal pouch	Sealed stump; efferent limb of diverting ostomy; mucous fistula	Diversion colitis; diversion-associated stricture
Strictureplasty	Proximal and distal small bowel; lumen of strictureplasty; inlet; outlet	Heineke-Mikulicz; Finney; Michelassi; variants	Inlet or outlet stricture; recurrent Crohn's disease
Bowel bypass surgery	Bypassed duodenum; gastrojejunal anastomosis; duodenojejunal anastomosis; stomach; jejunum	Roux-en-Y bypass; gastrojejunostomy; duodenojejunostomy	Gastrojejunostomy stricture; Crohn's disease in the bypassed duodenum

*Ileostomy, jejunostomy, colostomy, mucous fistula.

Table 1: **Endoscopically accessible surgically altered bowel in inflammatory bowel disease**

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surgically altered bowel anatomy usually necessitate a multidisciplinary team approach, involving IBD specialists, endoscopists, gastrointestinal radiologists, colorectal surgeons, and gastrointestinal pathologists.

Clinicians have benefited from practice guidelines from professional societies (such as the European Crohn's and Colitis Organisation [ECCO], British Society of Gastroenterology [BSG], American College of Gastroenterology, American Gastroenterological Association, and American Society for Gastrointestinal Endoscopy [ASGE]) in the diagnosis and management of IBD. However, there are no published guidelines on the techniques and principles of the evaluation of patients with IBD after surgery. The Global Interventional IBD Group is a volunteer-based interest party of gastroenterologists, advanced endoscopists, colorectal surgeons, radiologists, and pathologists, all of whose main practice is in IBD, who put together this document.

Data collection

Search strategy and selection criteria

The steering committee (BS, GSK, UN, CNB, RKC, FAF, DAS, JS, and MI) reviewed the medical literature and generated statements. We did a systematic search of MEDLINE, Google Scholar, Embase, and the Cochrane Central Register of Controlled Trials from Jan 1, 2000 to Aug 31, 2020, with the following key search terms: "anastomosis", "bypass", "colectomy", "complications", "Crohn's disease", "cuffitis", "diversion colitis, "endoscopy", "enteroscopy", "ileal pouch", "ileoscopy", "ileocolonic anastomosis", "ileocolic anastomosis", "ileorectal anastomosis", "IBD", "obstruction", "postoperative", "pouchitis", "procedure", "recurrence", "stoma", "strictureplasty", "surgery", and "ulcerative colitis". We reviewed articles describing the following: (1) Crohn's disease, ulcerative colitis, pouchitis, or diversion colitis; (2) postoperative; and (3) bowel resection, anastomosis, faecal diversion, ostomy, ileal pouch, strictureplasty, or bypass. We reviewed articles in English only.

Literature review and consensus process

Published articles for evaluation were required to meet the following criteria: (1) any randomised controlled studies; (2) any case-control studies; (3) case series with: at least 100 cases describing endoscopy for bowel resection and anastomosis; at least 25 cases of endoscopy via stoma, diverted bowel, or continent ileostomy; at least 50 cases for pouchoscopy in pelvic pouches; or any cases of endoscopy in strictureplasty or bypass surgery. In the scenario of multiple publications reporting on the same cohorts, we used the most recent publications. We referenced consensus guidelines on Crohn's disease, ulcerative colitis, or IBD from the major professional societies. The selection criteria for the articles were determined by members of the steering committee, on the basis of literature review and consensus of relevance. The statements in this paper refer to diagnostic procedures; the statements for therapeutic endoscopy procedures are described in a separate document from the Global Interventional IBD Group.[3]

Investigators were included in the consensus group if they met at least two of the following three criteria: (1) involvement in clinical practice geared towards adult or paediatric IBD; (2) experience in doing both diagnostic and therapeutic IBD endoscopy; and (3) expertise in IBD, gastrointestinal endoscopy, gastrointestinal pathology, gastrointestinal radiology, or colorectal surgery. Members of the steering committee were required to have expertise in IBD care, diagnostic and therapeutic IBD endoscopy, and advanced endoscopy, as well as familiarity with gastrointestinal radiology, gastrointestinal pathology, and basic surgical modalities of IBD. The consensus group consisted of nationally or internationally renowned IBD experts, gastrointestinal endoscopists, gastrointestinal radiologists, gastrointestinal pathologists, and IBD surgeons.

We used the Delphi method to guide the preparation of documents. The initial questionnaire and statement were developed by, and circulated among, members of the steering committee. A virtual consensus meeting with the first round voting process was convened on Sept 5, 2020. The participants voted anonymously on their agreement with the statements, provided comments, and suggested revisions. The second round of the web-based voting process for the revised statements was done within 1 month of the virtual meeting. A statement was accepted if more than 80% of participants agreed with the statement; a statement was rejected if less than 80% of participants agreed with it. The manuscript was drafted, reviewed, and approved by all members of the consensus group.

We developed the guidelines on the basis of published literature and consensus among expert participants in the group. We adopted the Oxford Center for Evidence-Based Medicine methodology to generate recommendations (appendix).[4] For each statement, we graded the evidence level from 1 to 5 (with a score of 1 indicating the strongest evidence) and graded the level of recommendation from A to D (with a score of A indicating the highest recommendation).

Findings and guidelines

The selection process and inclusion and exclusion criteria of the literature are shown in figure 1 and the consensus statements are listed in table 2.

Preprocedural preparation

Endoscopic evaluation of surgically altered bowel can be technically challenging. It is important to delineate the endoscopic anatomy and its associated inflammatory and structural abnormalities with radiographic imaging. Appropriate bowel preparation is often required. IBD-focused ultrasound, CT enterography, or magnetic resonance enterography are commonly used to assess intraluminal, bowel wall, and extraluminal structures.

CT enterography or magnetic resonance enterography are particularly helpful in patients with known or suspected stricturing, transmural bowel disease, or penetrating bowel disease. Occasionally, upper gastrointestinal series, small bowel follow-through, enteroclysis, or contrast enemas via the anus or stoma are used to provide dynamic images to characterise bowel anatomy and disease conditions (recommendation 1.1, table 2). Quality of bowel preparation is key for safe and successful diagnostic and therapeutic endoscopy. There has been concern about bowel erosions and nephrotoxicity resulting from sodium phosphate-based agents. Polyethylene glycol-based regimens are preferred, although mixed sodium picosulfate, magnesium oxide, and citric acid agents have also been used (recommendations 1.2, 1.3; table 2). Due to altered bowel anatomy, prolonged preparation might be needed in some patients (recommendation 1.4, table 2). For the same reason, some patients might require monitored anaesthesia care or general anaesthesia for endoscopy (recommendation 1.5, table 2). For endoscopic therapy, such as balloon dilation of a stricture, endoscopic stricturotomy, or endoscopic stent placement, fluoroscopy might be needed (recommendation 1.6, table 2). Patients who have had surgery for IBD usually have a lower bowel reserve and hence poor accommodation of air. Therefore, low-flow carbon dioxide insufflation is preferred (recommendation 1.7, table 2).

The use of systemic corticosteroids in IBD is associated with complications during endoscopy, such as gastrointestinal bleeding and perforation,[5,6] and so their use in patients undergoing endoscopy should be minimised or avoided, if possible (recommendation 1.8, table 2).[3] The use of topically active corticosteroids, such as budesonide, can be continued in patients undergoing endoscopy. We believe that the use of immunomodulators, biologics, or small molecule agents can be continued in patients undergoing endoscopy (recommendation 1.9, table 2). Similar recommendations in the endoscopic management of strictures of Crohn's disease have been made in our previous guidelines.[3] The recommendations for the use of aspirin, non-steroidal anti-inflammatory drugs, anticoagulants, and antiplatelet agents in patients with IBD undergoing therapeutic endoscopy are also published in our previous guidelines (recommendation 1.10, table 2).[3] Detailed instructions can be found in the ASGE guidelines.[7]

The only rejected statement regarding preprocedural preparation was "prophylactic antibiotics may be used in selected patients with diverted bowels who may be at risk for bacterial translocation during endoscopy". This statement was rejected because it was based on weak evidence consisting of case reports.[8]

Bowel resection and anastomosis

Ileocolonic resection with ileocolonic anastomosis or ileorectal anastomosis[9] is the most commonly done surgical procedure for L1 or L3 Crohn's disease (of various phenotypes) refractory to medical treatment. Small bowel resection with enteroenteric anastomosis is done for L1 Crohn's disease, whereas partial colectomy with colocolonic anastomosis or colorectal anastomosis is done for L2 Crohn's disease. Various types of anastomosis have been fashioned, including end-to-end anastomosis, end-to-side anastomosis, side-to-side anastomosis, and Kono-S anastomosis. Subtotal colectomy with ileorectal anastomosis is occasionally done in selected patients with ulcerative colitis with relative rectal sparing.[10]

The most common location of recurrent Crohn's disease following bowel resection and anastomosis is the bowel segment proximal to the anastomosis. The clinical implication of isolated ulcerations or strictures along the suture or staple line is controversial. The definition of recurrent disease, quantification of disease activity, and diagnosis of recurrent disease vary in the literature and require further consensus (figure 2).

The International Organization for the Study of Inflammatory Bowel Disease proposes target goals for both Crohn's disease and ulcerative colitis. The therapeutic targets are clinical, endoscopic, biological, and histological.[11] Endoscopy plays a key role in disease monitoring and assessment of response to treatment. Various endoscopy scores have been developed to characterise mucosal inflammation, ulcers, and strictures, of which only the Rutgeerts score was specifically

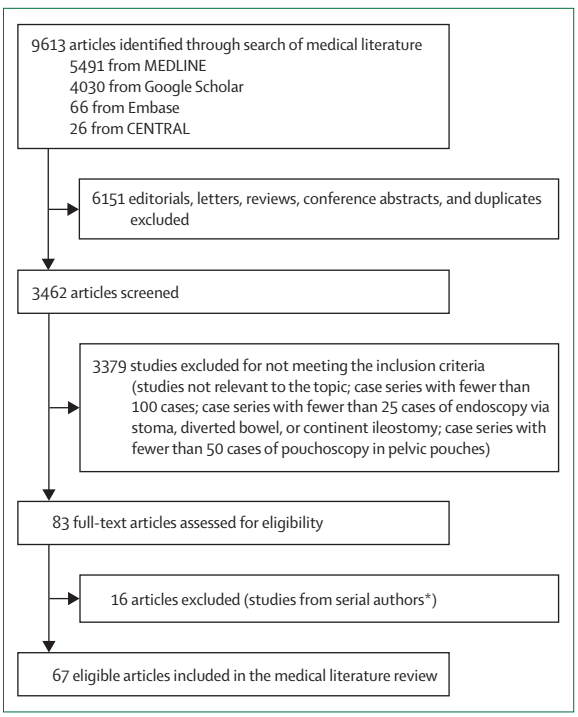

Figure 1: **Flow chart of studies included in the review**
CENTRAL=Cochrane Central Register of Controlled Trials. *Refers to authors of sequential or serial publications on the same topic with cumulative cases over time.

