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82.1 Introduction

Inflammatory bowel disease (IBD) constitutes a group of chronic immune diseases affecting the gastrointestinal (GI) tract, most commonly presenting as Crohn's disease and ulcerative colitis.

The prevalence of inflammatory bowel disease has increased over the last decades and is now of 84.3 per 100,000, with the highest prevalence reported in the United States of America and in the United Kingdom [1].

Inflammatory bowel disease has an important impact on society and quality of life, as it bears an age-standardized disability-adjusted life-years of 23.2 per 100,000 individuals [1]. Its etiology appears multifactorial, including genetic predisposition, intestinal microbiota, and environmental factors [2–10].

Crohn's disease is a chronic inflammatory bowel disease which causes focal and skipped transmural inflammation of the entire gastrointestinal tract, ultimately leading to perforation and fistulizing disease, with around half of patients having typical granulomas on biopsies [11].

Ulcerative colitis affects the large bowel mucosa in continuity from the rectum, characterized by relapses, and remissions, and without granulomas found on biopsies [12].

In approximately 10% of patients, it is not possible to distinguish between Crohn's and ulcerative colitis. These patients are considered to have IBD-unclassified colitis [11].

Learning Goals

- To review the basic knowledge regarding management of patients suffering from inflammatory bowel disease (IBD).
- To adequately diagnose and manage complications related to inflammatory bowel disease in the emergency setting.
- To know the indications for emergency surgery in patients with inflammatory bowel disease.
- To perform optimal surgical treatment in patients with inflammatory bowel disease who require emergency surgery.

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82.2 Diagnosis

82.2.1 Clinical Presentation

Chronic diarrhea associated with weight loss is a typical symptom of inflammatory bowel disease. Abdominal pain, anorexia and fever are

common in Crohn's disease, which can also manifest itself with fistulizing and perianal symptoms. Patients with ulcerative colitis usually present with diarrhea, urgency, tenesmus, and lower gastrointestinal bleeding. If the symptoms of inflammatory bowel disease are long-lasting, poor nutrition or growth retardation in children can be evident.

One-fifth of patients have extra-intestinal manifestations, such as arthropathy, erythema nodosum, pyoderma gangrenosum, primary sclerosing cholangitis or inflammation of the different compartments of the eye.

82.2.2 Diagnostic Management

For a first presentation or a suspicion of flare of inflammatory bowel disease, blood tests should include hemoglobin, hematocrit, inflammatory markers such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), electrolytes, renal and liver function tests, albumin, vitamin B12, folic acid, and ferritin. Fecal calprotectin should be obtained and feces should be screened for infection, including *Clostridium difficile*. Serologic panels can be performed to help in the diagnosis, but the evidence supporting their use is of low quality [13].

Where Crohn's disease is suspected, ileocolonoscopy should be performed to assess the extent of the disease and obtain biopsies. Gastroscopy can be obtained if upper gastrointestinal involvement is suspected. Imaging can include computed tomography (CT), magnetic resonance imaging (MRI) enterography or video-capsule [14]. Diagnosis is usually based on a combination of clinical, radiological, endoscopic, and histologic elements [15]. The phenotype of Crohn's disease, which describes the areas of the gastrointestinal tract involved and the disease behavior (non-stricturing and non-penetrating, stricturing, penetrating, perianal) can be classified according to the Vienna score or the Montreal classification system [12]. Crohn's disease activity can be quantified according to an important number of clinical and/or endoscopic severity scores [16]. The most commonly used is the Crohn's disease activity index (CDAI).

In case of suspicion of ulcerative colitis, an initial flexible sigmoidoscopy can be obtained during the acute phase, but a full ileocolonoscopy should be performed within 1 year of diagnosis [11]. Rectal sparing can be observed in less than 5% of patients, and backwash ileitis in around 20%. The proximal extent of inflammation can also be demonstrated by CT scan.

Ulcerative colitis phenotype is usually classified according to the Montreal classification system [12]. The extent of the inflammation influences the risk of future colectomy [17]. Disease activity is preferentially quantified by the Truelove and Whitts score, by the Ulcerative Colitis Endoscopic Index of Severity (UCEIS) and by the modified Mayo scores [18].

82.3 Treatment

82.3.1 Medical Treatment

The main objective of medical treatment for inflammatory bowel disease is to obtain and maintain remission.

Treatment for patients with Crohn's disease should include smoking cessation and correction of nutritional deficiencies supervised by a dietician and intestinal failure team where indicated. Remission is usually obtained with oral corticosteroids or, if the disease is limited to the ileocecum, using oral budesonide. Exclusive enteral nutrition using polymeric, elemental, or semi-elemental feeds can serve as an alternative or as an adjunct in motivated patients. In case of moderate-to-severe episodes, treatment relies on intravenous steroids or, as a second line, immunotherapy. Once remission is obtained, thiopurines are usually used for maintenance. In case of failure, immunotherapy (e.g., anti-tumor necrosis factor-alpha [TNF-alpha] therapy) can be used in association with thiopurine [11, 19].

In Crohn's disease, elective surgery is most commonly indicated in patients suffering from complications not responding to medical treatment, such as chronic obstructive symptoms due to stricturing disease, symptomatic intra-abdominal fistula (Figs. 82.1 and 82.2), entero-cutaneous

