



Surgical treatment of inflammatory bowel disease: From the gastroenterologist's stand-point

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Abstract

Treatment of ulcerative colitis (UC) and Crohn's disease (CD) represents, in the majority of cases, a real challenge to the gastroenterologist's abilities and skills as well as a clinical test concerning his/her levels of medical knowledge and experience. During the last two decades, our pharmaceutical arsenal was significantly strengthened, especially after the introduction of the so-called biological agents, drugs which to a large extent not only improved the results of conservative treatment but also changed the natural history of the disease. However, colectomy is still necessary for some patients with severe UC although smaller compared to the past, precisely because of the improvements achieved in the available conservative treatment. Nevertheless, surgeries to treat colon dysplasia and cancer are increasing to some extent. At the same time, satisfactory improvements in surgical techniques, the pre-and post-operative care of patients, as well as the selection of the appropriate time for performing the surgery have been noticed. Regarding patients with CD, the improvement of conservative treatment did not significantly change the need for surgical treatment since two-thirds of patients need to undergo surgery at some point in the course of their disease. On the other hand, the outcome of the operation has improved through good preoperative care as well as the wide application of more conservative surgical techniques aimed at keeping as much of the bowel *in situ* as possible. This article discusses the indications for surgical management of UC patients from the gastroenterologist's point of view, the results of the emerging new techniques such as transanal surgery and robotics, as well as alternative operations to the classic ileo-anal-pouch anastomosis. The author also discusses the basic principles of surgical management of patients with CD based on the results of the relevant literature. The self-evident is emphasized, that is, to achieve an excellent therapeutic result in patients with severe inflammatory bowel disease in today's era; the close cooperation of gastroenterologists with surgeons, pathologists, imaging, and nutritionists is of paramount impor-

tance.

Key Words: Inflammatory bowel disease; Ulcerative colitis; Crohn's disease; Surgery; Treatment; Ileo-anal-pouch anastomosis; Indications; Techniques

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Core Tip: The main indications for surgery in inflammatory bowel disease concern acute or chronic complications and/or failure of the conservative treatment. Emergency surgery in Crohn's disease (CD) is performed in cases of intestinal obstruction, presence of perineal or intra-abdominal abscesses, and toxic colitis, while in patients with ulcerative colitis (UC) emergency surgery concerns bowel perforation, toxic megacolon, and uncontrolled bleeding. Elective surgery in CD concerns cases of strictures or perianal disease, while in patients with UC elective surgery is applied mainly in cases of patients unresponsive to conservative treatment. To achieve an excellent therapeutic result, the cooperation of a gastroenterologist, surgeon, pathologist, imaging physician, and nutritionist is necessary.

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INTRODUCTION

Treatment of ulcerative colitis (UC) and Crohn's disease (CD) represents a real challenge to the gastroenterologist's abilities and skills as well as a good clinical test concerning his/her levels of medical knowledge and experience. During the last two decades, our pharmaceutical arsenal was significantly strengthened, especially after the introduction of the so-called biological agents, drugs which to a large extent not only improved the results of conservative treatment but also changed the natural history of the disease.

The long-term course and evolution of CD are characterized by relative resistance to treatment, frequent recurrences, and high rates of both initial surgery and reoperations. Surgery is the second part of the treatment available today after the first which corresponds to medical treatment. It is well-argued that a delay in referring a patient for surgery can result in significant postoperative complications and prolonged hospital stay. This means that clinical gastroenterologists should correctly calculate the severity of the disease, as well as the effectiveness of the applied medication to choose the appropriate time when the patient will be taken to the operating room so that the maximum possible benefit could be obtained. Probably in the future, there will be a satisfactory basis for an individualized schedule of surgical intervention based on data related to radiomics, metabolomics, and microbiomics which would become accessible in daily clinical practice.

Regarding UC patients, colectomy is still necessary in some proportion of patients although smaller compared to the past, probably due to the improvements achieved in the available conservative treatment. On the other hand, surgeries to treat colon dysplasia and cancer are increasing to some extent. At the same time, satisfactory improvements in surgical techniques, the pre-and post-operative care of patients, as well as the selection of the appropriate time for performing the surgery have been noticed.

Regarding CD patients, conservative treatment aims at the disappearance of the symptoms of the disease, the healing of the intestinal mucosa, the improvement of the quality of life, and the prevention of complications. Surgery represents the second "hand" of the comprehensive treatment of CD, although the decision to choose the most appropriate time to perform the surgery has been controversial for a long time[1]. However, despite the significant improvements achieved in the conservative treatment of CD, these did not significantly change the need for surgical treatment since two-thirds of patients need to undergo surgery at some point in the course of their disease. The outcome of the operation has improved through good preoperative care as well as the wide application of more conservative surgical techniques aimed at keeping as much of the bowel *in situ* as possible. It should be particularly emphasized that due to the advances in conservative treatment, there is a tendency among gastroenterologists to consider surgical treatment as a last resort and indeed this opinion is also widespread among patients. This has the disadvantage of delaying surgery which may therefore increase the rate and severity of postoperative complications and severe nutritional deficits. Although the decision for surgery instead of conservative treatment is the patient's "prerogative" this will be done under the guidance of the attending physician, except in cases of complications in which surgery is required anyway[2].

The surgical approach to CD should generally be minimally invasive because it is associated with earlier recovery, fewer complications, fewer adhesions and incisions, and preserved body image and fertility. Today, stricturoplasty has replaced segmental small bowel resection, laparoscopic procedures are performed with increasing frequency replacing open surgery, permanent ileostomy is eliminated through restorative procedures, and loss of continence is improved with anal fistula plug application. Single-incision laparoscopic surgery reduces postoperative pain and improves the aesthetic result of surgery. The diseased intestinal segment can be removed from the site of the surgical incision, through a created

stoma, or natural openings (*e.g.*, transvaginal), although the magnitude of the actual benefit of this method has not been adequately determined. In patients with severe perianal disease or rectal involvement, transperitoneal total proctectomy may be feasible with the benefit of avoiding repeat laparotomy. Through transsphincteric resection of the rectum, the risk of damage to the pelvic autonomic nerves is significantly reduced, while the risk of presacral abscess formation is reduced by leaving mesorectal tissue. Minimally invasive surgery and related techniques have become standard clinical practice in the surgical treatment of patients with CD. These developments achieve a reduction in hospital stay, a reduction in morbidity, and an improvement in aesthetic results[3].