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See **Online** for appendix

	Evidence level (1–5)	Grade of recommendation (A–D)
1. Preprocedural preparation		
1.1 Cross-sectional imaging (eg, CT enterography, magnetic resonance enterography, or bowel ultrasound) with or without retrograde contrast enemas or small bowel series should be obtained before endoscopy (including therapeutic endoscopy) in patients with suspected strictures, fistulas, or abscesses. Preprocedural abdominal imaging can be done for diagnostic endoscopy at the discretion of the endoscopist	2	B
1.2 Bowel preparation with polyethylene glycol-based regimens is preferred for patients with non-diverted colon or pelvic ileal pouches. Sodium phosphate-based enemas can be used in patients with ileosigmoid anastomosis, ileorectal anastomosis, or ileal pouches	2	D
1.3 Oral bowel preparation is generally not needed in patients undergoing ileoscopy via stoma, lower gastrointestinal endoscopy for diverted large bowel, or diverted ileal pouches	5	C
1.4 Prolonged or slower bowel preparation might be needed in patients with strictureplasty or stenosis of the mid-small bowel	4	D
1.5 Monitored anaesthesia care or general anaesthesia should be strongly considered for patients with significant comorbidities, or when anticipating a long procedure time, such as for deep small bowel enteroscopy or therapeutic endoscopy. General anaesthesia should also be strongly considered for any cases of suspected bowel obstruction due to small bowel stenosis; if using general anaesthesia, intubation is required to protect the airway, because of the risk of aspiration	4	C
1.6 Fluoroscopy might be needed in particular therapeutic endoscopy procedures	4	D
1.7 Low-flow carbon dioxide insufflation is preferred for all endoscopic procedures	4	D
1.8 Caution should be exercised in patients who are taking systemic corticosteroids who undergo therapeutic endoscopy for IBD	2	B
1.9 Immunomodulators and biological or small molecule agents can be continued around the time of the endoscopy	2	B
1.10 Non-steroidal anti-inflammatory drugs, aspirin, and warfarin can be continued during diagnostic endoscopy. Antiplatelet agents or anticoagulants should be discontinued in patients with anticipated therapeutic endoscopy after considering risks and benefits	2	B
2. Bowel resection and anastomosis		
2.1 Ileocolonic resection with ileocolonic anastomosis or ileorectal anastomosis in Crohn's disease and ulcerative colitis		
2.1a The first postoperative ileocolonoscopy should be done at 6–12 months post-ileocolectomy, for disease monitoring and possible delivery of endoscopic therapy (such as balloon dilation of a stricture) and subsequent ileocolonoscopies done every 1–3 years at discretion of treating physician?	1	A
2.1b The depth of intubation of the ileocolonoscopy should be at least 10 cm of the neo-terminal ileum	2	B
2.1c The landmarks of the neo-terminal ileum, configuration of anastomosis (eg, end-to-end, end-to-side, or side-to-side anastomosis), other anastomosis-associated anatomical structures (eg, transverse staple line), and proximal colon should be photo-documented	5	B
2.1d As a measurement of the disease activity, endoscopic scores, such as the Rutgeerts score, modified Rutgeerts score, or SES-CD, should be reported and photo-documented for the neo-terminal ileum and anastomosis	2	A
2.1e The role of routine histological evaluation of endoscopically inflamed or non-inflamed neo-terminal ileum, ileocolonic anatomosis, or ileorectal anastomosis, and its effect on medical management, is controversial	4	D
2.1f Disease-associated complications such as strictures and fistulas should be characterised and photo-documented	4	B
2.1g In patients who have had bowel resection and anastomosis for small or large bowel cancer, the first surveillance for recurrence of small or large bowel neoplasia should be done within 1 year after surgery and every 1–3 years thereafter at the discretion of the treating physician; surveillance should be done using high-definition endoscopy with random biopsy, or image-enhanced endoscopy with targeted biopsy	5	D
2.2 Small bowel resection and enteroenteric anastomosis in Crohn's disease		
2.2a The first postoperative ileocolonoscopy or enteroscopy should be done at 6 months after the small bowel resection surgery, for disease monitoring. We recommend subsequent ileocolonoscopy or enteroscopy for disease monitoring and possible delivery of endoscopic therapy (such as balloon dilation of a stricture) every 1–3 years at the discretion of the treating physician	5	D
2.2b Landmarks of enteroenteric anastomosis and the small bowel segments distal and proximal to the anastomosis should be reported and photo-documented	5	D
2.2c As a measurement of disease activity, endoscopic scores, such as the Rutgeerts score or SES-CD, can be adapted for the enteroenteric anastomosis and the small bowel	5	D
2.2d Disease-associated or surgery-associated complications such as strictures and fistulas should be characterised and photo-documented	5	D

(Table 2 continues on next page)

	Evidence level (1–5)	Grade of recommendation (A–D)
(Continued from previous page)		
2.2e For patients who have had small bowel resection and enteroenteric anastomosis for small bowel cancer, the first surveillance for recurrence of small bowel neoplasia should be done within 1 year of surgery, then every 1–3 years; surveillance should be done using image-enhanced endoscopy and biopsy of the small bowel. If the resection area cannot be reached by conventional endoscopy, then deep enteroscopy, capsule endoscopy (with patency capsule), or cross-sectional imaging (such as magnetic resonance enterography or small bowel ultrasound) should be used	5	D
2.3 Partial colectomy with colocolonic anastomosis or colorectal anastomosis in Crohn's disease		
2.3a The first postoperative colonoscopy should be done at 6–12 months after partial colectomy, for disease monitoring. Subsequent colonoscopies should be done at intervals of 1–3 years at the discretion of the treating physician, for disease monitoring, dysplasia surveillance, and possible delivery of endoscopic therapy (such as polypectomy and balloon dilation of a stricture)	5	D
2.3b The disease activity of the large bowel segments should be reported and photo-documented using a validated endoscopic disease activity score	5	D
2.3c Landmarks of the colorectal anastomosis and the large bowel segments distal and proximal to the anastomosis should be reported and photo-documented	5	D
2.3d Disease-associated or surgery-associated complications such as strictures and fistulas should be characterised and photo-documented	5	D
2.3e Postoperative yearly surveillance of the large bowel with high-definition endoscopy and random biopsy, or image-enhanced endoscopy (such as dye-based chromoendoscopy or virtual chromoendoscopy) and targeted biopsy, is recommended in patients with a history of intestinal neoplasia or primary sclerosing cholangitis. The surveillance should be started at the time of diagnosis of primary sclerosing cholangitis. Surveillance endoscopy should be done every 1–3 years in patients with Crohn's colitis for more than 8 years, colon strictures, tubular colon, or colorectal cancer in a first degree relative (younger than 50 years), at the discretion of the treating physician	3	C
3. Stoma		
3.1 A standard gastroscope should be used for ileoscopy, jejunoscopy, or (in most cases) colonoscopy via the stoma	5	D
3.2 The endoscopist should carefully review and document the configuration of the ileostomy or colostomy before scoping via the stoma	4	B
3.3 Endoscopy via stoma requires intubation passing the level beyond the fascia by at least 10 cm	4	B
3.4 Endoscopic intubation of the efferent limb of loop ileostomy or colostomy or loop-end ileostomy is optional, as recurrence of Crohn's disease in this segment of diverted bowel is rare	4	D
3.5 Lesions at the peristomal skin and the presence of stenosis, prolapse, retraction, or fistula of the stoma should be evaluated and documented, preferably with photo-documentation	4	B
3.6 Endoscopy scores can be adapted and used to quantify the disease activity and assess the response to treatment in Crohn's disease in the neo-small bowel	4	B
3.7 Endoscopic alterations, such as ulcers, strictures, and fistulas, in the neo-small bowel distal to the fascia level most likely result from surgical factors, rather than active Crohn's disease	5	D
4. Ileal pouch		
4.1 Digital examination of the anus and pouch–anal anastomosis before insertion of an endoscope should be done to assess the resting sphincter tone, strictures, fistulas, or abscesses	4	B
4.2 The use of a standard gastroscope is preferred for the diagnosis and management of ileal pouch disorders, due to its small calibre and flexibility	5	D
4.3 Landmarks seen on pouchoscopy should be documented, including the prior stoma site (stoma takedown anastomosis), afferent limb, inlet, tip of the J, pouch body, mid-pouch staple line, anastomosis, cuff, anal transition zone, and dentate line	2	B
4.4 Superficial ulcers along the suture or staple lines at the stoma takedown site, tip of the J, middle reflection of the pouch body, and anastomosis, or at the pouch inlet might represent post-surgical changes, not necessarily indicating pouchitis or Crohn's disease	4	C
4.5 In patients suspected of having surgical leaks or fistulas, attention should be paid during pouchoscopy to areas prone to these problems, particularly the suture or staple lines—ie, the stoma takedown site, stapled blind end of the ileum (the tip of the J), or posterior wall of the pouch–anal anastomosis suture line	4	C
4.6 In patients suspected of having strictures, attention should be paid during pouchoscopy to areas prone to the formation of strictures—ie, the stoma site, inlet, and pouch-anal anastomosis. Differential diagnoses of both ulcerated and non-ulcerated strictures in those areas include Crohn's disease, surgical ischaemia, or medication use (such as non-steroidal anti-inflammatory drugs)	2	A
4.7 In the absence of marked pouch inflammation, retroflexion is recommended for the evaluation of cuffitis, distal pouchitis, perianal fistula, or pouch–vaginal fistula	4	D

(Table 2 continues on next page)