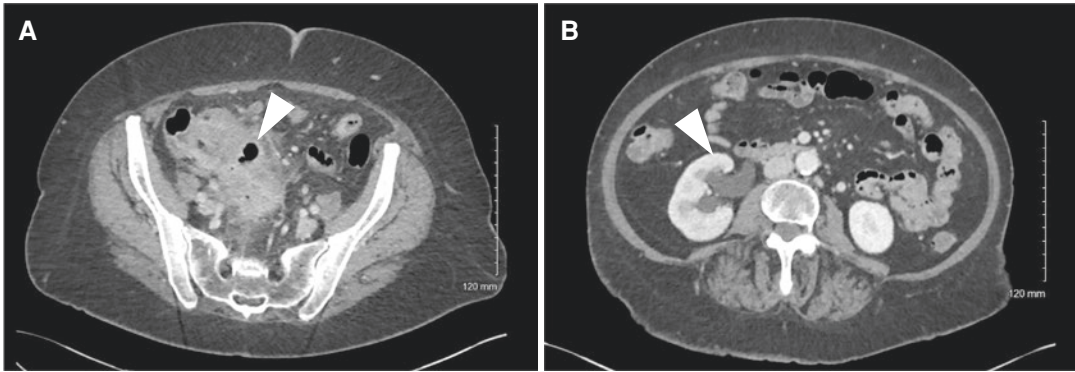


Fig. 82.1 A 60-year-old female patient, known for Crohn's disease with poor response to immunotherapy, who presented to the emergency department with an acute abdomen and raised inflammatory markers. Computed tomography showed an inflammatory mass in the right iliac fossa (**a**, arrow) with multiple entero-enteric fistulae. There was no collection amenable to drainage. In addition,

computed tomography showed a moderate right hydro-ureteronephrosis (**b**, arrow) due to involvement of the right ureter in this inflammatory process and a non-occlusive left common femoral vein thrombus. The patient initially underwent a defunctioning loop ileostomy and ureteric JJ stent, with definitive surgery to be planned subsequently on an elective basis

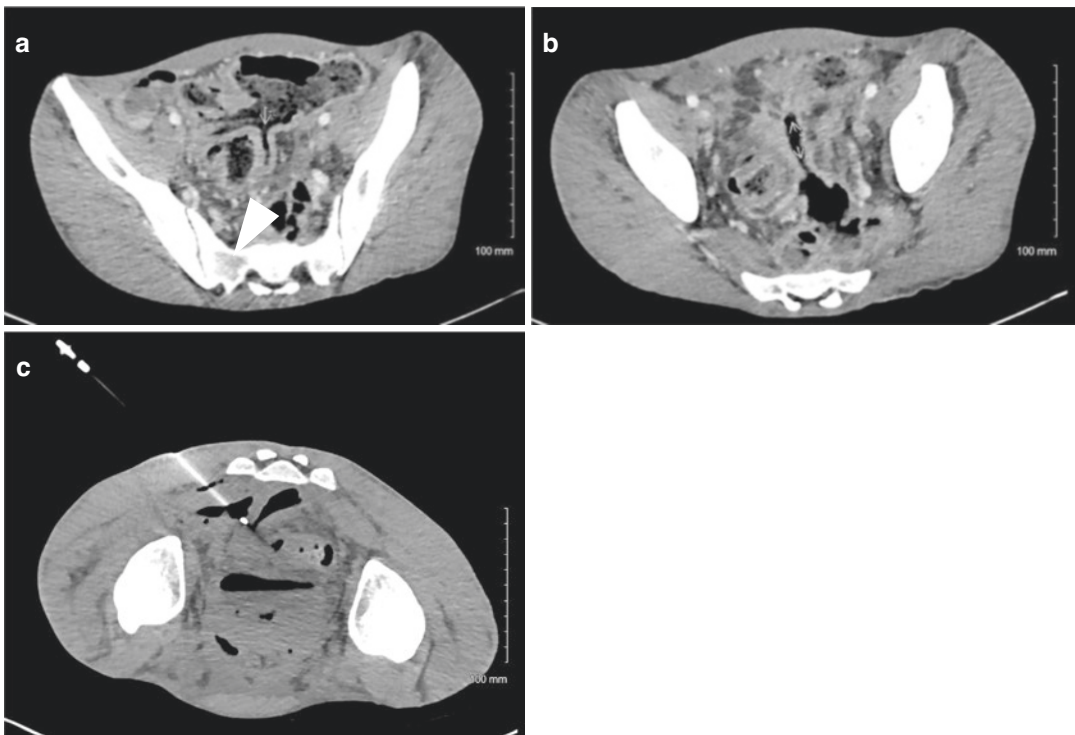


Fig. 82.2 A 24-year-old male patient, known for Crohn's disease but with poor medical compliance, who presented to the emergency department because of lower abdominal pain and cloudy urine. Computed tomography found an extended pre-sacral collection with a large fistula tract (**a**, **b**, small arrows) arising from the distal sigmoid colon and

extending toward the bladder (colovesical fistula) and towards the pre-sacral space. A computed tomography drainage of the posterior collection was performed (**c**), antibiotics were given and the patient underwent an initial defunctioning loop ileostomy with definitive surgery to be planned subsequently on an elective basis

fistula, and perianal disease. Elective surgery in these patients requires careful surgical planning with particular attention to nutrition and medication management.

Patients with ulcerative colitis are usually treated with oral and topical 5-ASA therapy. Oral corticoids constitute the second line of treatment for moderate-to-severe episodes. In case of recurrence requiring repeated administrations of corticoids, or of cortico-dependence, escalation can be performed using thiopurines or immunotherapy [11, 20].

Patients with ulcerative colitis should be considered for elective surgery if they experience persistent symptoms despite maximal medical management, if they cannot tolerate the medical treatment, or if they present with dysplasia, non-endoscopically resectable sporadic adenomas or colorectal cancer [21]. The initial surgical treatment for failure of medical therapy is subtotal colectomy and ileostomy, with subsequent discussions around the role and timing of completion proctectomy, with or without restoration of intestinal continuity (most commonly in the form of an ileoanal pouch).

82.3.2 Indications for Emergency Surgery

General surgeons providing emergency care encounter a significant number of patients with inflammatory bowel disease during their clinical practice. Patients with Crohn's disease and ulcerative colitis are exposed to several complications that require hospital admission and emergency life-saving surgery (Tables 82.1 and 82.2).

Patients with Crohn's disease have an annual incidence of hospitalization of 20% [22]. More than half of patients with Crohn's disease will experience bowel resection after 10 years of follow-up [23].

Emergency surgery represents 3.8% of admissions for ulcerative colitis [24]. The risk of having a colectomy is approximately 8%, 10% and 15% after 5, 10, and 20 years of follow-up [25].