This article discusses recent topics on surgical management of UC patients from the gastroenterologist's point of view, results of the emerging new techniques such as transanal surgery and robotics, as well as alternative operations to the classic ileo-anal-pouch anastomosis (IAPA). The article also refers to the basic principles of surgical management of patients with CD based on the results of the current literature. Finally, the self-evident is emphasized, that is, to achieve an optimal therapeutic outcome in patients with severe inflammatory bowel disease (IBD) in today's era. To achieve this close cooperation of gastroenterologists, surgeons, pathologists, radiologists, and nutritionists is of paramount importance.

SURGERY FOR CD

Surgery in CD patients is generally following certain rules, has specific indications, and is performed by experienced surgeons. The cooperation of a gastroenterologist, surgeon, and physicians of other specialties, cooperated by nutritionists-dietitians is required, as the risk of short bowel syndrome lurks behind every surgical manipulation. The gastroenterologist with experience in the diagnosis and treatment of patients with IBD, as well as with deep acquaintance with the current statements concerning IBD contributes significantly for patients to achieve a favorable outcome. Finally, extensive enterectomy is no longer necessary and it can be potentially dangerous. The prevailing trend is not to remove the entire diseased intestine, but only the part responsible for the symptoms that brought the patient to the operating room. Thus the risk of short bowel syndrome due to extensive resection is reduced.

While complicated CD benefits from surgical treatment, uncomplicated disease is a major point of dispute regarding conservative or surgical treatment options. The current treatment of the disease aims to stop the progression of the inflammatory process and to prevent the occurrence of irreversible fibrosis and other tissue damage through two treatment strategies, the step-up and the top-down approach. The gradual introduction of stronger pharmaceutical agents into the treatment of patients has the disadvantage that treatment may be delayed resulting in the creation of permanent damage to the affected part of the bowel. On the contrary, the top-down approach can constitute "over-treatment" as a result of which the patient receives biological agents that he does not need and is thus exposed to potential risks as a consequence of their unnecessary use.

Recently, it has been argued that early surgery could be an appropriate treatment option both in terms of clinical results and treatment costs[4]. In this phase, it is considered that the surgeon should be included in the decision-making process already from a very early stage of the disease. Several studies show that delaying surgery in anticipation of disease improvement with biological agents is responsible for suboptimal management, failure to achieve adequate disease control, and the need for extensive resections resulting in increased complications including malnutrition, abscesses, and fistulas. Data suggest that early surgery does not harm disease progression and may offer some advantages[2]. The main indications for surgery in patients with CD are shown in [Table 1](#).

SURGERY FOR UPPER GASTROINTESTINAL CD

It should be pointed out at the outset that the data regarding the surgical treatment of CD located in the esophagus, stomach, or duodenum are quite few. The frequency of the involvement of the upper gastrointestinal tract fluctuates according to various studies from 17%-75% [5]. Esophageal involvement is around 2%. Surgery is rarely required for CD located in the esophagus. Usually, endoscopic dilation or segmental resection helps effectively. Gastric and/or duodenal involvement is also rarely seen (0.5%-4%). Currently, there is no consensus regarding the optimal surgical management of gastroduodenal CD. Surgical treatment can be applied in patients resistant to conservative management, taking into account the possibility of the existence of dysplasia or cancer in stenotic areas. Profound bleeding and obstruction of the gastric outlet are also important indications. This last case is treated with antrectomy with Roux-en-Y bypass or laparoscopic bypass surgery with gastrojejunostomy[6].

SURGERY FOR SMALL BOWEL CD

CD of the small intestine manifests clinically as inflammatory and/or fibrous stricture, penetrating disease, or a combination of both. In cases of intestinal stricture, it is necessary to determine whether the nature of the stricture is fibrous, inflammatory, or both. This is necessary because in the case of the inflammatory nature of the stenosis, the appropriate treatment with the pharmaceutical agents is expected to improve the inflammation and therefore the stenosis as well as the clinical picture. On the contrary, in the case of the fibrotic nature of the stenosis, conservative treatment is not expected to achieve significant clinical benefits. As mentioned elsewhere, early surgical resection has equally good

Table 1 Main indications for surgery in patients with Crohn's disease

Indications	Treatment
Bowel obstruction	Conservative: Elimination of inflammation. On failure: Surgical resection of narrowed segment or endoscopic balloon dilatation
Intraabdominal abscess	Percutaneous drainage - administration of antibiotics. Surgery: Failure to improve septic symptoms, abscess rupture, multiple abscesses, enterectomy
Presence of fistulae	Simple fistulae: Pharmaceutical agents, enteral nutrition, biologic agents. Complex enteric fistulae: Surgery, treatment of sepsis, nutritional support
Perianal disease	Fistulae: Multidisciplinary approach, antibiotics, biological agents, surgery, stems cells. Abscess: Surgical drainage, antibiotics
Perforation	Emergency surgery
Massive bleeding	Conservative, endoscopic, invasive hemostasis. On failure: Emergency surgery
Malignancy	Absolute indication for surgery
Failure of conservative treatment	Drug intolerance, failure of biological agents, antibiotics, enteral nutrition, and total parenteral nutrition

and longer-lasting results compared to the administration of biological agents. Furthermore, various surgical techniques such as wide mesenteric resection, lateral anastomosis, or Kono-S seem to offer significant help. Long-term administration of metronidazole or ornidazole also has good results at the cost of some side effects, in a significant proportion of patients. Finally, penetrating disease requires a multidisciplinary approach with special attention to the nutritional rehabilitation of patients, the restoration of deficits, and skin care[7].

Surgical treatment of strictures of the small intestine

Strictures in which the inflammatory component predominates are usually treated conservatively and/or surgically. As a rule, CD is diagnosed by clinical gastroenterologists and is therefore treated conservatively with surgery following if necessary. In the L1RIC study patients with terminal ileitis unresponsive to conservative treatment underwent either treatment with an anti-tumor necrosis factor (TNF)- α agent or laparoscopic ileocolonic resection. One year later, quality of life did not differ between the two groups, but costs were significantly lower in the group that underwent surgery[8]. Five years later, none of the operated patients required re-excision and only 25% required treatment with biological agents. In the group that received anti-TNF- α treatment, half of the patients required surgery while the rest received treatment with a biological agent[9]. The incidence rates of postoperative anastomotic leak after elective ileocecal or ileocolonic resection with ileocolonic anastomosis in CD range from 2% in patients with a stapled side-to-side anastomosis to 14% in patients with a handsewn end-to-end anastomosis[10]. In case of recurrence, the operation can be repeated.