	Evidence level (1–5)	Grade of recommendation (A–D)
(Continued from previous page)		
4.8 Endoscopic characterisation of inflammation in the afferent limb, inlet, pouch body, ileal pouch–anal anastomosis, cuff, and anal transition zone should include severity, location, and distribution of the disease. The distance to which inflammation extends in the afferent limb should be measured and documented	2	B
4.9 In addition to inflammation, strictures, fistulas, or anastomotic leaks, pouchoscopy should include documentation of the configuration, length of pouch body, size of the lumen, distensibility (of pouch body), and luminal abnormalities (such as twist and prolapse)	4	C
4.10 Redundant afferent limb, pouch body, or efferent limb can result in so-called floppy pouch complex, a group of structural disorders with predominant phenotypes of afferent limb syndrome, pouch folding, pouchocele, and pouch prolapse. The consensus group recommends a combined assessment of symptoms, endoscopy, defecographic pouchography, and anorectal manometry for floppy pouch complex	3	C
4.11 Pouchitis is diagnosed on the basis of a combined assessment of symptoms and endoscopy. Histological evaluation can provide additional information on some causes of pouchitis	2	A
4.12 Assessment of response to treatment in inflammatory pouch disorders (ie, pouchitis, Crohn's disease of the pouch, or cuffitis) should include endoscopic documentation of disease activity scores	1	A
4.13 Crohn's disease-like condition of the pouch is classified into inflammatory, fibrostenotic, and fistulating phenotypes	2	B
4.14 Crohn's disease of the pouch is diagnosed on the basis of a combined assessment of clinical presentation, endoscopy, histology, imaging, and pattern of response to medical therapy of Crohn's disease	2	B
4.15 Prepouch ileitis has been defined as the presence of endoscopic and histological inflammation of the afferent limb proximal to the pouch inlet. Biopsy of the neo-terminal ileum should be interpreted in the context of pouch and rectal cuff biopsies	2	C
4.16 Cuffitis can be a form of remnant ulcerative colitis, a part of Crohn's disease, or a result of prolapse of the pouch	3	C
4.17 For the diagnosis and differential diagnosis of inflammatory disorders of the pouch, two to four biopsies are taken from each of: the afferent limb or neo-terminal ileum at least 10 cm above the pouch inlet, the afferent limb and efferent limb sides of the pouch body, and the cuff or anal transition zone. These samples should be submitted in separate containers	2	B
4.18 Annual surveillance endoscopy is suggested in patients with a precolectomy diagnosis of colitis-associated dysplasia or cancer	2	B
4.19 Surveillance endoscopy (every 1–3 years) is suggested for patients with other purported risk factors—ie, the presence of primary sclerosing cholangitis, chronic pouchitis, chronic cuffitis, Crohn's disease of the pouch, long-duration of ulcerative colitis (>8 years in total), or family history of colorectal cancer in a first degree relative	3	C
4.20 For surveillance purposes, image-enhanced endoscopy is preferred, with at least three biopsies taken from the cuff or anal transition zone, along with biopsies from the afferent limb and pouch body	5	D
4.21 The landmarks of an S pouch seen on pouchoscopy include the afferent limb, inlet, pouch body, efferent limb, and anastomosis. Attention should be paid to angulation of the pouch inlet (ie, afferent limb syndrome) and angulation or excessive length of the efferent limb (ie, efferent limb syndrome)	4	D
4.22 The landmarks of a Kock pouch seen on pouchoscopy should be documented, including the afferent limb, inlet, pouch body, nipple valve, and exit channel. Attention should be paid to stricture at the inlet or valve, prolapse of the valve, and fistula at the base of the valve	4	C
4.23 Surveillance endoscopy is not recommended in patients with continent ileostomies (eg, Kock pouch and Barnett continent ileal reservoir)	5	D
5. Diverted bowel		
5.1 Endoscopy should be done using a standard gastroscope or paediatric colonoscope, minimal air insufflation (carbon dioxide when available), and superficial biopsy to minimise the risk of bleeding, bacterial translocation, and perforation, as the mucosa of diverted bowel is often friable	5	D
5.2 Diagnostic endoscopy can be done in symptomatic patients with temporary or permanent faecal diversion	5	D
5.3 Endoscopic grading of inflammation of the diverted large bowel or the ileal pouch should be reported and photo-documented, although existing endoscopic activity indices might not be reliable in this setting and should not be used	5	D
5.4 There are no reliable endoscopic features to differentiate between diversion-associated inflammation and active IBD	4	D
5.5 Yearly surveillance endoscopy of the diverted large bowel is recommended for patients at risk of dysplasia. The location and number of biopsies depend on which anorectal or bowel segments were affected by IBD before faecal diversion	4	C
5.6 Surveillance endoscopy of the diverted bowel is indicated only in patients with permanent faecal diversion, and is not recommended in those with temporary faecal diversion	4	D

(Table 2 continues on next page)

	Evidence level (1–5)	Grade of recommendation (A–D)
(Continued from previous page)		
5.7 Yearly surveillance endoscopy of the diverted ileal pouch is recommended for patients with a precolectomy diagnosis of colorectal neoplasia or with previous dysplasia of the pouch. Surveillance endoscopy every 1–3 years can be done for patients with potentially high risk for dysplasia, including patients with primary sclerosing cholangitis or Crohn's disease of the pouch	5	D
6. Strictureplasty		
6.1 Endoscopy along with cross-sectional imaging (ie, CT enterography and magnetic resonance enterography) is the main modality to assess activity and recurrence of Crohn's disease at the strictureplasty site and adjacent areas and to deliver endoscopic therapy	5	D
6.2 Strictureplasty sites can be assessed via deep enteroscopy, including push enteroscopy, balloon-assisted enteroscopy, ileocolonoscopy, or ileostomy via the stoma	5	D
6.3 Capsule endoscopy is not recommended for assessment of the activity of Crohn's disease in patients with strictureplasty because of the risk of capsule retention	5	C
6.4 Landmarks of commonly done strictureplasties (eg, Heineke-Mikulicz, Finney, and Michelassi) seen on endoscopy include the inlet of the strictureplasty, lumen of the strictureplasty, mid-pouch staple or suture line, and outlet of the strictureplasty	5	D
6.5 The presence of mucosal inflammation, strictures, fistulas, and bezoars should be recorded and photo-documented	5	D
6.6 There is variation in the definition of recurrent Crohn's disease in the strictureplasty site. The consensus group believes that disease activity (eg, erosions, ulcers, and strictures) in the lumen of the strictureplasty indicates recurrent Crohn's disease, but ulcers and strictures at the inlet or outlet site do not necessarily indicate recurrent Crohn's disease	5	D
6.7 The assessment of disease activity in the strictureplasty site includes measures such as discontinuation of non-steroidal anti-inflammatory drugs	5	D
6.8 Histological detection of non-caseating granulomas in inflamed, ulcerated, or strictured areas outside of the suture line provides evidence for recurrent Crohn's disease	5	D
6.9 Routine surveillance enteroscopy for neoplasia is not recommended, as strictureplasty is contraindicated with malignant strictures, and neoplasia at the strictureplasty site is rare	5	D
7. Bypass surgery		
7.1 The bypassed duodenum, along with the stomach, proximal jejunostomy, and gastrojejunal or duodenojejunal anastomosis, should be closely monitored with upper gastrointestinal endoscopy for signs of Crohn's disease. The first upper gastrointestinal endoscopy should be done 6 months postoperatively. For asymptomatic patients, the endoscopy can be done every 1–3 years. For symptomatic patients or those with complications (such as strictures) or those at risk of small bowel adenocarcinoma or lymphoma, the endoscopy for the diagnosis, treatment, or surveillance should be done at least yearly	5	D
7.2 The landmarks of the gastrojejunal or duodenojejunal bypass, such as the stomach, anastomosis, proximal jejunum, and bypassed duodenum, should be reported and photo-documented	5	D
8. Immediate postoperative endoscopy		
8.1 Immediate postoperative emergency endoscopy for the diagnosis and treatment of complications of IBD surgery can be done by an experienced endoscopist, with consideration of the risks and benefits	5	D

IBD=inflammatory bowel disease. SES-CD=Simple Endoscopic Score for Crohn's Disease.

Table 2: **Consensus statements for endoscopic evaluation of surgically altered bowel in IBD**

designed for the postoperative setting (figure 3).[12] The other commonly used and validated endoscopic indices are: for Crohn's disease, the 44-point Crohn's Disease Endoscopic Index of Severity (CDEIS)[13] and the 60-point Simple Endoscopic Score for Crohn's Disease (SES-CD);[14] and for ulcerative colitis, the 3-point Mayo Endoscopy Subscore,[15,16] the 3-point Modified Mayo Endoscopic Score with segmental evaluation, the 11-point Ulcerative Colitis Endoscopic Index of Severity,[17,18] and the 10-point Ulcerative Colitis Colonoscopic Index of Severity.[19] For selected patients with Crohn's disease, capsule endoscopy can be done and its scores, such as the Lewis score[20] or Capsule Endoscopy Crohn's Disease Activity Index,[21,22] can be used.

Ileocolonic resection with ileocolonic anastomosis or ileorectal anastomosis in Crohn's disease and ulcerative colitis

We recommend that the first postoperative ileocolonoscopy should be done 6–12 months after surgery and subsequent ileocolonoscopies, for disease monitoring, dysplasia surveillance, and possible delivery of endoscopic therapy, are done every 1–3 years at the discretion of the treating physician (recommendation 2.1a, table 2). ECCO guidelines recommended the first ileocolonoscopy to be done within 12 months of surgery.[23]

Deep intubation (ie, at least 10 cm) of the neo-terminal ileum provides better characterisation of disease recurrence, although it can be technically difficult. For example, the Rutgeerts score that includes the main

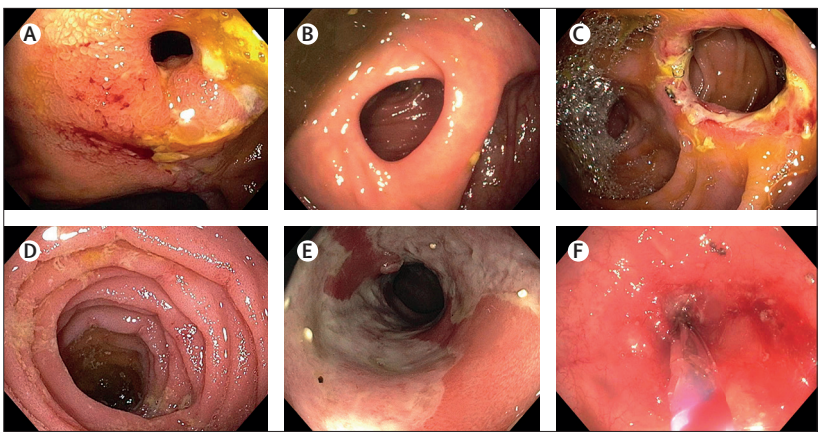

Figure 2: **Postoperative anatomy of ileocolonic resection**
(A) End-to-side ileocolonic anastomosis. (B) Normal and (C) ulcerated side-to-side anastomosis. (D) Multiple erosions in the neo-terminal ileum. (E) Large linear ulcers in the neo-terminal ileum. (F) Adenocarcinoma detected in stricture of ileocolonic anastomosis for Crohn's disease with attempted balloon dilation.

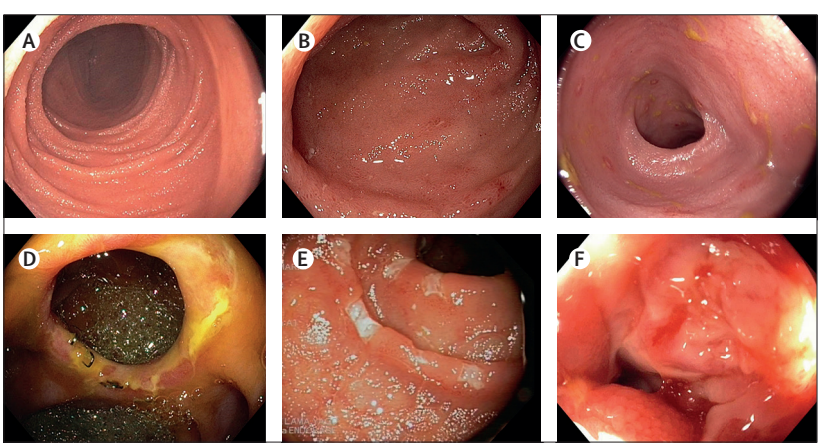

Figure 3: **Postoperative Crohn's disease of ileocolonic resection measured by the Rutgeerts score**
(A) i,0: no lesion. (B) i,1: 5 or fewer aphthous lesions. (C) i,2: more than 5 aphthous lesions with normal mucosa in between the lesions. (D) i,2: lesions confined to the ileocolonic anastomosis (<1 cm in length). (E) i,3: diffuse small ulcers with ileitis. (F) i,4: diffuse inflammation with large ulcers, nodules, and strictures.

component of erosions and ulcers is calculated at the distal 30 cm of the neo-terminal ileum (recommendation 2.1b, table 2). Retroflexion with a paediatric colonoscope can help with intubation of side-to-side antiperistaltic or isoperistaltic anastomoses.[24] Anatomical landmarks should be photo-documented (recommendation 2.1c, table 2). Endoscopic scores, such as the Rutgeerts score, modified Rutgeerts, score, or SES-CD, should be used for the measurement of disease activity (recommendation 2.1d, table 2). The effect of the degree of histological inflammation in the neo-terminal ileum or anastomosis with endoscopic biopsy on the postoperative disease course of Crohn's disease is not clear, although histopathological features such as active histological inflammation at the resection margin, granulomas, or neural plexitis on surgically resected specimens predict postoperative recurrence (recommendation 2.1e, table 2).[25,26]

Various endoscopy scores have been developed for the measurement of disease activity before and after surgery. The Rutgeerts score, which still requires full validation, was initially developed to assess the need for immunomodulators,[12] but has been extrapolated in the practice of the current biological era. Alternatively, CDEIS[13] or SES-CD[14] can also be used. The presence of anastomotic ulcers was found to be associated with recurrent Crohn's disease,[27] although surgery-associated ischaemic changes at the anastomosis are common. Endoscopic recurrence on the neo-terminal ileum but not on the anastomosis is the main factor associated with long-term outcome in postoperative Crohn's disease.[28] In addition to mucosal inflammation, ileocolonoscopy can identify structural abnormalities, such as strictures and fistulas (recommendation 2.1f, table 2).