Table 82.1 Indications for emergency surgery in ulcerative colitis

Life-threatening emergencies
• Massive colorectal hemorrhage
• Toxic megacolon
• Colonic perforation
Delayed emergency
• Severe acute colitis refractory to medical treatment

Table 82.2 Indications for emergency surgery in Crohn's disease

Life-threatening emergencies
• Massive colorectal hemorrhage
• Toxic megacolon
• Gastrointestinal tract perforation
Delayed emergency
• Penetrating disease refractory to non-surgical management
• Obstruction refractory to non-surgical management

Table 82.3 Definition of severe acute ulcerative colitis

≥6 bloody stools per day	
At least one of the following:	Fever >37.8 °C
	Heart rate >90 beats/min
	Erythrocyte sedimentation rate (ESR) >30 mm/h
	Hemoglobin <105 g/L

82.3.2.1 Acute Severe Colitis

Severe ulcerative colitis, previously known as fulminant colitis, is usually associated with ulcerative colitis and defined by the Truelove and Witts classification as more than 6 bloody stools per day associated with at least one systematic sign of toxicity (Table 82.3) [26].

Management includes insertion of at least one intravenous cannula, administration of intravenous fluids, complete bloods comprising full blood count, CRP, electrolytes, renal function, and lactate. Polymerase chain reaction (PCR) of the stools should eliminate any infectious cause (notably *Clostridium difficile*) to the clinical presentation, and a CT can confirm the extent of inflammation of the colon and the absence of complications (toxic megacolon, perforation) is indicated. Flexible sigmoidoscopy confirms the diagnosis with histology aid-

ing this process, as well as excluding cytomegalovirus (CMV) colitis [18]. A gastroenterology team should be principally involved in care with regular multidisciplinary review with the surgical team.

First-line treatment consists of intravenous corticosteroids and second-line with cyclosporin or anti-TNF- α therapy [18, 21]. If no improvement is observed within several days of joint medical and surgical care, stoma nurses should be asked to counsel the patient and if the patient deteriorates further, surgery should be performed (subtotal colectomy with end ileostomy).

Patients with Crohn's disease can present with an episode of severe acute colitis which is indistinguishable from that of ulcerative colitis. Its management is initially the same as previously outlined for ulcerative colitis, although second-line therapy tends to favor anti-TNF- α therapy [27].

82.3.2.2 Toxic Megacolon

Toxic megacolon refers to the acute dilatation of the colon due to dysfunction of the autonomic nervous system in the context of an acute segmental or total colitis. Toxic megacolon, also sometimes named toxic colitis (in the absence of pathologic dilatation of the colon), is by definition associated with signs of systematic inflammation and/or sepsis (Table 82.3).

Toxic megacolon was first described by Marshak and Lester in 1950 as a complication of ulcerative colitis [28]. Since then, several etiologies of toxic megacolon have been reported, including inflammatory bowel disease, infectious colitis due to *Clostridium difficile*, *Salmonella* spp., *Shigella* spp., *Campylobacter* spp., *Escherichia coli* spp., *Entamoeba* spp., *Aspergillus*, or CMV in immunosuppressed patients [29–31]. Inflammatory bowel disease represents about half of the etiologies of toxic megacolon [32].

Pathogenic mechanisms leading to toxic megacolon probably involve significant mucosal inflammation, leading to the release of inflammatory mediators and nitric oxide, as well as transmural inflammation with direct injury to the smooth muscle layer and the myenteric plexus.

Progress to toxic megacolon can be worsened by rapid withdrawal of immunomodulators in the context of inflammatory bowel disease, electrolyte disturbances, and medications slowing bowel motility.

Patients with toxic megacolon usually complain of diarrhea, malaise, abdominal pain, and abdominal distension. Many have signs of hemodynamic instability, such as tachycardia and hypotension [33].

Initial management of patients with suspected toxic megacolon should include insertion of two large gauge venous cannulae, volume resuscitation using crystalloids (as these patients are by definition hypovolemic), insertion of a nasogastric tube, insertion of a urinary catheter, analgesia, and empirical broad-spectrum antibiotics according to local guidelines. Vital signs and urine output should be carefully monitored. Blood tests should look for inflammatory markers, electrolyte disturbance, and signs of organ failure. They should include full blood count, prothrombin time, electrolytes, renal function, liver function, and lactate. Arterial blood gas and insertion of an arterial line can be useful adjuncts. Fluid resuscitation should be undertaken to correct any defects and stabilize the patient [34].

If the patient remains unstable, an initial abdominal X-ray should be performed to look for colonic dilatation and potential free air suggestive of perforation. If found, the patient should be directed to surgery.

If the patient is hemodynamically stable, a CT scan with intravenous contrast is the modality of choice as it allows to confirm the extent of dilatation, to look for evidence of perforation and also to rule out any alternative diagnosis. Administration of rectal contrast or endoscopy should be avoided due to the risk of perforation. In patients who remain stable, a trial of medical therapy should be considered. Medical management of toxic megacolon was initially shown to avoid surgery in half of patients, but improved over the last decade so nowadays only 11.5–21.6% of patients require emergency surgery [35, 36].

Stool samples should be taken to exclude *Clostridium difficile* infection and other patho-

gens reported to be causative pathogens for toxic megacolon. Then, the patient should be directed to an intensive care unit or intermediate care unit for monitoring of vital signs. Total parenteral nutrition should be started, and medications slowing down bowel movement should be avoided. Some authors recommend to roll the patient to redistribute the intestinal gas, but the evidence supporting this maneuver is of low quality and thus it is not generally recommended [37]. If the episode of toxic megacolon is related to inflammatory bowel disease, intravenous steroids should be administered, according to the local gastroenterology team preference. Serial abdominal X-ray should be obtained to monitor colonic dilatation and surgical review arranged. In case of failure of steroid therapy after 2–3 days, anti-TNF- α therapy should be started. Cyclosporine might constitute an alternative in patients with known ulcerative colitis.

Absolute indications for surgery are perforation, intraluminal colonic hemorrhage and septic shock. Progression of colonic dilatation on serial abdominal X-ray during second-line therapy, or failure of medical treatment using anti-TNF therapy should also prompt surgical intervention.