If the nature of the stricture is predominantly fibrous and the inflammatory component, as visualized on magnetic resonance imaging (MRI), is minimal or absent, or there is prestenotic dilatation or a history of episodes of incomplete intestinal obstruction, the patient is not expected to be substantially helped by conservative treatment and surgery is inevitable. Depending on the extent and location of the stenosis, endoscopic dilation may be attempted beforehand, but the author's opinion is in favor of surgical intervention. In cases of (fibrous) strictures, either segmental enterectomy or stricturoplasty should be performed. In the absence of fistulizing disease, cancer, or inflammatory mass, stricturoplasty is an alternative for resection. Long-term results indicate similar recurrence rates of resection as compared to stricturoplasty. The most frequently performed technique is the Heineke-Mikulicz one, in which a longitudinal incision is made along the stricture, which is then converged transversely. In this way, the length of the intestine is kept unchanged. If required, multiple stricturoplasties can be performed. Short strictures could be repaired with conventional stricturoplasty such as Heineke Mikulicz (< 10 cm) or Finney (10-25 cm), while in cases of large or multiple stenotic areas, non-conventional operations such as isoperistaltic side-to-side (or Michelassi) stricturoplasty could be applied[11].

Terminal ileitis with fistula

The indication for surgery in patients with entero-enteric, entero-abdominal, or enterovesicular fistulas is certain when there are symptoms indicative of the presence of complications such as urinary tract infections or bowel obstruction. Enteroenteric fistulas are usually asymptomatic and are treated only when there is a stricture. A special subgroup is symptomatic patients with fistulizing disease that does not respond to conservative treatment. In these patients, due to the possibility of the co-existence of an inflammatory mass, the decision to operate should be made early. It is pointed out that resection surgery should be focused on the affected organ. The pre-operative performance of the two basic diagnostic tests, *i.e.*, colonoscopy and MRI enterography, is of paramount importance.

Intra-abdominal abscesses

Small abscesses are treated with antibiotics. Abscesses larger than 3 cm or multiple abscesses require percutaneous drainage combined with conservative treatment. Conservative treatment should precede since this allows the improvement of the general condition of the patient and is accompanied by fewer postoperative complications, fewer stoma, limitation of bowel resection, and higher rates of laparoscopic intervention[12]. The presence of a stricture and a

small portion of diseased bowel also require intervention with *in situ* drainage. The abscess is drained, enteral or parenteral nutrition and antibiotics are administered, and immunosuppressants are discontinued. After 2 wk, laparoscopic resection could be attempted.

Other surgical issues

An important clinical question is related to the preoperative factors that increase the length of postoperative hospital stay in patients who underwent surgery. In a very recently published study of a large number of patients (1710 with CD and 1291 with UC), it was found that clinically significant factors contributing to increased postoperative length of hospital stay were rectal surgery, creation of a new ileostomy, preoperative hospitalization, hypoalbuminemia and the presence of bleeding disorder. Of interest was the finding that chronic use of corticosteroids, immunosuppressants, and biological agents including orally administered small molecule drugs, was insignificant[13]. Another clinical question concerns the possible relationship between serum infliximab (IFX) levels and the presence of endoscopic recurrence in patients undergoing cecal and ileal resection for CD. In 21 patients who underwent ileocecal resection and were given IFX for 4 wk before or after surgery, serum IFX levels were determined concurrently with colonoscopy. Patients were divided into two groups according to the presence or absence of endoscopic recurrence. Of the 21 patients included in the study, 7 experienced endoscopic recurrence, and 14 did not. The results showed that patients with endoscopic recurrence had previously been treated with biological agents more often compared to the group of patients without endoscopic recurrence. No differences were observed concerning the median values of serum IFX levels between the two groups. This study suggests that low serum IFX levels are not associated with postoperative endoscopic recurrence[14].

Diarrhea is a common symptom in CD patients who have undergone segmental enterectomy, especially after removal of the terminal ileum and cecum. Since fecal calprotectin levels are within normal limits (meaning the absence of inflammation), the most likely mechanism responsible for the onset of diarrhea is bile salt malabsorption. In these cases, oral administration of cholestyramine is the appropriate therapeutic approach. Of course, other mechanisms are involved in the etiology of postoperative diarrhea, causing the clinical gastroenterologist to be called upon to deal with postoperatively[15].

SURGERY FOR LARGE BOWEL CD

In cases of CD involving the large bowel, resection of the affected part of the bowel is the method of choice. Surgical procedures include subtotal colectomy and segmental enterectomy. Of these, subtotal colectomy with end ileostomy and intraperitoneal rectal closure (Hartmann) can be performed in cases of colon involvement that does not respond to conservative treatment, and urgently in cases of toxic megacolon, perforation, or significant bleeding[16]. The time to perform the surgery is an important part of the therapeutic effort since sufficient and appropriate conservative treatment can save part of the large bowel, but also includes the risk of delaying the operation with significant consequences on the patient's situation and the occurrence of complications such as wound breakdown, the appearance of intra-abdominal abscesses, small bowel obstruction, ileostomy-related complications, and bleeding. However, a decrease in these complications (5%-10%) was noticed during the last years[17].

Surgical procedures in large bowel CD include subtotal colectomy and segmental enterectomy. Of these, ileocolonic resection with end ileostomy, and intraperitoneal rectal closure (Hartmann procedure) can be performed in cases of colon involvement that does not respond to conservative treatment, and urgently in cases of toxic megacolon, perforation, or significant bleeding[16]. The size of the resection depends on the extent of the disease and the presence of symptoms. In localized colon disease (single localization with involvement of less than one-third of the colon), the resection concerns only the affected part. Segmental resection has higher recurrence rates than proctocolectomy. Avoiding a permanent stoma outweighs the increased risk of recurrence. In cases of multi-segmental CD of the colon, two segmental resections are performed when the disease affects the proximal and distal segments of the colon and when two segments of the colon are significantly distant from each other. In these cases, a segmental resection with two anastomoses is performed. Subtotal colectomy with ileorectal anastomosis is performed when the disease affects the anion and the entire sigmoid. Alternatively, a separate segmental resection could be performed.

Ileocolonic resection is the most frequently performed type of surgery in CD patients with many types of techniques and anastomoses. Usually the recurrence of CD after ileocolonic anastomosis occurs without significant clinical symptoms, which means that the monitoring of patients mainly by checking the levels of calprotectin in the feces and with periodic colonoscopies should be done systematically. There are data to support that the application of this type of surgery can influence the occurrence or non-occurrence of postoperative recurrence[18].