Ileocolonic resection with ileocolonic anastomosis or ileorectal anastomosis is done for patients with L1, L2, or L3 Crohn's disease, or for selected patients with ulcerative colitis with rectal sparing. These patients occasionally have a preoperative diagnosis of neoplasia of the small or large bowel. The natural histories of small bowel adenocarcinoma and large bowel adenocarcinoma appear to be different from each other. Surveillance ileocolonoscopy for recurrence of small or large bowel neoplasia is needed for patients with a preoperative diagnosis of small or large bowel cancer (recommendation 2.1g, table 2).

Dysplasia surveillance programmes in surgery-naive patients with ulcerative colitis are well established.[29–31] Patients with longstanding (>8 years) left-sided, extensive, or severe colitis require surveillance. The cutoff level of 8 years was based on the recommendation from the professional societies,[29–31] with the knowledge that the duration from IBD diagnosis to the development of colorectal cancer can be shorter than 8 years in some patients.[32,33] When deciding on the cutoff level for patients with ileocolonic anastomosis or ileorectal anastomosis, we also took the presence of part of the large bowel into consideration.

The interval of surveillance is based on risk stratification. The group of patients at high risk of colorectal cancer includes patients with extensive, severe colitis; patients in whom dysplasia has been detected within the last 5 years; patients with a colonic stricture; patients with concurrent primary sclerosing cholangitis; and patients with a family history of colorectal cancer in a first degree relative diagnosed at age 50 years or younger. The group of patients at intermediate risk of colorectal cancer includes patients with extensive colitis with mild or moderate active inflammation or tubular colon.[29] The presence of pseudopolyps in patients with IBD does not appear to convey an increased risk of colitis-associated neoplasia, but does make surveillance of dysplasia more difficult, as the pseudopolyps can obscure the view of dysplastic lesions.[34] Patients with isolated ulcerative proctitis do not have an increased risk of colorectal cancer, and routine

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surveillance is not recommended in these patients.[29,35] The data on surveillance of the small or large bowel segment after resection and anastomosis in patients with Crohn's disease or ulcerative colitis are scant. In such patients, the aforementioned risk stratification can be applied to help determine the need for, and interval of, surveillance. For patients who are at high risk of colorectal cancer, such as those with a history of IBD-associated cancer or concurrent primary sclerosing cholangitis, yearly image-enhanced endoscopy can be done to screen for colon neoplasia (eg, dye chromoendoscopy and virtual chromoendoscopy with targeted biopsy as well as random biopsy).[36]

Small bowel resection and enteroenteric anastomosis in Crohn's disease

Endoscopic monitoring of disease activity and the development of complications in patients with small bowel resection and enteroenteric anastomosis has been challenging, as some of the bowel segment might not be reached via conventional upper gastrointestinal endoscopy or ileocolonoscopy. We recognise that deep enteroscopy or device-assisted enteroscopy requires technical expertise, and capsule or cross-sectional imaging can serve as alternatives (recommendations 2.2a–2.2c, table 2). The disease activity can be measured with the Rutgeerts score,[12] CDEIS,[13] or SES-CD,[14] although these instruments have not been established or validated in the setting of enteroenteric anastomosis. There is no published study comparing the Rutgeerts score, SES-CD, and CDEIS for the postoperative monitoring of Crohn's disease activity in patients with enteroenteric anastomosis. The consensus group did not reach a consensus on the preference of one scoring system over others. The presence of strictures, fistulas, or other structural abnormalities should be reported (recommendation 2.2d, table 2).

Diagnosis of small bowel neoplasia in Crohn's disease remains difficult as the small bowel is usually not accessible for biopsy. There is scant literature on postoperative surveillance for small bowel cancer in patients with Crohn's disease with small bowel resection and enteroenteric anastomosis. Our recommendation on surveillance in these patients is based on the consensus of expert opinion, with a preference for endoscopy or a combination of endoscopy with cross-sectional imaging (recommendation 2.2e, table 2). This consensus group suggests that, for patients who have had small bowel resection and enteroenteric anastomosis for small bowel cancer, the first surveillance for recurrence of small bowel neoplasia should be done within 1 year of surgery, then every 1–3 years; the recommended diagnostic technique for this surveillance is image-enhanced endoscopy and biopsy of the small bowel. To assess the area of resection and anastomosis deep in the small bowel, special endoscopy (such as device-assisted enteroscopy) and cross-sectional imaging can be used. For histological evaluation, device-assisted enteroscopy with virtual or dye-based chromoendoscopy is preferred over capsule imaging (with patency capsule) and cross-sectional imaging. However, delineation of intestinal anatomy with cross-sectional imaging might be needed before endoscopy.

Partial colectomy with colocolonic anastomosis or colorectal anastomosis in Crohn's disease

Patients with Crohn's colitis are sometimes treated with partial colectomy with colocolonic anastomosis or a more extensive resection with an ileorectal anastomosis. Despite scant literature, we recommend colonoscopy for disease monitoring and dysplasia surveillance at the same interval as colonoscopy for these reasons in ileocolonic resection and ileorectal anastomosis (recommendation 2.3a, table 2). The frequency of diagnostic and surveillance colonoscopy is based on the risk of recurrence, the risk of neoplasia, symptoms, and biomarkers. Disease activity can be measured by CDEIS,[13] SES-CD,[14] or the Rutgeerts score,[12] although these instruments have not been validated in this setting (recommendation 2.3b, table 2). There is no published study comparing the Rutgeerts score, SES-CD, and CDEIS for the postoperative monitoring of Crohn's disease activity in patients with colocolonic or ileorectal anastomosis. The consensus group again did not reach a consensus on the preferences of one instrument over others. Colonoscopy should be used to document landmarks and structural abnormalities, in addition to inflammation or neoplastic lesions (recommendations 2.3c, 2.3d; table 2).

The risk of colitis-associated neoplasia in patients with Crohn's colitis is similar to that in patients with ulcerative colitis.[37,38] Dye-based chromoendoscopy and virtual colonoscopy can characterise the neoplastic lesion better than can conventional colonoscopy.[39–41] The improved quality of images helps guide the targeted biopsy. If image-enhanced endoscopy is not available, high-definition colonoscopy or flexible sigmoidoscopy and random biopsy is an alternative. For patients at high risk of colitis-associated neoplasia, such as those with primary sclerosing cholangitis, a history of colitis-associated neoplasia, or tubular colon, image-enhanced endoscopy (such as chromoendoscopy with random biopsy in addition to targeted biopsy) is recommended.[36]

Stoma

Faecal diversion with the creation of an ileostomy, or less commonly colostomy or jejunostomy, is done for the treatment of refractory disease in the downstream bowel segment, for the treatment of perianal disorders, or for the protection of newly created anastomoses. The ostomy can be permanent or temporary, depending on the indication for faecal diversion. The common configurations of ostomies are end ileostomy, loop ileostomy, end colostomy, and end jejunostomy. Other forms include loop-end ileostomy, loop colostomy, loop jejunostomy, and mucous fistula (figure 4). Endoscopy

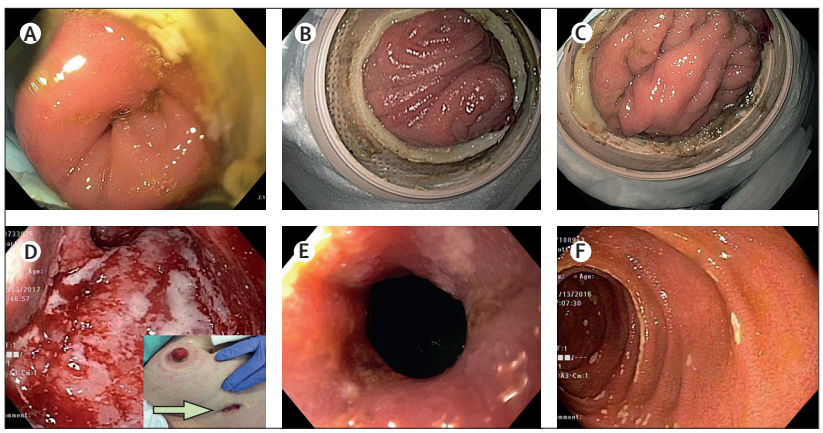

Figure 4: **Ostomy**
(A) End ileoscopy. (B) Loop ileostomy. (C) Loop colostomy. (D) Mucous fistula in Hartmann's pouch with enterocutaneous fistula (green arrow). (E) Stricture at the facia level. (F) Erosions in the neo-distal ileum reflecting active Crohn's disease.

plays a key role in the diagnosis, disease monitoring, and treatment of Crohn's disease in patients with ostomies (recommendations 3.1–3.4, table 2).[42–44] Digital examination of the stoma can help to identify its configuration and detect stoma anastomosis. Peristomal skin and structural abnormalities of the stoma should be inspected (recommendation 3.5, table 2).

The status of disease activity in the neo-small or large bowel in patients with ostomies determines proper medical therapy and decision on closure of the ostomy. The Rutgeerts score,[12] which was originally designed for the assessment of disease of the neo-terminal ileum in ileocolonic resection and anastomosis, has also been used for the evaluation of disease activity of the neo-small bowel in patients with Crohn's disease with ileostomies.[45] The CDEIS[13] or SES-CD[14] can also be adapted for use in this cohort of patients. Inflammation, stricturing, and fistulation at the stoma or the bowel segment between the stoma and fascia level can result from surgical factors, not necessarily from recurrent Crohn's disease (recommendation 3.3, table 2). The differential diagnoses of stenosis, ulcers, or fistulas in the bowel segment distal to the fascia include Crohn's disease, surgical factors, and the use of non-steroidal anti-inflammatory drugs (recommendation 3.5, table 2). Endoscopy scores can be used to monitor the disease activity in Crohn's disease in the neo-small bowel (recommendation 3.6, table 2). Ulcers, strictures, and fistulas in the neo-small bowel distal to the fascia level often result from surgical factors, rather than active Crohn's disease (recommendation 3.7, table 2). The role of routine histological evaluation of the small or large bowel in patients with stomas is not clear.