Surgery consists of subtotal colectomy with end ileostomy for both ulcerative colitis and Crohn's disease, removing the diseased colon which is the source of inflammatory mediators and bacterial translocation. In general, no attempt should be made to remove the rectum in the emergency setting. In very selected cases where the patient is not fit for major abdominal surgery, colonic decompression using ultrasound (US)- or CT-guided cecostomy or loop transverse colostomy can be considered as an alternative treatment [32].

Mortality rate is estimated to range between 7.9% and 16% [32, 35] but can rise as high as 44% in case of perforation [38].

82.3.2.3 Bowel Obstruction

Bowel obstruction is more common in patients suffering from Crohn's disease than in those with ulcerative colitis [39]. Intestinal obstruction due to Crohn's disease may either be the consequence

of active inflammation or the consequence of fibrotic stricture of the bowel lumen due to chronic inflammation, and can occur anywhere in the gastrointestinal tract. Areas of previous anastomosis are at increased risk. Approximately half of patients with Crohn's disease will experience bowel obstruction after 10 years of follow-up [23, 40], and adhesions from previous abdominal surgery can also be a cause of obstruction in some patients.

Bowel obstruction is less common in ulcerative colitis and represents 5% of admissions in these patients [41]. By definition, the area most commonly affected is the colon. An important differential diagnosis is colonic obstruction due to colorectal cancer, which represents one quarter of colonic strictures in patients with ulcerative colitis [41].

Depending on the level of obstruction, patients complain of abdominal pain, nausea and vomiting, abdominal distension, impaired evacuation of flatus and stools.

Management includes insertion of a nasogastric tube to avoid vomiting and broncho-aspiration, insertion of at least one venous cannula, and intravenous fluids to compensate for the lack of reabsorption due to the obstruction. Blood tests should include full blood count, CRP, electrolytes, renal, and liver function and lactate to check for tissue hypoperfusion. We do not recommend initial abdominal X-ray as it does not give a detailed anatomical picture of the bowel obstruction, does not allow assessment of bowel perfusion and also does not look for the cause of obstruction. Abdominal CT scan with intravenous contrast is the gold standard to look for the level of obstruction, to exclude complications such as perforation, to assess bowel perfusion and to rule out any alternative diagnosis. Of note, the CT images should be carefully analyzed to look for colorectal cancer that may change the therapeutic strategy.

In a patient with fever, if the bowel distension is significant (to avoid bacterial translocation), if the bowel wall is thickened on CT or in case of elevated inflammatory parameters, broad-spectrum antibiotics covering the gastrointestinal flora should be added.

Prolonged abdominal pain, clinical signs of peritonitis, hypoperfusion of the bowel on CT, or evidence for bowel perforation should prompt for emergency surgery. Colonic dilatation >6 cm, the absence of a transition point and signs of systematic inflammation should orientate towards toxic megacolon.

Small bowel obstruction is much more common in patients with Crohn's disease. In these patients, initial conservative management should be favored [42]. This is of importance to avoid multiple and repeated bowel resections that could lead to short bowel syndrome (defined as a bowel length <100 cm [43]). Initial CT scan of the abdomen is important to aid in the diagnosis, cause, and level of obstruction, to guide whether the stricture(s) is fibrotic or inflammatory in nature (if present) and to look for any evidence of fistula/collection. Conservative management consists of bowel rest, aspiration on the nasogastric tube, correction of electrolytes disorders and avoidance of medications slowing down bowel motility. Intravenous fluids should be continued, but should be switched to parenteral nutrition as soon as is feasible. If adhesions are a suggested cause of obstruction, gastrografin should be administered through the nasogastric tube, which is then clamped for 2 h. An abdominal X-ray is obtained after 4–6 h to check if the contrast product has reached the colon. Further, this procedure may be therapeutic through an osmolar effect and lead to bowel opening. Bowel obstruction in patients with Crohn's disease might also be related or be caused by a flare of the disease. Therefore, if the stenotic area appears inflamed on CT and suggests a flare, the gastroenterology team should be involved and consider changes to medical therapy.

In case of failure of conservative management, the strategy will mostly depend on the level and the extent of obstruction. If the stenosis is localized in an area accessible to endoscopy, either enteroscopy or colonoscopy can be considered [44, 45]. Careful balloon dilatation of the stenotic area can be performed, keeping in mind that these procedures might lead to perforation and prompt for surgery. Placement of a stent, even resorbable, is not recommended. If the ste-

nosis is not accessible to balloon dilatation, either due to its localization or its extent, careful surgical planning should be undertaken.

If emergency surgery is required, the treatment of choice is resection of the stenotic small bowel segment, removing the inflamed area with minimal margins. In cases where the stenotic segment is the terminal ileum, as it is often the case, an ileocecal resection should be performed. If the nutritional status allows and there is absence of sepsis and steroids, a wide side-to-side anastomosis is most commonly performed, although there is no particular benefit over an end-to-end anastomosis. If the patient is cachectic or at high risk for anastomotic leak, resection with formation of a double barrel stoma is preferred, allowing to close the stoma later without entering the abdominal cavity, although an end ileostomy with potential mucous fistula can be considered too and often leads to a stoma that is more easily managed. If the stricturing disease affects several bowel loops (skip lesions), resection of these loops might expose the patient to short bowel syndrome, and strictureplasty should therefore be favored if strictures are fibrotic and short (generally than 10 cm for a Heineke-Mikulicz strictureplasty [42, 44, 46]). A relative contraindication to strictureplasty is the presence of active Crohn's disease. Controlling the inflammation, if present, and involving the gastroenterology team is therefore of paramount importance. Whatever the surgical procedure, remaining bowel length should be precisely measured and reported in the operative note. If possible, a drawing should be made, depicting the resections and anastomoses/stomas.

In case the patient is hemodynamically unstable, and might benefit from an anastomosis instead of a stoma after hemodynamic stabilization (for example if the affected segment is close to the duodeno-jejunal flexure and creating a stoma might lead to high-output stoma), damage control surgery is possible, leaving the divided stapled bowel ends in the open abdomen equipped with a vacuum assisted closure (VAC) system, and performing the anastomosis during a second look surgery after 48–72 h when the hemodynamic status and bowel perfusion are improved.