Elective subtotal colectomy or segmental enterectomy is performed in treatment-resistant CD colonic involvement. Results in both procedures are similar although functional results may be superior to segmental enterectomy[19]. In cases of universal involvement of the colon operations include subtotal colectomy, or total colectomy with permanent ileostomy. An important issue regarding the surgical strategy and practice concerns the choice of performing proctocolectomy or simple proctectomy in patients with treatment-resistant Crohn's proctitis or proctocolitis. The operation is performed trans-sphincterically using the Transanal Minimally Invasive Surgery (TAMIS) technique in combination with laparoscopy[20]. The TAMIS technique achieves better access to the pelvic anatomy compared to the conventional abdominal approach. In CD located in the descending and/or sigmoid, a left hemicolectomy is applied. Sigmoid resection can be achieved using the top-down approach with laparotomy, laparoscopy, or *via* TAMIS. The TAMIS technique is also applied in cases of rectum deformed by scarring processes with a transanal approach or by combining a transabdominal laparoscopic or open technique, achieving preservation of the sphincter mechanisms of the anus.

In patients with severe refractory CD, proctectomy can be performed either through close rectal dissection leaving the mesorectum in situ, or through total mesorectal excision (TME)[21]. Strictureplasty is not applied in the CD of the colon. The risk of the existence of a malignant neoplasm is quite high.

An important question that arises in the daily management of patients with ileocecal involvement of CD is whether early enterectomy should be performed, or drug therapy should be applied. There are some studies supporting the first version. Husnoo *et al*[22] in their most recently published systematic review and meta-analysis included a total of 8 studies, with 1867 patients. In the early intestinal resection group, they found a reduced need for drug therapy. The rate of bowel resection at 5 years was 7.8% in the early resection group and 25.4% in the drug-treated group. Even the early resection group (ileocecal resection of ileo-cecal-anion resection) showed longer survival without further surgery. These results suggest that early resection in selected patients with ileocolic CD represents a reliable alternative treatment[22]. Active CD of the small intestine with the simultaneous presence of an intra-abdominal abscess is treated with antibiotics and percutaneous or surgical drainage, as long as there are no obstructive symptoms, depending on the clinical case, followed by later resection.

The existing data support the assumption that ileocaecal resection is a reasonable treatment option in patients with limited CD who have failed conventional treatment. It should be pointed out that most studies comparing early surgery with the use of biological agents are retrospective and the criteria for selecting patients for one or the other treatment are unclear. Thus, patients who underwent early surgery had more severe symptoms and complications of the disease, making the comparison of the groups flawed. Furthermore, there is great heterogeneity in the definition of early surgery. Nevertheless, early surgery is considered safe and feasible and may be advantageous compared to surgery at a later stage.

The role of the mesentery

In recent years, the role of the mesentery in CD has been extensively discussed with controversial opinions. It has been argued that the mesentery may be involved in the pathogenesis of the disease since it contains an abundance of inflammatory cells, while others support the possibility that the changes seen in the mesentery are secondary. During either proctectomy or ileocolonic resection, the surgeon must decide whether or not to include the mesentery in the tissues to be removed through total mesorectal resection or close bowel resection. Supporters of the role of the mesentery believe that the fat around the diseased stenotic small intestine is colonized by microorganisms such as *Clostridium innocuum*, causing an inflammatory reaction with fat production and fibrosis[23]. On the other hand Coffey *et al*[24] claim that they observed significantly lower recurrence rates after ileocolonic resection and mesenterectomy (2.9%) compared to conventional, closed ileocolic resection (40%). However, these data should be accepted with caution since the groups compared had different follow-up and conservative treatment, much more since similar or even better results were observed with the Kono-S anastomosis, thus questioning the effect of this technique *per se*[25,26]. The so-called Kono-S anastomosis has gained significant surgical interest in the attempt to prevent the recurrence of CD. Also, the Kono-S technique (antimesenteric hand-sewn functional end-to-end anastomosis) seems to achieve very satisfactory results in reducing the recurrence rate of the anastomosis. Patient follow-up showed that anastomotic recurrence occurred in a small percentage of patients. This new approach is superior to stapled functional end-to-end anastomosis because the stumps are sewn together creating a stabilizing structure. The technique requires a careful mesenteric resection to obtain the best possible blood supply as well as preserve the innervation. The Kono-S technique prevents postoperative recurrences[27].

EMERGENCY SURGERY FOR CD

The surgical treatment of CD represents a challenge for the modern surgeon, who, to implement the most appropriate surgical intervention, must design an appropriate plan of action, after taking into account many clinical and laboratory parameters of the patient. Indications for surgical management of CD include poor response to conservative treatment and/or the occurrence of acute or chronic complications. Elective surgery is reserved for cases of obstructive phenomena that do not respond to conservative treatment. The main indications for emergency surgery are toxic megacolon, obstructive ileus, intestinal perforation, intra-abdominal abscess, and massive bleeding. These patients are usually immunosuppressed being treated with biological agents and/or immunosuppressants, possibly septic, with many nutritional deficits, that is, conditions that favor the occurrence of postoperative complications and a poor prognosis in terms of survival. Usually, however, the significant help provided during the surgical intervention with the administration of antibiotics, plasma whole blood, and fluid restoration, results in the successful completion of the operation. It should be emphasized that many of the patients require postoperative admission to an intensive care unit[28]. From the above, it becomes clear that for the complete and adequate treatment of the patient, the close cooperation of specialists consisting of gastroenterologist, surgeon, nutritionist, radiologist, and nurse specialized in the care and treatment of stoma is required. Individualized treatment is the basis of a successful therapeutic approach.

SURGERY FOR FIBROSTENOTIC CD

Regarding the fibrostenotic type of the disease, it appears that despite the introduction of biological agents into CD therapy, fibrostenotic bowel disease occurs in one-third of patients, thus increasing morbidity. Conservative treatment with biological agents and (short-term) corticosteroids is now considered the first-line treatment for inflammatory

strictures. However, conservative treatment does not significantly help in cases of strictures in which the fibrous element predominates. Many of these patients will eventually need surgery. Depending on the characteristics of the stenosis, endoscopic minimally invasive techniques such as endoscopic balloon dilation and endoscopic stricture plastic surgery performed in specialized centers are quite safe with little risk of complications. Surgery is indicated in patients considered unfit for endoscopic treatment[29].

Strictures of the digestive tract mainly concern the small intestine. In most cases, they concern the area of the ileocecal valve and less often other parts of the ileum or jejunum. Duodenal strictures due to CD are quite rare. The treatment of small bowel strictures includes stricturoplasty, surgical resection, and endoscopic dilatation. Plastic surgery of strictures with a conventional method should be done when the length of the stricture is less than 10 cm. In extensive disease with a large stenosis, non-conventional plastic methods should be applied due to the risk of losing a large part of the intestine.