Ileal pouch

Open, laparoscopic, or robotic restorative proctocolectomy with ileal pouch is usually done in stages. The procedures include subtotal colectomy, Hartmann's procedure, end ileostomy, completion proctectomy, construction of an ileal pouch with or without mucosectomy, handsewn or stapled pouch-anal anastomosis, loop ileostomy, and ileostomy closure. Ileal pouches are classified into abdominal pouches or continent ileostomy (ie, Kock pouch or Barnett continent ileal reservoir) and pelvic pouch (eg, J pouch or S pouch). This series of surgical procedures results in unique anatomies, and disease conditions can occur at any of these locations (figure 5).

Various adverse sequelae can develop in the ileal pouch: these can be structural (eg, anastomotic stricture, anastomotic leak, pouch prolapse); inflammatory (eg, pouchitis, Crohn's disease of the pouch or Crohn's disease-like condition of the pouch, cuffitis); functional (eg, irritable pouch syndrome, dyssynergic defecation), neoplastic (eg, cuff adenocarcinoma), or metabolic (eg, anaemia, renal stones).[46] Endoscopy plays a key role in the diagnosis, differential diagnosis, disease monitoring, therapy, and dysplasia surveillance (figure 6).

We recommend doing routine perianal and digital examination at endoscopy (recommendation 4.1, table 2). We suggest using a standard gastroscope and documenting various anatomical landmarks (recommendations 4.2, 4.3; table 2).[47] Some endoscopic features can reflect normal postoperative changes (recommendation 4.4, table 2) and biopsy of the area should be avoided. The anastomotic locations that are prone to the development of diseased pouch or postsurgical morbidities should be carefully inspected (recommendations 4.5, 4.6; table 2).[48,49] Retroflexion of endoscopy can help in inspecting the distal pouch, cuff, or anal transitional zone (recommendation 4.7, table 2). Endoscopic characterisation of pouch disorders should involve more than just the grading of inflammation (recommendations 4.8, 4.9; table 2). For example, careful evaluation of the anatomical features of the pouch usually provides clues to the diagnosis, differential diagnosis, and prognosis of pouch disorders. For instance, in a study by Elder and colleagues on endoscopic features associated with ileal pouch failure, distortion of the normal so-called owl's eye of the proximal pouch body was associated with a higher risk of pouch failure.[50] A syndrome that has gradually become recognised as a possible pouch-related complication of restorative protocolectomy with ileal pouch creation is so-called floppy pouch complex, a constellation of pouch disorders which can occur together.[51] Pouch volvulus can be a part of floppy pouch complex (recommendation 4.10, table 2).[52]

Pouchoscopy is the most accurate tool to assess the level of inflammation in pouchitis. The severity of inflammation can be measured by using instruments such as the Pouchitis Disease Activity Index.[53] Combined index scores, such as the Pouchitis Disease Activity Index or modified Pouchitis Disease Activity Index,[54] are recommended. Of all items of endoscopy subscores, ulceration in the pouch is the most reliable and reproducible marker of inflammation.[50] The main purpose of histology is to diagnose the secondary cause of

pouch inflammation, such as cytomegalovirus infection, ischaemia, collagenous pouchitis, or an autoimmune cause (recommendation 4.11, table 2). The endoscopic evaluation also plays an important role in the assessment of response to treatment (recommendation 4.12, table 2).

De novo Crohn's disease or Crohn's disease-like conditions can occur in patients with a preoperative diagnosis of ulcerative colitis or indeterminate colitis. The phenotype of Crohn's disease of the pouch can be classified by adapting the Montreal Classification (recommendation 4.13, table 2).[55] Clinical and endoscopic features of Crohn's disease of the pouch and morbidities associated with surgical ischaemia can overlap, and it can be difficult to distinguish between these conditions when seeking to identify the cause of ulcers, strictures, and fistulas. Histological evidence of granulomas is present in only a small proportion of patients with a clinical diagnosis of Crohn's disease of the pouch.[56] If fistulas, sinuses, or abscesses occur within 6–12 months of pouch surgery, these are likely to be complications related to surgical technique, rather than Crohn's disease (recommendation 4.14, table 2). A therapeutic trial of biologics can help with the differential diagnosis. For example, a clinical, endoscopic, and radiographic response to anti-TNF therapy suggests a diagnosis of Crohn's disease, rather than a surgical complication.

Prepouch ileitis is a loosely defined term. Whether it represents a variant of pouchitis or Crohn's disease of the pouch is not clear.[57,58] Prepouch ileitis can result from diffuse pouchitis with backwash enteritis, concurrent primary sclerosing cholangitis, Crohn's disease, surgery-associated ischaemia, or medications (such as non-steroidal anti-inflammatory drugs; recommendation 4.15, table 2). Various conditions can cause cuff inflammation (recommendation 4.16, table 2). We propose a biopsy protocol for pouchitis, Crohn's disease of the pouch, cuffitis, and other pouch disorders (recommendation 4.17, table 2).

Proctocolectomy with ileal pouch–anal anastomosis, even with mucosectomy, does not completely eradicate the risk of neoplasia, although the prevalence of neoplasia is low. The predominant location of neoplasia is at the cuff or anal transitional zone. The prognosis of pouch cancer is poor. In a case series of 14 patients with pouch adenocarcinoma, six patients (43%) died after a median follow-up of 2·1 years (IQR 0·6–5·2).[59] The poorly defined natural history and poor prognosis of pouch neoplasia make surveillance of the pouch necessary, despite some arguments against surveillance pouchoscopy in asymptomatic patients due to the rarity of pouch neoplasia.[34] The risk of pouch neoplasia in patients undergoing total proctocolectomy and ileal pouch–anal anastomosis can be stratified into high risk (eg, the presence of colitis-associated rectal dysplasia or colorectal cancer),[60–62] potentially high risk (eg, the presence of primary sclerosing cholangitis, chronic pouchitis, chronic cuffitis, family history of colorectal cancer in a first degree relative, or type C mucosa of the pouch), and average risk.[61,62] Current guidelines or consensus from the BSG,[30] ASGE,[31] and ECCO[29] all recommend yearly surveillance endoscopy in patients undergoing total proctocolectomy and ileal pouch–anal anastomosis. The BSG guideline also categorises patients with primary sclerosing cholangitis or type C mucosa in the pouch as a high-risk group and recommends yearly surveillance.[30] There is no published consensus on the need for, or interval of, surveillance pouchoscopy in patients in the potentially high risk or average risk groups. Cancer in the cuff or anal transition zone spreads laterally. The practice of deep or tunnel biopsy is acceptable. In theory, the presence of concurrent cuffitis could affect the accuracy of the histological evaluation of the biopsy specimen. For surveillance endoscopy for pouch neoplasia, at least three biopsies are taken from each of: the prepouch afferent limb, the

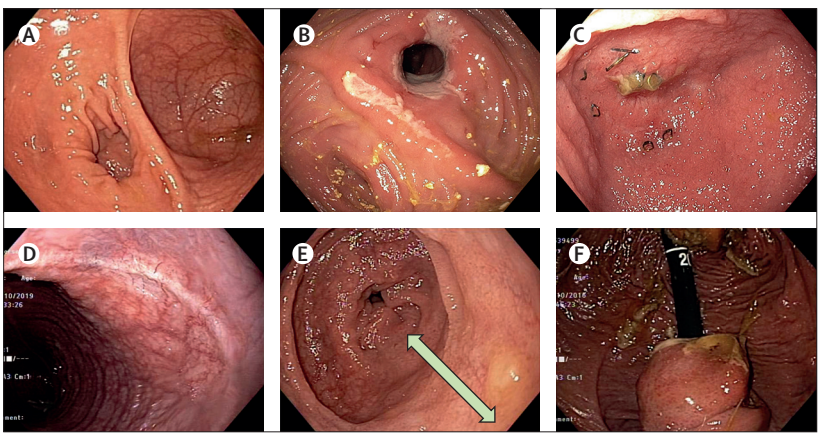

Figure 5: **Normal anatomy of the ileal pouch**
(A) Side-to-side anastomosis at stoma takedown side. (B) Owl's eye configuration at the proximal pouch with ulceration at the inlet and staple line. (C) Tip of the J with visible surgical staples. (D) Rectal cuff with circumferential anastomosis. (E) Efferent limb of an S pouch (green arrow) in the absence of the rectal cuff. (F) Nipple valve of a Kock pouch on the retroflexion view.

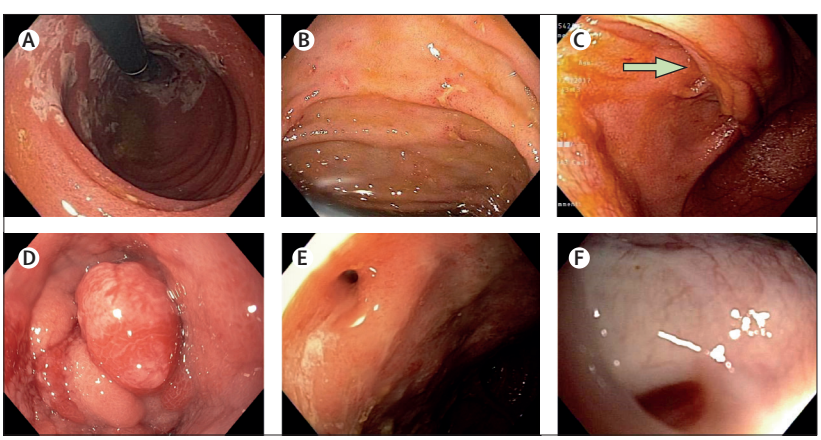

Figure 6: **Pouch disorders**
(A) Ischaemic pouchitis. (B) Crohn's disease of the pouch with multiple erosions and ulcers in a long segment of the afferent limb. (C) Afferent limb syndrome with a sharp angulation between the pouch body and afferent limb (green arrow). (D) Distal pouch prolapse blocking the pouch outlet. (E) Opening of a presacral sinus. (F) Opening of a pouch–vaginal fistula.

afferent limb and efferent limb sides of the pouch body, and the rectal cuff or anal transitional zone. These samples should be submitted in separate containers. In addition, any endoscopically evident lesions should also be sampled and submitted separately (recommendations 4.18–4.20, table 2).

The configuration and structure of the S pouch and Kock pouch are different from that of the J pouch (recommendations 4.21, 4.22; table 2). Routine dysplasia surveillance in patients with Kock pouches is not recommended because the risk of neoplasia in continent ileostomies is low (recommendation 4.23, table 2).

Diverted bowel

Faecal diversion with ileostomy or colostomy is indicated for various conditions in IBD, such as refractory perianal fistulas or abscesses in Crohn's disease, or protection of a downstream high-risk anastomosis. Faecal diversion results in a temporary or permanent diverted colon, rectum, or ileal pouch. The diverted bowel is characterised by mucous exudates and friable mucosa on endoscopy, and extensive lymphoid aggregates on histology (figure 7).[63] There are scant data in the literature on the need for, frequency of, and techniques of endoscopy in the diverted bowel.