For patients with ulcerative colitis presenting with large bowel obstruction due to a colonic stricture, subtotal colectomy and creation of an end ileostomy are the procedure of choice, although a bridge to surgery with a colonic stent may be considered if there is no evidence of active colitis and the stricture is malignant.

82.3.2.4 Gastrointestinal Hemorrhage

The first case of gastrointestinal hemorrhage related to a regional enteritis was reported in 1941 [47].

In ulcerative colitis, bloody diarrhea is a cardinal symptom of the disease. Bleeding is usually diffuse and caused by multiple ulcerations of the colonic and rectal mucosa. In Crohn's disease, hemorrhage can occur anywhere in the gastrointestinal tract as the consequence of transmural inflammation and direct injury to a vessel [48].

There is no strict definition that allows to distinguish between a low intensity bleed due to a flare of ulcerative colitis, for example, and a life-threatening hemorrhage. Therefore, clinical assessment should prevail and any drop in hemoglobin associated with active gastrointestinal bleeding or hemodynamic instability should be considered as an inflammatory bowel disease life-threatening hemorrhage and promptly addressed.

The incidence of severe hemorrhage varies, but represents approximately 0.1% of admissions for ulcerative colitis and 1.2% of admissions for Crohn's disease. It represents up to 10% of urgent colectomies for patients with ulcerative colitis [49].

Initial management includes insertion of two large gauge venous cannulae, a urinary catheter, and volume resuscitation including blood products. If hematemesis is suggested, a nasogastric tube should be inserted. Vital signs and urine output should be carefully monitored. Blood tests should look for hemoglobin concentration, hematocrit, prothrombin time, and platelets. Further, electrolytes, renal function, liver function, and lactate should also be determined. A quick way to obtain the hemoglobin concentration is to perform arterial or venous blood gas

determination. In case of hemodynamic instability, insertion of an arterial line can be a useful adjunct [34].

Transfusion with red blood cells, platelets, and plasma should be performed as required. Considering that these patients are most often malnourished, and associated liver disease might be present, correction of coagulation factors should be considered.

In both ulcerative colitis and Crohn's disease, hemorrhage occurs most often in the lower GI tract and is associated with inflammation [49]. Even in Crohn's disease, the upper gastrointestinal tract is rarely involved [48].

A CT scan with arterial phase (CT angiography) should be the imaging of choice and quickly obtained to localize the source of the bleeding. If an active arterial bleed is identified, the patient should be directed immediately to interventional radiology for angiography and selective embolization of the causative vessel [50, 51]. After successful embolization, the patient should be monitored in an intensive care unit or intermediate care unit for 48 h to ensure there is no rebleeding and look for potential complications of embolization, such as bowel ischemic necrosis and perforation. If ischemia is a consideration, a further CT scan or a diagnostic laparoscopy and simultaneous sigmoidoscopy/colonoscopy can be performed. Peroperative fluorescence angiography can be used in case of doubt to identify ischemic areas.

If the source of bleeding is not identified, as is the case in two-thirds of patients [50], usual rules of management of gastrointestinal bleeding should be applied.

If an upper gastrointestinal hemorrhage is suspected (above the duodeno-jejunal junction), gastroscopy is the modality of choice. In case of lower gastrointestinal hemorrhage (below the duodeno-jejunal junction), the patient should undergo colonoscopy. In patients with ulcerative colitis and colonic bleeding, complete hemostasis using clips at different sites has been reported [52, 53]. However, when the inflammation is severe, full colonoscopy is not recommended in patients with ulcerative colitis due to the risk of perforation but flexible sigmoidoscopy should be

performed to confirm the diagnosis and be sure there is no significant source of bleeding in the rectum.

In patients with ulcerative colitis, failure to control the hemorrhage with non-surgical techniques should prompt for subtotal colectomy, which often constitutes the only efficient treatment especially since bleeding is usually diffuse [54]. Bleeding from the rectum after subtotal colectomy can be controlled by adding local hemostatic products, preferentially leaving a rectal catheter in place to monitor the volume of bleeding which can accumulate in the rectal stump without being noticed. In the rare case where the rectal stump is the source of significant bleeding, proctectomy might be necessary.

In patients with Crohn's disease, medical management can aim at reducing the causative inflammation and controlling the disease, but has a failure rate of approximately 40% [48, 55, 56]. In addition, emergency video capsule endoscopy can be performed. If the bleeding cannot be controlled and has an identified source, surgical treatment can be performed, keeping in mind that surgery might be difficult in these patients and expose them to the risk of short gut syndrome. Surgery is, however, the fate of around one third of patients with Crohn's disease presenting with significant bleeding [55].

82.3.2.5 Penetrating Crohn's Disease

A significant proportion of patients with Crohn's disease will develop penetrating disease, characterized as inflammatory transmural ulceration communicating with adjacent organs or the skin (fistula) [57]. After 10 years of follow-up, approximately a third will also have perianal disease, and a quarter will have internal fistulae [23].

Perianal Disease

Crohn's disease was first reported in 1938 based on the description of a perianal fistula [58]. Perianal disease is a very common finding in patients with Crohn's disease and will be encountered on many occasions by emergency general surgeons.

Perianal Crohn's disease leads to chronic inflammatory changes in the perianal region

leading to perianal fistulae, abscesses, ulceration, fissures, skin tags, and stenosis [59]. Anal incontinence can also be reported.

History of the disease should be carefully taken, and attention should be given to disease activity and signs of sepsis. The activity can be measured by the Perianal Disease Activity Index (PDAI). Blood tests should at least include inflammatory markers. Clinical examination should look for any discharge or mass suggesting an abscess. If the patient is stable and there is no suspicion of sepsis requiring emergency surgery, MRI of the perineum constitutes an excellent imaging technique to guide more elective surgical decision making. In the emergency setting, examination under general anesthesia, often in lithotomy position, should be performed, looking also for any sign of proctitis that would mandate discussing appropriate medical treatment. Any abscess should be drained, and any very obvious fistula should be treated with a loose, draining, low-profile seton. However, if no very obvious fistula is found, forced cannulation of blind orifices should not be attempted due to the significant risk of creating an iatrogenic fistula, and abscess drainage alone should be performed.