Indications for plastic surgery of the strictures concern diffuse involvement of the small intestine with multiple strictures, stricture in patients who had undergone a previous large resection of the small intestine, rapid recurrence of the disease manifested as an obstruction, stricture in patients with short bowel syndrome, non-inflammatory fibrous bowel stenosis, and finally stenosis located in the duodenum. Contraindications to plastic surgery of strictures include free or hidden perforation, the existence of multiple strictures in a small part of the intestine, stricture near a part chosen for resection, stricture of the large bowel, and suspicion of the presence of cancer at the site of the stricture.

Endoscopic dilatation of strictures in patients with CD is the preferred technique for treating accessible, short-length strictures. It should only be performed with surgical coverage. It is an accepted technique for the treatment of mild or moderate stenotic disease. The results suggest a short- to medium-term benefit since it can delay surgery by up to 3 years on average. On the question of whether endoscopic dilatation or surgical excision of the narrowed part should be performed, the available data are not sufficient to provide a clear answer. A very recent retrospective study investigated the safety and efficacy of endoscopic balloon dilatation in patients with duodenal stenosis due to CD compared with surgery. Thirty patients underwent endoscopic dilatation and 18 underwent surgery. Patients in the operated group showed significant symptomatic improvement compared to patients in the endoscopic dilatation group as well as significantly longer recurrence-free survival at the cost of more postoperative adverse events (16.67% vs 0.74% respectively). Approximately 27% of patients who underwent endoscopic dilatation required surgery at a later stage. These results show that surgery in patients with duodenal stenosis due to CD offers longer recurrence-free survival. In contrast, endoscopic dilation is safe and effective with minimal side effects but is associated with frequent recurrences [30].

If the patient has previously undergone ileocolonic resection and a stricture has developed at the anastomosis, it is initially treated with endoscopic dilatation before resection. In the case of ileo-jejunal CD with recurrence in the ileocolonic area, stricturoplasty is a safe alternative to resection, with similar clinical results. When the disease is located in the duodenum, the only surgical intervention when deemed necessary is the bypass with gastroenteroanastomosis.

The presence of a clinical picture compatible with intestinal obstruction in a patient with CD is always worrying for both the gastroenterologist and the surgeon who will decide whether the patient will be taken to surgery or not. Regarding the etiology of incomplete small bowel obstruction, it seems that magnetic enterography and computed tomography offer significant help in the correct diagnosis by determining, among other things, the possible site of obstruction. Treatment with powerful anti-inflammatory drugs including biologic agents reduces the need for surgery in symptomatic CD of the small intestine in which the inflammatory component of the strictures predominates[31].

IAPA IN CD: IS IT FEASIBLE?

IAPA is classically applied only to patients suffering from UC. However, this surgical approach is also applied to a small proportion of carefully selected patients with CD to restore intestinal continuity in which there is no perianal disease, and the CD is located exclusively in the colon. In most cases, however, the presence of CD in the pouch is revealed either after a detailed examination of the colectomy surgical specimen, or during follow-up with the diagnosis established by endoscopy and biopsies taken on the occasion of pouchitis. Even in cases in which the preoperative diagnosis of the disease was indeed UC, 10% will present with inflammation of the pouch, the characteristics of which resemble CD. The diagnostic approach of patients with pouchitis resembling phenotypically CD should be based on the evaluation of risk factors predisposing to the appearance of the disease and the endoscopic picture of the pouch. Moreover, previous history, the histological picture, the location of the complications in the pouch, and the time of appearance of the complications will help in the correct diagnosis. However, the prognosis of CD diagnosed in a pouch performed in a patient with a previous diagnosis of UC is poor. In the future, this area should be systematically investigated both in terms of preventive and therapeutic strategies[32].

In the case of pouchitis due to CD, the underlying IBD is manifested either exclusively in the ileum, in the small intestine, or even as a perianal disease with characteristics similar to the classic disease (inflammatory, stenotic, fistulizing type). Treatment is usually conservative with biological agents. Because at least 60% of the pouches are not functioning properly, especially in cases of fistulizing disease or accompanying severe perianal disease, it is necessary to remove the pouch surgically. In uncomplicated patients, long-term outcomes are comparable to those of patients undergoing IAPA for UC[33].

In a recent review, Hassan *et al*[34] studied the functional postoperative outcomes as well as the type and impact of complications during long-term follow-up of patients with IBD. The data from 49 studies finally included in the study were analyzed. Regarding pouchitis, the median value of the incidence of chronic pouchitis and pouch failure was 17.1% and 6.9%, respectively. Multivariate analysis correlated the occurrence of pouchitis with preoperative corticosteroid use,

extensive UC, and the presence of extraintestinal manifestations. Regarding pouch failure they found in the multivariate analysis that it was significantly related to the preoperative diagnosis of CD, the development of perioperative pelvic septicemia, and the presence of anastomotic leak. The study also highlighted the long-term complications with the main representative being the multiple bowel movements per day. Despite all this, and given the high rate of long-term patient satisfaction, the gastroenterologist should recommend the operation after adequately informing the patient and his relatives regarding the long-term effects of the operation[34].

TREATMENT OF POUCHITIS

Very recently the relevant recommendations of the American Gastroenterological Association were published (2024). These guidelines suggest that, in patients with UC who have undergone IAPA and who present with intermittent symptoms of pouchitis, the use of antibiotics is recommended. Probiotics are also recommended for patients who respond to antibiotics but have frequent relapses. In patients who respond to antibiotics but relapse after discontinuation (“chronic antibiotic-dependent pouchitis”), chronic antibiotic use is recommended. Alternatively, immunosuppressants or immunomodulators (e.g., biologic agents or oral small molecule drugs) can be used. In patients with recurrent pouchitis with inadequate response to antibiotics (“chronic antibiotic-dependent pouchitis”), the use of immunosuppressants, or biological agents, is recommended. Corticosteroids can be used as an alternative. The use of corticosteroids and immunosuppressants is recommended in the group of patients in whom IAPA was erroneously performed and who present a clinical and laboratory picture of pouchitis. In patients presenting with symptoms of cuffitis, the topical use of mesalazine and corticosteroids is recommended[35].

POSTOPERATIVE FOLLOW-UP AND TREATMENT OF CD PATIENTS

The Rutgeerts score was developed to predict disease progression based on postoperative endoscopic appearance and to guide medical therapy. However, this grading system groups ileal lesions and anastomotic lesions into the same category. The modified Rutgeerts score distinguishes lesions found in the anastomosis from those occurring in the neoterminal ileum. This system is expected to help in understanding the role of anastomotic lesions in the development of CD. Non-invasive diagnostic methods, such as small bowel ultrasound, are highly sensitive and specific in the hands of experienced specialists in detecting postoperative recurrences. Postoperative treatment with biological agents reduces the rate of endoscopic recurrence. However, preoperative treatment with anti-TNF- α agents may influence the postoperative response to these agents. New surgical techniques such as Kono-S (antimesenteric functional end-to-end anastomosis) may reduce postoperative recurrence rates[36].