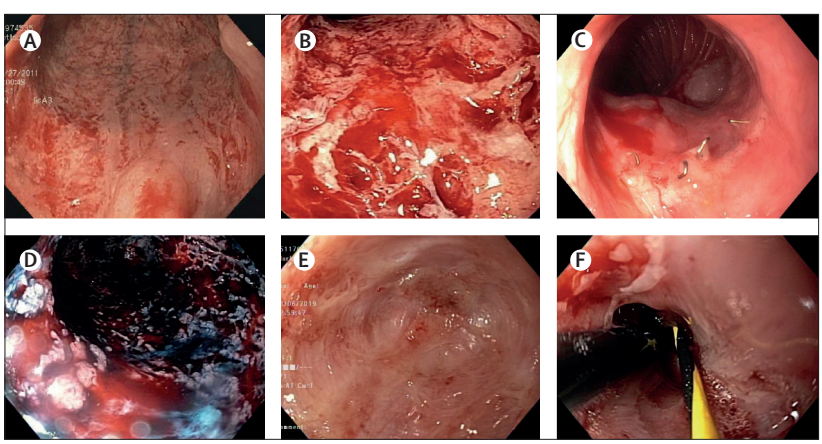

Figure 7: **Diverted bowel**
(A) Mild and (B) severe diversion proctitis. (C) Diverted ileal pouch. (D) Chromoendoscopy of the diverted colon. (E) Sealed anorectum due to a long-term faecal diversion. (F) Endoscopic stricturotomy along the guidewire for anorectal stricture in the diverted rectum.

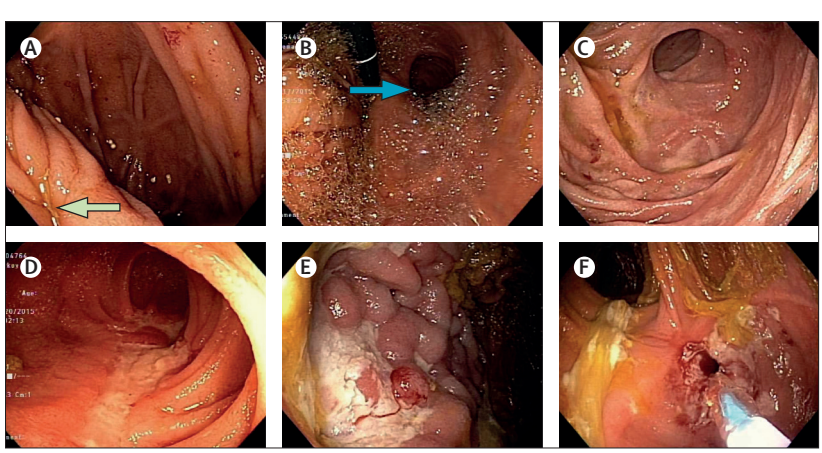

Figure 8: **Strictureplasty**
(A) Lumen of strictureplasty and outlet of strictureplasty (green arrow). (B) Lumen of strictureplasty and outlet under retroflexion view (blue arrow). (C) Lumen of strictureplasty with white linear ulcers. (D) Linear longitudinal ulceration in lumen of strictureplasty indicating active Crohn's disease. (E) Ulcerated stricture at outlet of strictureplasty. (F) Ulcerated stricture at inlet of strictureplasty undergoing balloon dilation.

The mucosa of the diverted bowel is often friable and special techniques should be applied to prevent damage to the mucosa. Accurate endoscopic evaluation and photographic documentation should be done at the time of insertion, as the mucosa can become inflamed with air insufflation. Barotrauma from the endoscopic biopsy or therapy (such as balloon dilation of a stricture) in the diverted bowel is more marked than that in the non-diverted bowel (recommendation 5.1, table 2). Therefore, diagnostic endoscopy can be avoided in asymptomatic patients (recommendation 5.2, table 2). Endoscopic grading of inflammation of diverted bowel and distinction between diversion-associated mucosal injury and active IBD might not be reliable in all cases. Four random biopsies every 10 cm should be taken using a modified Seattle protocol. Additionally, any endoscopically visible lesion should have biopsies taken or be completely removed for histology (recommendations 5.3, 5.4; table 2). Diversion-associated injury, in contrast to IBD, is characterised by extensive lymphoid aggregates on mucosal biopsy.[59] The distinction between diversion-associated mucosal injury and active IBD is important for the decision on surgical stoma closure.

The diverted bowel segment which was affected by IBD before stoma construction can develop colitis-associated neoplasia. The decision on the frequency of surveillance for colorectal cancer in the diverted bowel is based on the risk of colorectal cancer (recommendations 5.5–5.7, table 2). The risk of dysplasia or cancer in the diverted colorectum appears to be low in patients with diversion colitis in the absence of a history of IBD or colorectal cancer.[64,65] Patients at risk of dysplasia or cancer are those with a preoperative diagnosis of colitis-associated neoplasia in the segment of bowel, with or without endoscopic therapy for the neoplasia; a long history (>8 years) of ulcerative colitis or Crohn's colitis involving the colon and rectum; concurrent primary sclerosing cholangitis; large bowel strictures; or a family history of colorectal cancer in a first-degree relative younger than 50 years. Four random biopsies every 10 cm should be taken using a modified Seattle protocol. Additionally, any endoscopically visible lesion should have biopsies taken or be completely removed for histology. The role of image-enhanced endoscopy in the surveillance of colitis-associated neoplasia in the diverted pouch has not been established, as the friability of the mucosa makes the application of the endoscope and dye difficult.

There is little literature on the risk of colorectal cancer in patients with a permanently diverted ileal pouch.

We provide recommendations based on the consensus of our experts. The purported risk factors for pouch neoplasia are a preoperative diagnosis of colitis-associated neoplasia, primary sclerosing cholangitis, and Crohn's disease of the pouch.[56–58] We agreed that the grading of mucosal inflammation and identification of dysplastic lesion in the diverted bowel with conventional or image-enhanced endoscopy is difficult due to the presence of friable mucosa. We also recognised that the risk of bleeding from an endoscopic biopsy is higher in patients with diverted bowels than in patients with non-diverted bowels (recommendation 5.7, table 2).

Strictureplasty

Surgical strictureplasty, as a bowel-preserving measure, is commonly done in patients with Crohn's disease with small bowel strictures. Commonly constructed strictureplasties include Heineke-Mikulicz, Finney (a form of side-to-side enteroenterostomy), and Michelassi strictureplasty I (side-to-side isoperistaltic)[66] and II (end-to-side-to-side-to-end) configurations.[67] The construction of a Finney strictureplasty leads to the formation of a diverticulum. The lumen of a Michelassi strictureplasty is larger than that of the the Heineke-Mikulicz and Finney strictureplasties. Strictureplasty results in acceptable long-term outcomes, despite a higher rate of recurrence of Crohn's disease than occurs with resection and anastomosis.[68] It is anticipated that all strictureplasty is associated with faecal stasis and bacterial overgrowth. The mucosa of the lumen of the strictureplasty site is characterised by loss of vascular pattern and shortening of villi. Although strictureplasty results in reversal or resolution of the previously strictured area, it is common to have a narrowed inlet or outlet at the strictureplasty site. The narrowed inlet or outlet might be ulcerated. Gaining access to a strictureplasty by conventional or device-assisted endoscopy can be difficult. Cross-sectional imaging is often used in conjunction with, or as an alternative to, endoscopy (recommendations 6.1, 6.2; table 2). We do not recommend capsule endoscopy in patients with strictureplasty, to avoid the risk of retention of the capsule (recommendation 6.3, table 2).

The recognition of the anatomy of a strictureplasty on endoscopy is important (recommendations 6.4–6.6, table 2). Retroflexion may be carefully done. There is no consensus on the definition of disease recurrence in the strictureplasty site. Furthermore, there are no data on whether medical therapy of the mucosal or luminal features affects the disease course of recurrent Crohn's disease at the strictureplasty site. Nonetheless, we provide recommendations for the diagnosis and differential diagnosis of recurrent Crohn's disease and surgery-associated abnormalities (recommendations 6.6, 6.7; table 2; figure 8). In our expert opinion, a therapeutic trial of oral budesonide or a biological agent can help to distinguish between recurrent Crohn's disease and other causes of abnormalities seen on endoscopy. A histological evaluation might also be valuable for the differential diagnosis (recommendation 6.8, table 2). We do not recommend routine dysplasia surveillance endoscopy at the strictureplasty site (recommendation 6.9, table 2). However, biopsies should be taken from these sites to rule out neoplasia if these sites are endoscopically accessible for biopsy and if the patient has a history of intestinal neoplasia or long-term, non-healing fistulas; such fistulas can be associated with the development of adenocarcinoma. If the strictureplasty site is not accessible to endoscopy and biopsy, then cross-sectional imaging, such as CT enterography or magnetic resonance enterography, can be done.

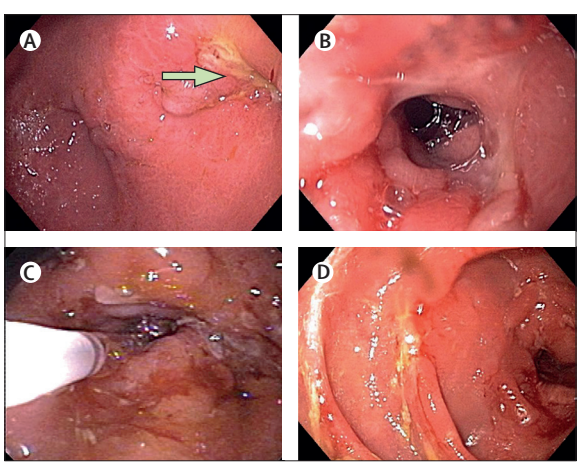

Figure 9: **Bypass surgery for upper small bowel Crohn's disease**
(A) Severely strictured pylorus and duodenum, not traversable by a gastroscope. (B) Ulcerated stricture at gastrojejunostomy. (C) Endoscopic balloon dilation of gastrojejunostomy stricture. (D) Active Crohn's disease at the proximal jejunum with ulcers and additional inflammatory strictures.

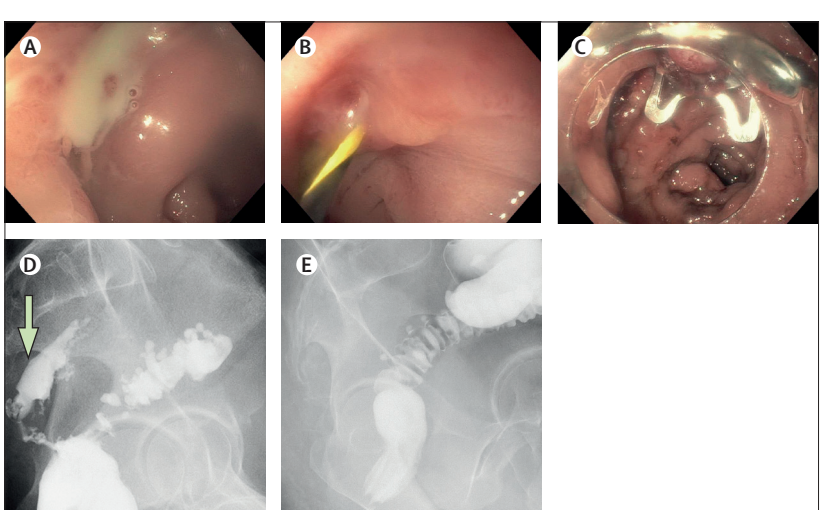

Figure 10: **Endoscopic management of acute colorectal anastomosis leak**
(A) and (B) Severe presacral abscess with pus detected by an endoscopic guidewire. (C) Endoscopic deployment of an over-the-scope clip at the leak. (D) Large presacral sinus seen on preprocedural gastrografin enema (green arrow). (E) Resolution of the presacral sinus on repeat gastrografin enema.