Antibiotics should be added in case of localized cellulitis, but no evidence supports their use in the long-term for fistula closure [60]. When the sepsis is addressed, thiopurine and biologic therapy should be introduced by the gastroenterology team before reassessment with endoscopy after 3 months, and definitive treatment if needed [61].

If the perianal disease is very extensive, diverting stoma constitutes an option to improve quality of life and decrease local sepsis, but is rarely indicated in the emergency setting [42].

Intra-abdominal Fistula, Abscess, and Perforation

Fistulizing Crohn's disease can manifest itself by gastrointestinal perforation leading to abscess or peritonitis. An important cohort study showed that 11.4% of patients with Crohn's disease experienced an intra-abdominal abscess and 6.5% a disseminated intra-abdominal perforation [62].

Septic Crohn's patients with suspected penetrating complication should initially be managed

with insertion of two large bore venous catheters, volume resuscitation, and delivery of broad-spectrum antibiotics. Vital signs and urine output should be monitored. Blood tests should include full blood count, prothrombin time, CRP, electrolytes, renal function, liver function and lactate. In case of hemodynamic instability, arterial blood gas and insertion of an arterial line are useful adjuncts. A CT scan should be performed, with intravenous contrast if the renal function allows for it. The objective is to identify the source of sepsis and to look for an associated intra-abdominal abscess or fistula.

The main objective is to control the sepsis with non-surgical measures if feasible [42]. Intra-abdominal abscesses should be drained using US- or CT-guided percutaneous drainage. Samples should be sent for microbiological analysis as antibiotic resistance is frequent in these patients who have often been hospitalized. Of note, it was shown that percutaneous drainage led to lower rate of stoma creation, fewer complications, and shorter hospital stay when compared to emergency surgery [63]. The patient may benefit from initial parenteral nutrition and a repeat CT should be performed after a week or so to assess treatment response.

If the abscess is not accessible to drainage, antibiotics alone, and associated parenteral nutrition can constitute an option but have a higher rate of failure.

In case of failure of medical management, surgical exploration should be performed [42], preceded by nutritional optimization and careful surgical planning (unless the patient has a free perforation and signs of peritonitis, whereby emergency surgery will be needed without time for significant optimization). In this setting, surgical exploration is most commonly performed as an open procedure, although laparoscopy may be feasible in appropriately trained teams, with abscess drainage and abdominal lavage, resection of the perforated segment of bowel and stoma formation, although defunctioning stoma proximal to the pathology may also be considered in selected cases. If a stoma is performed after resection, exteriorization of the two ends is preferable, as it allows to perform stoma closure

Table 82.4 Definition of toxic megacolon

Radiographic evidence of colonic distension	>6 cm
At least three of the following:	Fever >38 °C
	Heart rate >120 beats/min
	Leukocytosis >10,500/ μ L
	Anemia
At least one of the following:	Dehydration
	Altered sensorium
	Electrolyte disturbances
	Hypotension

Table 82.5 Management of entero-cutaneous fistula

S	Sepsis and skin
N	Nutrition
A	Anatomy
P	Procedure

through a local access after a minimum of 6 months.

Enterocutaneous Fistula

Entero-cutaneous fistulas are feared complications of Crohn's disease, as they expose the patient to severe complications [64]. The management of enterocutaneous fistula can be summarized by the acronym SNAP (Table 82.4) [64, 65]. Briefly, priority should be given to address the sepsis and to protect the skin. This step also includes volume resuscitation and correcting the complications induced by the fistula output. This requires the emergency general surgery team to pay attention to these details. Afterwards, adequate nutritional support should be provided, the fistula anatomy should be defined using appropriate imaging and the definitive surgical procedure should be planned. Principles of management of entero-cutaneous fistula are summarized in Table 82.5.

History taking should look for history of disease, previous interventions, history of the fistula and stoma output. Entero-cutaneous fistulas are classified as high-output if the volume of output is >500 mL/day [66]. Clinical examination should describe the external anatomy of the fistula and look for skin damage. Blood tests should include inflammatory markers, electrolytes, renal and liver function tests as well as trace elements.

Further, detailed nutritional screening can be performed to facilitate future involvement of an intestinal failure team [65]. A CT scan can be obtained as a first step to evaluate the gastrointestinal tract anatomy and exclude eventual intra-abdominal abscess or other complications of Crohn's disease. Administration of oral and/or rectal contrast might be useful adjuncts. At least one peripheral large bore venous catheter should be inserted, which can be later changed for a peripherally inserted central catheter (PICC) for parenteral nutritional support. Intravenous fluids can be administered to compensate for fistula output, and correct eventual electrolytes and renal function disorders. The skin around the fistula should be adequately protected and a specialized stoma nurse team should be actively involved.

Fistula output mainly depends on the level of the fistula in the gastrointestinal tract. The output can be reduced by hypotonic fluid oral restriction, administration of oral rehydration solution, proton pump inhibitor (PPI), loperamide, codeine, and occasionally somatostatin analogues [67]. Some centers also advocate the consumption of dry water-absorbing biscuits or the administration of GLP-2 analogues [68].

As a second step, the anatomy of the entero-cutaneous fistula can be determined using MRI entero- or fistulography. Once any eventual accompanying sepsis is addressed, anti-TNF-alpha therapy can be considered with some success reported in entero-cutaneous fistula closure [64, 69]. Surgery usually constitutes the definitive treatment.

82.3.2.6 Appendicitis in Patients with Inflammatory Bowel Disease

Some patients with inflammatory bowel disease might present with typical symptoms for appendicitis. History taking should be detailed and investigate whether the patient has a flare or not. In addition, an abdominal CT scan should be performed to provide a complete picture of the gastrointestinal tract and areas of potential inflammation.

In case of inflammation of the lower gastrointestinal tract outside the appendix, the episode

should be considered as a flare of inflammatory bowel disease and treated as such. If the radiological findings confirm uncomplicated acute appendicitis, treatment can be conservative with broad-spectrum antibiotics and close follow-up. In case of clinical or biological deterioration or radiological evidence of complicated appendicitis and/or the presence of an appendicolith(s), laparoscopic appendectomy should be performed and consideration given to stapling the appendix base across an area of non-inflamed cecal pole.