The answer to the question of whether preoperative treatment with biological anti-TNF agents affects the rate of postoperative complications is not clear. In a systematic review and meta-analysis Cira *et al*[37] investigated the effect of treatment with anti-TNF- α agents applied during the previous 12 wk before surgery on the type and rate of postoperative complications occurring within 30 d postoperatively in patients with IBD. The authors chose the preoperative period of 12 wk since this is the period where the effect of the anti-TNF drugs is still present, although decreasing. This meta-analysis included 55 studies with a total of 22714 patients. Postoperative complications, readmission rate, and intra-abdominal septic complications were found to be significantly higher in patients who received preoperative anti-TNF- α agents. In addition, a significantly higher rate of intra-abdominal abscess development as well as hospital admissions was found in CD patients treated with anti-TNF- α agents. It was also found that concomitant use of immunosuppressants with anti-TNF- α agents was associated with a significantly lower mortality rate. It therefore appears that receiving anti-TNF- α agents within 12 wk preoperatively increases the short-term rate of postoperative complications in IBD and especially in CD patients[37].

It is known that after surgery for CD the disease recurs in a significant proportion six months after the surgery. Previous clinical studies including meta-analyses have demonstrated the good effectiveness of anti-TNF- α agents in the prevention of postoperative recurrences. In a recent review, Gisbert and Chaparro[38] describe data from 37 relevant studies with 1863 patients 29%, of which had proven endoscopic recurrence 6-12 months after surgery. They found that the combination of thiopurines with anti-TNF- α agents resulted in controversial results, but could potentially be tried in patients who had previously been treated with anti-TNF agents[38]. Also, a recent retrospective study noticed that among 1037 patients undergoing ileocolic resection for CD, 278 received postoperative biological agents as a maintenance treatment. It was found that early initiation of an anti-TNF- α agent within 4 wk after surgery, was associated with a reduced rate of postoperative recurrence[39]. IFX administered postoperatively does not differ in efficacy from adalimumab. There is no need to change the anti-TNF- α used preoperatively to another anti-TNF- α agent. The period of administration, although unspecified, should be long (months or years). If there is proven postoperative endoscopic and clinical recurrence, anti-TNF- α agents are the recommended choice. It therefore appears that postoperative use of biological agents reduces endoscopic and clinical disease recurrence. This is of particular importance in the group of patients at high risk for postoperative recurrence such as patients under 30 years of age, current smokers and patients who have previously undergone more than one operation mainly for perianal disease. With the data so far, it seems that the administration of anti-TNF- α agents for the prevention of postoperative relapse in CD patients should be preferred over the other biological agents. Vedolizumab seems to be quite effective in high-risk patients, while ustekinumab also appears to be effective but the data are relatively insufficient[38]. Further investigation is needed to explore the role of new biological agents in the postoperative management of CD patients. It should be noted that nitroimidazoles

(metronidazole and ornidazole) have been used successfully in the postoperative management of patients with CD, although the side effects of chronic administration of metronidazole and to a lesser extent ornidazole should be taken into account. Immunosuppressants of the thiopurine type also reduce the risk of clinical but not endoscopic recurrence.

MINIMALLY INVASIVE SURGERY IN PATIENTS WITH CD

In recent years, the application of minimally invasive surgery in the treatment of patients with CD has been an important step forward. The method presents significant advantages not only in terms of safety but also in other parameters such as reduced length of hospitalization, satisfactory aesthetic results, and the creation of fewer intra-abdominal adhesions which can create further clinical problems. Minimally invasive surgery is not only a modern but also a future challenge since it is an ideal method for patients with CD who, due to the nature of the disease, often present with thickened mesentery, fistulae, abscesses, and intra-abdominal masses. It seems that there are prospects for further defining the indications and results of its application as well as technical improvements and developments in the method itself[40].

Laparoscopic surgery should be preferred in case of ileocolic resection in CD when an experienced surgeon is available. In more difficult cases or when a second resection is required, there is no data in favor of the laparoscopic operation as the first choice. It is emphasized that the principles applied in the laparoscopic technique must be the same as in the open one. The minimally invasive surgical access is the element that differentiates and excels laparoscopy from open surgery. In cases of entero-intestinal fistulas, resection is performed only in the part of the intestine affected by the disease, while the intestine is sutured in one or two layers (the same applies to the intestine and the bladder). However, if both communicating parts are affected, *e.g.*, ileum/sigmoid then both are resected.

TREATMENT OF PERIANAL CD

Perianal disease, one of the most distressing complications of CD with a significant impact on quality of life, occurs in 25%-35% of CD cases increasing to approximately 40%, 20 years after initial diagnosis[41]. It can manifest as perianal fistula, fissures, skin tags, strictures, ulcerations, hemorrhoids, or malignancy. Fecal incontinence and pain are the most undesirable clinical features of the disease, which often force patients to seek hospital help. It is accompanied by significant morbidity and a significant reduction in the level of quality of life.

To successfully manage the patient with perianal fistula, a multidisciplinary team of specialists should be established (as repeatedly emphasized in various sections of this review) to achieve remission of the bowel lumen and fistula inflammation, as well as repair of the underlying dysfunction of the fistula[42]. Perianal fistula occurs in approximately 25% of patients with CD. MRI, colonoscopy, and examination under general anesthesia are necessary actions to categorize the patient with a fistula and choose the most appropriate therapeutic approach. The situation represents a diagnostic and therapeutic challenge for the team of specialists that deal with it since its various manifestations require a different therapeutic approach. Today, we indeed have a multitude of therapeutic options, namely conservative (antibiotics, immunosuppressants, biological agents, administration of stem cells), or surgical, all with specific indications depending on the peculiarities of each case. The existing conservative treatment options mainly include biological agents and immunosuppressants administered always under close clinical and laboratory monitoring. Surgical drainage of perineal abscesses before conservative treatment and seton placement are necessary actions. More permanent surgical access can be discussed, however, when the intense inflammatory phenomena subside. The use of stem cells is a promising approach in patients with CD perianal fistulae. Success rates of conservative and surgical treatment vary and failures are common[43]. The resistant nature of the disease indicates the need for a better classification as well as an understanding of its immunopathogenesis to rationalize therapeutic options in each case[44]. Successful management requires a delicate balance between the goal of eliminating the fistula and maintaining normal stool flow. Generally, surgical treatment must be conservative and based on the patient's cooperation, who should fully understand the purpose of the operation.