Bypass surgery

Upper gastrointestinal involvement represents a severe case of Crohn's disease with a greater frequency of complications such as obstruction and perforation. For stricturing or fistulising Crohn's disease of the proximal small bowel, surgical options include resection and anastomosis, gastrojejunal or duodenojejunal bypass, and strictureplasty.[69–72] Disease and stricturing can develop at the anastomotic site of a gastrojejunostomy or duodenojejunostomy, or in the areas of the digestive tract either side of the anastomosis. There also are case reports of adenocarcinoma arising in the bypassed duodenum[73] and in the strictureplasty site[74] in patients with Crohn's disease with duodenal stricturing. The main aims of endoscopy are disease monitoring of the stomach and jejunum and dysplasia surveillance of the bypassed duodenum (recommendations 7.1, 7.2; table 2; figure 9). Cross-sectional imaging can be used in conjunction.

Immediate postoperative endoscopy

Postoperative complications are common in IBD surgery. The most common immediate postoperative complications are bleeding at the anastomosis, and separation or leak at the anastomosis or the suture or staple lines. Although acute leaks can sometimes be managed conservatively, some might require surgical reintervention. Some patients can benefit from endoscopic therapy, such as treatment of bleeding vessels (by the application of endoclips, topical injection of corticosteroids, or the use of haemostatic power)[75] or anastomotic leaks (by the application of through-the-scope or over-the-scope clips; figure 10).[76] There have been concerns about the risk of disruption of freshly operated bowel and the timing of endoscopic intervention in this setting. However, careful rescue endoscopy with gentle air insufflation and a straight scope can be done by an experienced endoscopist with surgical backup readily available (recommendation 8.1, table 2).

Conclusion

Surgery is commonly required in patients with Crohn's disease or ulcerative colitis. Various destructive or reconstructive surgical modalities result in substantial alterations in bowel anatomy. Postoperative disease recurrence and surgery-associated complications are common. Diagnostic and therapeutic endoscopy plays a key role in disease monitoring, assessment of treatment response, dysplasia surveillance, and delivery of therapy. In this consensus guideline we have outlined anatomies frequently seen at endoscopy in the surgically altered bowel in healthy and diseased states, and have provided principles and techniques of endoscopy in these patients.

Contributors

BS was responsible for the conception of the manuscript. BS, GSK, UN, FAF, DAS, MI, JS, RKC, and CNB were on the steering committee. All authors were involved in preparing and critically reviewing the manuscript, and in voting on the consensus statements.

Declaration of interests

CNB reports grants and personal fees from AbbVie, Janssen Canada, Pfizer Canada, and Takeda Canada, and personal fees from Roche Canada, Bristol Myers Squibb Canada, Sandoz Canada, Mylan Pharmaceuticals, Takeda, and Medtronics Canada. DHB reports grants from Medtronic. JS reports personal fees from Takeda and Pfizer. PGK reports grants and personal fees from Pfizer and Takeda, and personal fees from AbbVie and Jansen. UN reports grants and personal fees from Takeda, Janssen, and AbbVie, and personal fees from Pfizer. RKC reports personal fees from AbbVie, Janssen, Pfizer, Samsung Bioepis, and Takeda. WJS reports grants, personal fees, and stock or stock options from Prometheus Biosciences; grants and personal fees from AbbVie, Abivax, Alimentiv, Arena Pharmaceuticals, Boehringer-Ingelheim, Celgene, Genentech (Roche), Gilead Sciences, Glaxo Smith Kline, Janssen, Lilly, Pfizer, Seres Therapeutics, Shire, Surrozen, Takeda, and Theravance Biopharma; personal fees and stock or stock options from Beigene, Gossamer Bio, Oppilan Pharma, Progenity, Shoreline Bioscience, and Vivreon Biosciences; grants and stock options from Allakos; personal fees from Alivio Therapeutics, Admirx, Alfasigma, Allergan, Amgen, Applied Molecular Transport, Avexegen Therapeutics, Bausch Health (Salix), Bellatrix Pharmaceuticals, Boston Pharmaceuticals, Bristol Meyer Squibb, Celltrion, Cellularity, Conatus, Cosmo Pharmaceuticals, Escalier Biosciences, Ferring, Forbion, Equillium, Glanmark Pharmaceuticals, Immunic (Vital Therapies), Incyte, Index Pharmaceuticals, Intact Therapeutics, Kyowa Kirin Pharmaceutical Research, Kyverna Therapeutics, Landos Biopharma, Miraca Life Sciences, Nivalis Therapeutics, Novartis, Nutrition Science Partners, Otsuka, Pandion Therapeutics, Paul Hastings, Protagonist Therapeutics, Provention Bio, Reistone Biopharma, Ritter Pharmaceuticals, Shanghai Pharma Biotherapeutics, Sienna Biopharmaceuticals, Sigmoid Biotechnologies, Sterna Biologicals, Sublimity Therapeutics, Thetis Pharmaceuticals, Tigenix, Tillots Pharma, UCB Pharma, Vendata Biosciences, Vivelix Pharmaceuticals, and Zealand Pharma; and stock or stock options from Ventyx Biosciences and Vimalan Biosciences. MSS reports grants and personal fees from Janssen, AbbVie, Takeda, and Pfizer, and grants from Prometheus. All other authors declare no competing interests.

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References

1 Fazio VW, Kiran RP, Remzi FH, et al. Ileal pouch anal anastomosis: analysis of outcome and quality of life in 3707 patients. *Ann Surg* 2013; **257:** 679–85.

2 Sinh P, Shen B. Endoscopic evaluation of surgically altered bowel in patients with inflammatory bowel diseases. *Inflamm Bowel Dis* 2015; **21:** 1459–71.

3 Shen B, Kochhar G, Navaneethan U, et al. Practical guidelines on endoscopic treatment for Crohn's disease strictures: a consensus statement from the Global Interventional Inflammatory Bowel Disease Group. *Lancet Gastroenterol Hepatol* 2020; **5:** 393–405.

4 Centre for Evidence-Based Medicine. OCEBM Levels of Evidence. https://www.cebm.ox.ac.uk/resources/levels-of-evidence/ocebm-levels-of-evidence (accessed Aug 1, 2020).

5 Mukewar S, Costedio M, Wu X, et al. Severe adverse outcomes of endoscopic perforations in patients with and without IBD. *Inflamm Bowel Dis* 2014; **20:** 2056–66.

6 Navaneethan U, Kochhar G, Phull H, et al. Severe disease on endoscopy and steroid use increase the risk for bowel perforation during colonoscopy in inflammatory bowel disease patients. *J Crohn's Colitis* 2012; **6:** 470–75.

7 Acosta RD, Abraham NS, Chandrasekhara V, et al. The management of antithrombotic agents for patients undergoing GI endoscopy. *Gastrointest Endosc* 2016; **83:** 3–16.

8 Hasan B, Khalid R, Charles R, Shen B. Abdominal pain in a patient with diverted bowel and inflammatory bowel disease. *ACG Case Rep J* 2020; **7:** e00437.

9 Salice M, Rizzello F, Sgambato D, et al. Long term remission after ileorectal anastomosis in Crohn's colitis. *Dig Liver Dis* 2020; published online June 29. https://doi.org/10.1016/j.dld.2020.06.021.

10 Da Luz Moreira A, Kiran RP, Lavery I. Clinical outcomes of ileorectal anastomosis for ulcerative colitis. *Br J Surg* 2010; **97:** 65–69.

11 Peyrin-Biroulet L, Sandborn W, Sands BE, et al. Selecting therapeutic targets in inflammatory bowel disease (STRIDE): determining therapeutic goals for treat-to-target. *Am J Gastroenterol* 2015; **110:** 1324–38.

12 Rutgeerts P, Geboes K, Vantrappen G, Beyls J, Kerremans R, Hiele M. Predictability of the postoperative course of Crohn's disease. *Gastroenterology* 1990; **99:** 956–63.

13 Mary JY, Modigliani R. Development and validation of an endoscopic index of the severity for Crohn's disease: a prospective multicentre study. Groupe d'Etudes Thérapeutiques des Affections Inflammatoires du Tube Digestif (GETAID). *Gut* 1989; **30:** 983–89.

14 Daperno M, D'Haens G, Van Assche G, et al. Development and validation of a new, simplified endoscopic activity score for Crohn's disease: the SES-CD. *Gastrointest Endosc* 2004; **60:** 505–12.

15 Schroeder KW, Tremaine WJ, Ilstrup DM. Coated oral 5-aminosalicylic acid therapy for mildly to moderately active ulcerative colitis. A randomized study. *N Engl J Med* 1987; **317:** 1625–29.

16 Colombel JF, Rutgeerts P, Reinisch W, et al. Early mucosal healing with infliximab is associated with improved long-term clinical outcomes in ulcerative colitis. *Gastroenterology* 2011; **141:** 1194–201.

17 Travis SP, Schnell D, Krzeski P, et al. Developing an instrument to assess the endoscopic severity of ulcerative colitis: the Ulcerative Colitis Endoscopic Index of Severity (UCEIS). *Gut* 2012; **61:** 535–42.

18 Travis SP, Schnell D, Krzeski P, et al. Reliability and initial validation of the ulcerative colitis endoscopic index of severity. *Gastroenterology* 2013; **145:** 987–95.

19 Samuel S, Bruining DH, Loftus EV Jr, et al. Validation of the ulcerative colitis colonoscopic index of severity and its correlation with disease activity measures. *Clin Gastroenterol Hepatol* 2013; **11:** 49–54.

20 Gralnek IM, Defranchis R, Seidman E, Leighton JA, Legnani P, Lewis BS. Development of a capsule endoscopy scoring index for small bowel mucosal inflammatory change. *Aliment Pharmacol Ther* 2008; **27:** 146–54.

21 Gal E, Geller A, Fraser G, Levi Z, Niv Y. Assessment and validation of the new capsule endoscopy Crohn's disease activity index (CECDAI). *Dig Dis Sci* 2008; **53:** 1933–37.

22 Melmed GY, Dubinsky MC, Rubin DT, et al. Utility of video capsule endoscopy for longitudinal monitoring of Crohn's disease activity in the small bowel: a prospective study. *Gastrointest Endosc* 2018; **88:** 947–55.

23 Gionchetti P, Dignass A, Danese S, et al. Third European evidence-based consensus on the diagnosis and management of Crohn's disease 2016: part 2: surgical management and special situations. *J Crohn's Colitis* 2017; **11:** 135–49.

24 Chen M, Shen B. Endoscopic therapy in Crohn's disease: principle, preparation, and technique. *Inflamm Bowel Dis* 2015; **21:** 2222–40.

25 Hirten RP, Mashiana S, Cohen BL, Sands BE, Colombel JF, Harpaz N. Ileocolic anastomotic inflammation after resection for Crohn's disease indicates disease recurrence: a histopathologic study. *Scand J Gastroenterol* 2020; **55:** 795–99.

26 Tandon P, Malhi G, Abdali D, et al. Active margins, plexitis, and granulomas increase post-operative Crohn's recurrence: systematic review and meta-analysis. *Clin Gastroenterol Hepatol* 2021; **19:** 451–62.