Moreover, there has been long-lasting controversy about the role of appendectomy in protecting against flares of ulcerative colitis. The evidence is not strong enough to conclude [70, 71], and the results of the ACCURE trial are awaited [72].

82.3.3 Basic Principles of Emergency Surgery for Inflammatory Bowel Disease

82.3.3.1 Principles of Emergency Surgery for Crohn's Disease

In patients with Crohn's disease, emergency surgery should constitute the final therapeutic option after failure of conservative management or as a life-saving procedure. Indeed, these patients are at risk of repeated operations during the course of their life, which may expose them to multiple resections and potential risk of short bowel syndrome. A prospective observational cohort study showed that emergency surgery for Crohn's disease resulted in longer bowel resection and higher rate of stoma formation than elective surgery [73]. Further, chronic malnutrition due to malabsorption associated with chronic transmural inflammation adds to the potential risk of anastomotic leak and fistula.

When surgery is necessary, steroids, if present, should be preferentially weaned off or at least reduced to as minimum a level as safely possible. Although there are some conflicting data, anti-TNF-alpha treatment appears not to increase the risk of infectious complications [27]. However, many surgeons will still prefer to operate following the washout period of the medica-

tion if possible. Careful surgical planning, including CT, MRI enterography, and ileocolonoscopy is advised when possible, although not always feasible in the emergency setting.

Laparoscopy should be favored over laparotomy when possible, but open surgery is preferred if the patient has a history of multiple abdominal operations, if the patient is not hemodynamically stable or in cases of significant bowel distention [27].

If a bowel resection is performed, vascular control of the mesentery can be difficult due to chronic inflammation. Repeated use of electrocautery devices is advised before mesentery division and suture transfixion or vascular stapler is recommended on large-caliber vessels, according to preference.

The decision to perform an anastomosis should be carefully weighed with the risk of anastomotic leak. In patients with hemodynamic instability, poor nutrition, sepsis, or significant collection/abscess and/or steroids, a stoma should be preferred. The risk of anastomotic leak increases with each of these risk factors, and as such decision making needs to be individualized for each patient. If an anastomosis is not performed, a double barrel stoma or, alternatively, a terminal stoma with a mucous fistula of the colonic segment for example, should be preferred as it potentially allows for stoma closure through the stoma site. If an anastomosis is performed, a side-to-side stapled technique is most commonly performed, but the surgeon preference in terms of configuration and material (suture vs. stapled) should be taken into account. If the anastomosis is ileocolic, some advocate an iso-peristaltic configuration, to facilitate future easier colonoscopy intubation.

The length and localization of resected bowel should be reported in detail in the operation note along with accurate measurement of the remaining small bowel length, if possible with a detailed schematic representation of the procedure.

82.3.3.2 Principles of Emergency Surgery for Ulcerative Colitis

Delaying surgery in patients with ulcerative colitis who require emergency surgery is not recom-

mended. A retrospective matched analysis from the American College of Surgeons National Surgical Quality Improvement Program database showed that early surgery (1 day) was associated with a lower mortality rate (4.9% vs. 20.3%, $p < 0.001$) and lower complication rate (64.5% vs. 72.0%, $p = 0.052$) than delayed surgery (6 days). Regression of morbidity on preoperative risk factors demonstrated that early surgery is associated with a 35% decrease in the odds of a complication with delayed surgery ($p = 0.034$) [74]. However, early surgery only represents 20.4% of patients who undergo surgery during an emergency admission [24], leaving room for improvement.

When emergency surgery is needed, subtotal colectomy and end ileostomy with preservation of the rectum is the procedure of choice. The procedure can be preferentially performed by laparoscopy, but laparotomy should be favored in case of hemodynamic instability, life-threatening hemorrhage, and toxic megacolon. In the absence of associated colorectal cancer, it is appropriate to dissect the mesocolon and the mesentery close to the colon, notably at the level of the ileocecal valve, in order to preserve the ileocolic vessels for a potential future ileorectal or ileoanal (pouch) anastomosis, and to retain the inferior mesenteric artery in order to facilitate safe future surgical planes for completion proctectomy. The so-called “rectal stump” should generally be divided in the distal sigmoid colon, leaving options for either a formal mucous fistula (possible at the ileostomy site or in the left iliac fossa) or subcutaneous placement below the midline or Pfannenstiel incision, which might help constitute a directed colocutaneous fistula in case of a leak from the stump (“blow out”). At the completion of the surgical procedure, the rectal stump should be irrigated to remove its content, and a rectal catheter should be considered for 2–3 days to decrease the pressure on the staple line.

In hospital mortality in patients having surgery for acute colitis is as high as 8% in some series, and the 30-day mortality is 5.2% [36].

As a second step, and after a minimum of 3 months when the patient has recovered from the

emergency surgery, the rectal stump can be addressed, with discussions around surveillance and future completion proctectomy with or without restoration of intestinal continuity with an ileoanal pouch. In carefully selected patients, there may be a role for future rectal preservation and ileorectal anastomosis [75].

82.3.3.3 Prevention of Venous Thromboembolism

Prophylaxis against venous thromboembolism is of crucial importance in patients suffering from inflammatory bowel disease. Patients with inflammatory bowel disease have increased risk for venous thromboembolism, which is approximately twice the risk of the general population. Among patients ≤ 20 years, this risk is sixfold the risk of the general population [76]. After surgery for ulcerative colitis, the 30-day incidence of venous thromboembolism is 3.8% [77].

Therefore, the American Association of Gastroenterology recommends thromboprophylaxis in hospitalized patients suffering from inflammatory bowel disease without active bleeding or with active non-severe bleeding, as well as in outpatients with moderate-to-severe active flare and positive history for venous thromboembolism [78]. Extended post-discharge prophylaxis should be standard of care for patients following emergency surgery for IBD, for a minimum of 28 days post-surgery [79].

82.3.3.4 Risk of Colorectal Cancer

Colorectal cancer should always be taken into account in the differential diagnosis when performing decision-making in patients with inflam-

operative planning and nutritional optimization.