Various surgical approaches could be applied to treat symptomatic, simple, and low trans-sphincteric fistula, as well as those that cause severe symptoms. In general, extensive drainage and opening of fistulas as well as sphincterotomy are avoided. The main goal is the drainage of abscess cavities and the maintenance of open drainage channels by placing settons. The existence of intraabdominal fistulas is not a technical surgical problem. In addition to detaching the thick intestinal loop from the abdominal wall, the affected part of the bowel (small or large intestine and cecum) must be removed.

In the treatment of patients with complex perianal CD, surgical bypass of the passing stool stream from the rectum appears to help a certain proportion of patients, particularly in cases of treatment-resistant perianal disease. The data so far show that fecal bypass results in an early clinical response in the majority of patients although chances of restoring the fecal stream to the previous situation are very small (20%). About half of the patients in these cases need to undergo a proctectomy. The most important factor in treatment failure is rectal involvement by CD. Combining fecal diversion with biological agents does not improve diversion outcomes. Therefore, the bypass of the faecal stream finds its application as a treatment modality offering short clinical relief and avoiding immediate proctectomy. Despite initial disappointing results, the administration of biological agents alone or in combination (dual biological therapy) alongside fecal bypass should be evaluated in future studies[45].

In a recent multicenter retrospective study, the authors collected data from 197 patients with CD who had undergone rectal *in situ*-preserving fecal diversion surgery and for whom at least two years of follow-up data were available. At the end of the follow-up, 92 (46.7%) of the 197 patients, finally underwent a proctectomy, while 105 (53.3%) did not. Of these

105 patients, 50 (47.6%) underwent re-anastomosis while in the remaining 55 the rectal obstruction from the fecal stream still existed. Of these 55 patients, most still reported symptoms, while patients who underwent fecal flow restoration were symptomatic in approximately 50%. Of the total number of patients included in the study, three-quarters either underwent rectal removal or remained symptomatic. Finally, the percentage of patients in whom restoration of intestinal continuity was performed was 15%. Only 5% achieved re-anastomosis without disease recurrence[46].

Regarding the penetrating type of the disease, it is argued that appropriate surgical planning is expected to reduce the risk of penetrating disease caused by the disease itself or at the time of surgery, while it is expected to improve the disease in cases of already established penetrating disease. To achieve this goal, a careful preoperative evaluation of the patient should be performed, an improvement of the nutritional status should be achieved using enteral or parenteral nutrition, and any coexisting septic complication should be appropriately treated[47].

In conclusion, patients with fistulizing CD should be treated by a multidisciplinary team with the main participants being the gastroenterologist and the specialized digestive surgeon. Early recognition of fistulas is essential for the rapid implementation of therapeutic interventions. Endoscopic ultrasound helps to anatomically define the lesions and to perform drainage of coexisting septic collection. MRI of the perineum offers important diagnostic help not only in terms of the exact localization of lesions but also in monitoring the therapeutic results. Finally, the expected therapeutic effect should be discussed with the patient since complete healing or even improvement of the fistula disease is not always possible. Today, between chronic seton drainage, taking anti-TNF- α for one year, and surgical closure with a short course of anti-TNF- α in patients with high perianal Crohn's fistulas with a single internal opening anti-TNF- α or surgical closure of their high perianal fistula either administration of anti-TNF- α agents or surgical closure of the perianal fistula through various techniques is preferred[48].

COLORECTAL CANCER AND DYSPLASIA IN PATIENTS WITH IBD

It has long been known that patients with IBD and extensive bowel involvement are at increased risk of developing colorectal cancer (CRC) after several years from the onset of bowel disease. It appears that chronic intestinal inflammation is the main predisposing factor causing carcinogenesis through the creation of precancerous lesions (dysplasia) that ultimately progress to cancer. The molecular similarities with sporadic cancer are several (although not fully understood), including the gut microbiome and gut immune responses. The concept of cumulative inflammatory burden over time highlights the importance of ongoing monitoring for histological evidence of inflammation as a significant risk factor for CRC development in an IBD setting. Dysplasia is the most important precancerous condition for which early identification and removal can temporarily prevent surgical resection of the bowel[49]. We can predict and better manage CRC in IBD patients in the coming years since the widespread application of new anti-inflammatory drugs, better identification and removal of precancerous lesions, and better utilization of genetic, immunological, and environmental factors associated with carcinogenesis will become widely available[50].

Patients with IBD who have undergone colectomy and in whom the rectum remains *in situ* are at increased risk of developing cancer of the rectal stump. In a recent systematic review and meta-analysis of 23 studies of rectal stump cancer in operated IBD patients, Georganta *et al*[51] found that the overall incidence of rectal cancer was 1.3%, which is lower than reported. Further analysis showed that the incidence of carcinoma in patients with a nonfunctioning rectal stump and patients with an ileorectal anastomosis was 0.7% and 3.2%, respectively. Patients with a reported diagnosis of colorectal dysplasia, as well as patients with a positive history of colorectal carcinoma, had higher odds of developing rectal carcinoma. Since there are no clear guidelines regarding the screening of these patients, it is necessary to carry out relevant studies that will precisely determine the way and methods of performing the screening[51].

The risk of cancer in the rectal region as well as cancer of the distal rectum and anus in patients with perineal CD is increased. Patients should be treated (as has been emphasized elsewhere) multidisciplinary by a team of experts[52]. Examination under general anesthesia continues to be an important part of the diagnostic effort and subsequent therapeutic interventions. The role of intracanal ultrasound in experienced hands is quite significant in providing diagnostic information. Finally, the fact that perianal disease can develop after IAPA should not be overlooked.

As is known, the term interval cancer is defined as the cancer that develops in the colon of patients who underwent a screening colonoscopy in a short period after a negative initial colonoscopy. IBD patients are submitted to CRC screening programs because of the increased risk of developing dysplasia and CRC. Nevertheless, just as it happens in the case of the normal population, cases characterized as interval cancers can also appear during the surveillance of patients with IBD. Currently, there is insufficient information regarding the exact period of CRC diagnosis after a previous negative colonoscopy, and the factors favoring its appearance[53].