27 Hirten RP, Ungaro RC, Castaneda D, et al. Anastomotic ulcers after ileocolic resection for Crohn's disease are common and predict recurrence. *Inflamm Bowel Dis* 2020; **26:** 1050–58.

28 Hammoudi N, Auzolle C, Tran Minh ML, et al. Postoperative endoscopic recurrence on the neoterminal ileum but not on the anastomosis is mainly driving long-term outcomes in Crohn's disease. *Am J Gastroenterol* 2020; **115:** 1084–93.

29 Magro F, Gionchetti P, Eliakim R, et al. European Crohn's and Colitis Organisation (ECCO). Third European evidence-based consensus on diagnosis and management of ulcerative colitis. Part 1: definitions, diagnosis, extra-intestinal manifestations, pregnancy, cancer surveillance, surgery, and ileo-anal pouch disorders. *J Crohn's Colitis* 2017; **11:** 649–70.

30 Mowat C, Cole A, Windsor A, et al. Guidelines for the management of inflammatory bowel disease in adults. *Gut* 2011; **60:** 571–607.

31 Shergill AK, Lightdale JR, Bruining DH, et al. The role of endoscopy in inflammatory bowel disease. *Gastrointest Endosc* 2015; **81:** 1101–21.

32 Winther KV, Jess T, Langholz E, Munkholm P, Binder V. Long-term risk of cancer in ulcerative colitis: a population-based cohort study from Copenhagen County. *Clin Gastroenterol Hepatol* 2004; **2:** 1088–95.

33 Lutgens MW, Vleggaar FP, Schipper ME, et al. High frequency of early colorectal cancer in inflammatory bowel disease. *Gut* 2008; **57:** 1246–51.

34 Mahmoud R, Shah SC, Ten Hove JR, et al. No association between pseudopolyps and colorectal neoplasia in patients with inflammatory bowel diseases. *Gastroenterology* 2019; **156:** 1333–44.

35 Katsanos KH, Vermeire S, Christodoulou DK, et al. Dysplasia and cancer in inflammatory bowel disease 10 years after diagnosis: results of a population-based European collaborative follow-up study. *Digestion* 2007; **75:** 113–21.

36 Moussata D, Allez M, Cazals-Hatem D, et al. Are random biopsies still useful for the detection of neoplasia in patients with IBD undergoing surveillance colonoscopy with chromoendoscopy? *Gut* 2018; **67:** 616–24.

37 Lightner AL, Vogler S, McMichael J, et al. Dysplastic progression to adenocarcinoma is equivalent in ulcerative colitis and Crohn's disease. *J Crohns Colitis* 2021; **15:** 24–34.

38 Kiran RP, Khoury W, Church JM, Lavery IC, Fazio VW, Remzi FH. Colorectal cancer complicating inflammatory bowel disease: similarities and differences between Crohn's and ulcerative colitis based on three decades of experience. *Ann Surg* 2010; **252:** 330–35.

39 Laine L, Kaltenbach T, Barkun A, et al. SCENIC international consensus statement on surveillance and management of dysplasia in inflammatory bowel disease. *Gastroenterology* 2015; **148:** 639–51.

40 Bisschops R, East JE, Hassan C, et al. Advanced imaging for detection and differentiation of colorectal neoplasia: European Society of Gastrointestinal Endoscopy (ESGE) guideline—update 2019. *Endoscopy* 2019; **51:** 1155–79.

41 Iannone A, Ruospo M, Wong G, et al. Systematic review of randomized trials. *Clin Gastroenterol Hepatol* 2017; **15:** 1684–97.

42 Wang X, Shen B. Management of Crohn's disease and complications in patients with ostomies. *Inflamm Bowel Dis* 2018; **24:** 1167–84.

43 Chen M, Shen B. Endoscopic needle-knife stricturotomy for nipple valve stricture of continent ileostomy (with video). *Gastrointest Endosc* 2015; **81:** 1287–88, discussion 1288–89.

44 Chen M, Shen B. Ileoscopic balloon dilation of Crohn's disease strictures via stoma. *Gastrointest Endosc* 2014; **79:** 688–93.

45 Chongthammakun V, Fialho A, Fialho A, Lopez R, Shen B. Correlation of the Rutgeerts score and recurrence of Crohn's disease in patients with end ileostomy. *Gastroenterol Rep (Oxf)* 2017; **5:** 271–76.

46 Shen B, Remzi FH, Lavery IC, Lashner BA, Fazio VW. A proposed classification of ileal pouch disorders and associated complications after restorative proctocolectomy. *Clin Gastroenterol Hepatol* 2008; **6:** 145–58.

47 Sinh P, Shen B. Endoscopic evaluation of surgically altered bowel in patients with inflammatory bowel diseases. *Inflamm Bowel Dis* 2015; **21:** 1459–71.

48 Broder JC, Tkacz JN, Anderson SW, Soto JA, Gupta A. Ileal pouch-anal anastomosis surgery: imaging and intervention for post-operative complications. *Radiographics* 2010; **30:** 221–33.

49 Gorgun E, Remzi FH. Complications of ileoanal pouches. *Clin Colon Rectal Surg* 2004; **17:** 43–55.

50 Elder K, Lopez R, Kiran RP, Remzi FH, Shen B. Endoscopic features associated with ileal pouch failure. *Inflamm Bowel Dis* 2013; **19:** 1202–09.

51 Freeha K, Gao XH, Hull TL, Shen B. Characterization of risk factors for floppy pouch complex in ulcerative colitis. *Int J Colorectal Dis* 2019; **34:** 1061–67.

52 Landisch RM, Knechtges PM, Otterson MF, Ludwig KA, Ridolfi TJ. Pouch volvulus in patients having undergone restorative proctocolectomy for ulcerative colitis: a case series. *Dis Colon Rectum* 2018; **61:** 713–18.

53 Sandborn WJ, Tremaine WJ, Batts KP, Pemberton JH, Phillips SF. Pouchitis after ileal pouch-anal anastomosis: a Pouchitis Disease Activity Index. *Mayo Clin Proc* 1994; **69:** 409–15.

54 Shen B, Achkar JP, Connor JT, et al. Modified pouchitis disease activity index: a simplified approach to the diagnosis of pouchitis. *Dis Colon Rectum* 2003; **46:** 748–53.

55 Silverberg MS, Satsangi J, Ahmad T, et al. Toward an integrated clinical, molecular and serological classification of inflammatory bowel disease: report of a Working Party of the 2005 Montreal World Congress of Gastroenterology. *Can J Gastroenterol* 2005; **19** (suppl A)**:** 5A–36A.

56 Liu G, Ma J, Liu X, Shen B. Clinical implications of noncaseating granulomas on histology in patients with ileal pouches. *Inflamm Bowel Dis* 2015; **21:** 1801–08.

57 Segal JP, Rottoli M, Felwick RK, et al. Biological therapy for the treatment of prepouch ileitis: a retrospective observational study from three centers. *Clin Exp Gastroenterol* 2018; **11:** 461–65.

58 Segal JP, McLaughlin SD, Faiz OD, Hart AL, Clark SK. Incidence and long-term implications of prepouch ileitis: an observational study. *Dis Colon Rectum* 2018; **61:** 472–75.

59 Wu XR, Remzi FH, Liu XL, et al. Disease course and management strategy of pouch neoplasia in patients with underlying inflammatory bowel diseases. *Inflamm Bowel Dis* 2014; **20:** 2073–82.

60 Kariv R, Remzi FH, Lian L, et al. Preoperative colorectal neoplasia increases risk for pouch neoplasia in patients with restorative proctocolectomy. *Gastroenterology* 2010; **139:** 806–12.

61 Derikx LA, Kievit W, Drenth JP, et al. Prior colorectal neoplasia is associated with increased risk of ileoanal pouch neoplasia in patients with inflammatory bowel disease. *Gastroenterology* 2014; **146:** 119–28.

62 Liu ZX, Kiran RP, Bennett AE, Ni RZ, Shen B. Diagnosis and management of dysplasia and cancer of the ileal pouch in patients with underlying inflammatory bowel disease. *Cancer* 2011; **117:** 3081–92.

63 Wu XR, Liu XL, Katz S, Shen B. Pathogenesis, diagnosis, and management of ulcerative proctitis, chronic radiation proctopathy, and diversion proctitis. *Inflamm Bowel Dis* 2015; **21:** 703–15.

64 Winther KV, Bruun E, Federspiel B, Guldberg P, Binder V, Brynskov J. Screening for dysplasia and TP53 mutations in closed rectal stumps of patients with ulcerative colitis or Crohn disease. *Scand J Gastroenterol* 2004; **39:** 232–37.

65 Ten Hove JR, Bogaerts JMK, Bak MTJ, et al. Malignant and nonmalignant complications of the rectal stump in patients with inflammatory bowel disease. *Inflamm Bowel Dis* 2019; **25:** 377–84.

66 Michelassi F, Mege D, Rubin M, Hurst RD. Long-term results of the side-to-side isoperistaltic strictureplasty in Crohn disease: 25-year follow-up and outcomes. *Ann Surg* 2020; **272:** 130–37.

67 Mege D, Michelassi F. Michelassi II strictureplasty for Crohn's disease: a new side-to-side isoperistaltic strictureplasty with discontinuous bowel loops. *Ann Surg* 2020; **271:** e1–2.

68 Uchino M, Ikeuchi H, Matsuoka H, Matsumoto T, Takesue Y, Tomita N. Long-term efficacy of strictureplasty for Crohn's disease. *Surg Today* 2010; **40:** 949–53.

69 Tonelli F, Alemanno G, Bellucci F, Focardi A, Sturiale A, Giudici F. Symptomatic duodenal Crohn's disease: is strictureplasty the right choice? *J Crohn's Colitis* 2013; **7:** 791–96.

70 Worsey MJ, Hull T, Ryland L, Fazio V. Strictureplasty is an effective option in the operative management of duodenal Crohn's disease. *Dis Colon Rectum* 1999; **42:** 596–600.

71 Lightner AL. Duodenal Crohn's disease. *Inflamm Bowel Dis* 2018; **24:** 546–51.

72 Zhang LP, Tabrizian P, Nguyen S, Telem D, Divino C. Laparoscopic gastrojejunostomy for the treatment of gastric outlet obstruction. *JSLS* 2011; **15:** 169–73.

73 Mansari OE, Parc Y, Lamy P, Parc R, Tiret E, Beaugerie L. Adenocarcinoma complicating Crohn's disease of the duodenum. *Eur J Gastroenterol Hepatol* 2001; **13:** 1259–60.

74 Tonelli F, Bargellini T, Leo F, Nesi G. Duodenal adenocarcinoma arising at the strictureplasty site in a patient with Crohn's disease: report of a case. *Int J Colorectal Dis* 2009; **24:** 475–77.

75 Shashi P, Kochhar G, Shen B. Endoscopic therapy of colorectal anastomotic hematoma with hypertonic dextrose. *Gastroenterol Rep (Oxf)* 2018; **7:** 455–58.

76 Kochhar GS, Shen B. Use of over-the-scope-clip system to treat ileocolonic transverse staple line leak in patients with Crohn's disease. *Inflamm Bowel Dis* 2018; **24:** 666–67.