- Do not rush decisions around surgery in patients suffering from Crohn's disease who do not have a free perforation, as you will expose these patients to the risk of short bowel syndrome and sepsis. Emergency surgery should constitute the final therapeutic option after failure of conservative management or as a life-saving procedure.
- Do preserve the inferior mesenteric artery when performing subtotal colectomy for ulcerative colitis.
- Do prescribe extended post-discharge prophylaxis against venous thromboembolism for patients who underwent emergency surgery for inflammatory bowel disease.

Take-Home Messages

- Patients suffering from inflammatory bowel disease pose complex problems, often with disease-associated comorbidities, and the potential for significant psychological impact. Their management should be cautious and multidisciplinary. Surgical indication should be discussed in accordance with the gastroenterology team, and wider IBD multidisciplinary team when feasible.
- Indications for emergency surgery in patients with inflammatory bowel disease include severe colitis refractory to medical treatment, gastrointestinal hemorrhage not amenable to or not responding to interventional radiology, toxic megacolon not responding to medical management and non-contained gastrointestinal perforation. In the context of Crohn's disease, penetrating disease refractory to non-surgical management and obstruction refractory to non-surgi-

Dos and Don'ts

- Do involve the gastroenterology team when assessing patients with inflammatory bowel disease.
- Do not perform non-life-saving surgery in patients suffering from inflammatory bowel disease without complete pre-

cal management should be referred to specialized teams when possible.

- Improvement in intensive care medicine and widespread availability of interventional radiology have decreased the need for emergency surgery in patients suffering from toxic megacolon, hemorrhage related to inflammatory bowel disease, and penetrating Crohn's disease. Similarly, balloon dilatation can be considered to manage accessible, short, fibrotic small bowel strictures.
 - Management of penetrating Crohn's disease is mostly conservative and should be focused on controlling the sepsis, nutrition and fluid balance.
 - When performing emergency surgery for Crohn's disease, attention should be given to preserve the small bowel length, and the total length of the bowel remaining should be documented.
 - When performing emergency surgery for inflammatory bowel disease, the patient should always be informed about the risk of extended gastrointestinal resection and of stoma. If possible, the potential stoma site should be marked by a specialized stoma therapist/nurse (but this should not delay the procedure).

Multiple Choice Questions

1. What laboratory exams should be obtained in a patient with a suspected flare of inflammatory bowel disease?
 - A. Inflammatory markers in the blood
 - B. Fecal calprotectin
 - C. Nutritional status
 - D. PCR for *Clostridium difficile*
2. What are the indications for emergency surgery in patients with ulcerative colitis?

Answer: A, B, C and D

- A. Acute severe colitis
- B. Gastrointestinal hemorrhage not responding to medical management
- C. Toxic megacolon
- D. Obstructive colorectal cancer

Answer: B, D

3. What are the indications for emergency surgery in patients with Crohn's disease?
 - A. Perianal abscess
 - B. Entero-cutaneous fistula
 - C. Toxic megacolon not responding to medical management
 - D. Bowel obstruction

Answer: A, C

4. What are the correct propositions regarding the management of severe ulcerative colitis?
 - A. Severe ulcerative colitis is defined as one sign of toxicity associated with the passage of 6 bloody stools per day
 - B. Microbiological examination of the stools should be performed
 - C. Flexible sigmoidoscopy is at high risk of perforation and should not be performed
 - D. Management is always surgical due to the risk of perforation

Answer: A, B

5. What propositions are correct regarding the management of Crohn's perianal disease?
 - A. Antibiotics should be the rule due to the extent of local penetrating disease
 - B. Identification of fistula tract is key for treatment success
 - C. An anoscopy should be performed
 - D. Anti-TNF-alpha treatment leads to perianal abscesses

Answer: C

6. During management of entero-cutaneous fistulas, what does the acronym SNAP stand for?
 - A. Support—Norfloxacin—Anterograde enema—Proctoscopy

- B. Support—Nutrition—Antibiotics—Planning
- C. Sepsis and skin—Nutrition—Anatomy—Planning
- D. Sepsis—Norfloxacin—Anatomy—Proctoscopy

Answer: C

7. What is correct regarding emergency surgery for Crohn's disease?
- A. Emergency surgery and elective surgery for Crohn's disease have the same surgical outcomes
 - B. Steroids should be discontinued within 7 days of surgery
 - C. Anti-TNF-alpha should be stopped at least 3 days before surgery
 - D. For obstructing disease, surgery should be performed as early as possible due to better outcomes

Answer: None of the above

8. What is correct regarding emergency subtotal colectomy for ulcerative colitis?
- A. Surgery should be delayed as much as possible in order to let the medical treatment have an effect
 - B. The ileocolic pedicle should be preserved
 - C. When possible, an anastomosis should be performed
 - D. A proctectomy should be performed to definitely cure the disease

Answer: B

9. Which ones of the following are risk factors for anastomotic leak in Crohn's patients undergoing emergency surgery?
- A. Poor nutritional status
 - B. Presence of an abscess
 - C. High dose steroids
 - D. Smoking

Answer: A, B, C and D

10. In which categories of patients suffering from inflammatory bowel disease

should prophylaxis against thromboembolism be administered?

- A. All patients with active inflammatory bowel disease who are hospitalized
- B. All inpatients and outpatients with inflammatory bowel disease
- C. Inpatients and outpatients who underwent surgery for inflammatory bowel disease within the past month
- D. Inpatients with inflammatory bowel disease-related hemorrhage

Answer: A, C

matory bowel disease. Population-based studies estimated the incidence of colorectal cancer to be of 0.82 per 1000 person-years in Crohn's disease (corresponding to a 1.4-fold more important risk than the reference population) [80], and 1.29 per 1000 person-years in those with ulcerative colitis (corresponding to a 1.7-fold increased risk) [81]. In case a colorectal cancer is found, and surgery performed, the extent of lymphadenectomy should respect oncological standards. Of note, in the case of a subtotal colectomy, oncologic resection should be performed on all parts of the colon due to the risk of synchronous lesions [21].

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