SPECIAL TOPICS IN THE SURGICAL TREATMENT OF CD

Appendectomy

The relationship between appendectomy and the clinical manifestation of UC is largely well-known. Existing data support that the performance of an appendectomy, especially if it was performed for acute appendicitis, exerts a protective effect against the appearance of UC. It is known that the appendix exerts an important immunological effect in both healthy individuals and those suffering from various diseases and that its removal entails important effects on the gut microbiome and immune responses. Recently, Zhang *et al*[54] published a systematic review and meta-analysis in

which the relationship of prior appendectomy and the onset and course of CD was evaluated. A total of 28 studies were included in their analysis. The authors found a positive association between prior appendectomy and risk of CD, and indeed the risk remained independent of the reason for which the appendectomy was performed (presence or absence of acute appendicitis). They also observed significant differences in the rates of histologic inflammation in the terminal ileum and colon of CD patients with prior appendectomy and CD patients who had not undergone prior appendectomy. These data suggest that the risk of developing CD, particularly of the terminal ileum, increases after appendectomy in contrast to what is observed in UC patients[54]. The same contrast between CD and UC patients is observed, as has also been known for a long time, about smoking habits. However, according to the author of this review, regarding the association of previous appendectomy and the occurrence of CD, it should be investigated if the surgery for acute appendicitis was performed erroneously and if the acute appendicitis was in fact due to *Yersinia enterocolitica* infection. In these cases, it is worth investigating the role of a possible *Yersinia enterocolitica* infection through the detection of YOP antibodies in the serum (western blot analysis)[55].

If terminal ileitis suggestive of CD is found at laparotomy for appendicitis, enterectomy should not be performed. A surgical finding of terminal ileitis or appendicitis should be considered as a non-specific finding. It is pointed out that the differential diagnosis from infectious enteritis (*e.g.*, *Yersinia species*) is impossible. Even if it is Crohn's ileitis, resection may not be indicated if the main character of the symptoms is inflammatory. Only when there are obstructive symptoms, or if the proximal bowel is distended and the inflamed bowel has a typical CD picture with mesenteric thickening is the surgeon justified in performing an enterectomy.

Haemorrhoidectomy

Regarding the performance or not of hemorrhoidectomy in patients with CD, the existing data are relatively insufficient. It is generally known that the standard practice of gastroenterologists is to avoid recommending hemorrhoidectomy in patients with CD because of the possibility of poor wound healing that may ultimately lead to proctectomy. A review of 4 studies analyzing data from 67 patients undergoing hemorrhoidectomy reported no cases of proctectomy or poor wound healing related to previous hemorrhoidectomy. Four (6%) cases of postoperative bleeding and 2 cases (3%) of postoperative perianal abscess were observed while 1 case developed anal stricture. These data suggest that hemorrhoidectomy can be performed in patients with CD provided that the disease is in endoscopic and clinical remission. In the future, prospective studies should prove whether the above conclusion is correct as well as what is the preferred type of surgical intervention[56].

Obesity

It is well established that IBD patients and especially CD patients, are obese, at least at the time of initial diagnosis of the disease. This phenomenon seems to exist also in the economically emerging countries of the world in which the incidence of IBD, as well as obesity, is on the rise. The role of obesity in IBD appears to be aggravating although the results are at least partially conflicting. Obesity is supported by most studies as negatively affecting the course of the disease, as well as the effectiveness of conservative and surgical treatment of patients while influencing medical and surgical treatments by promoting inflammatory reactions through pro-inflammatory cytokines produced by the adipose tissue. It is interesting to note that isolation of the mesentery from the surgical anastomosis *via* the KONO-S technique significantly reduces the rate of disease recurrence at the anastomotic site[57].

Some overweight IBD patients desire bariatric surgery to lose weight. The available scientific data regarding the effectiveness of bariatric surgery in patients with IBD is not clear. However, in a recent systematic review of 22 published relevant clinical trials, Mian and Khan[58] concluded that in patients with IBD, bariatric surgery is safe and effective as it results in significant weight loss at 6 and 12 months post-surgery, without significant side effects or effects on the underlying intestinal disease. However, when recommending bariatric surgery gastroenterologists should keep in mind that bariatric surgery itself may predispose to *de novo* IBD development[58].

Surgery for IBD in the elderly

There is a widespread impression among gastroenterologists that in elderly patients with exacerbation of underlying CD, surgery should be avoided, and if conservative treatment is preferred, immunosuppressants or biologic agents should be avoided for the fear of an increased incidence of side effects. Elderly patients indeed have much co-morbidity which may aggravate the underlying enteropathy. In addition, data for these patients are much less than for adult or pediatric patients because large studies usually exclude elderly patients. There is a misconception that elderly patients with CD are only treated with frequent and continuous steroid use, resulting in under-treatment. Surgery in the elderly should be performed safely as long as approved indications are met[59].

GENERAL RECOMMENDATIONS FOR THE SURGICAL TREATMENT OF CD PATIENTS

It is a fact that the introduction of biological agents into the therapeutic quiver has resulted in considering surgery in CD patients as a last resort. The result was the perpetuation of alternating therapeutic regimens with different biological agents and for long periods. However, the failure of these therapeutic regimens resulted in poor nutritional status, the appearance of complications, and greater clinical severity of the disease. An earlier prospective study showed that effective conservative treatment increases the rate of elective surgery, but at the cost of a significant increase in stricture and intestinal obstruction as indications for surgery as well as an increase in operations for acute conditions such as intestinal perforations and peritonitis[60], thus questioning what was previously published[61]. Today, it is considered

well-founded that early surgical resection in patients with limited disease unresponsive to conservative treatment is indicated since it is a feasible and safe option. Several guidelines now recommend it as an equal therapeutic alternative to medical treatment[62]. Preoperatively, patients should be in good nutritional status and, if possible, on reduced doses of corticosteroids. Patients with fistulas or abscesses are a particular therapeutic challenge whose surgical treatment includes extensive enterectomies, increasing the risk of complications, as well as the appearance of short bowel syndrome. Initial conservative treatment can limit the disease making surgery safer. If conservative treatment does not produce satisfactory results, surgery by an experienced surgeon is considered necessary and without time delays. The initiation of postoperative treatment with biological agents is recommended. The group of patients with strictures should be treated either endoscopically or surgically[63]. In these patients, insisting on the use of biological agents may delay surgery, but it cannot eliminate it as a possibility. Finally, in patients with short bowel syndrome, the application of conservative treatment methods such as the administration of home parenteral nutrition is indicated. Surgery should no longer be considered as a treatment of last resort for medically refractory or complicated CD but should be regarded as a satisfactory alternative in terms of efficacy, quality of life, and cost as first-line therapy or even as part of combination therapy with biologics agents, under certain conditions. Operated patients with CD should be checked periodically for the possibility of endoscopic recurrence, the early treatment of which is expected to have positive effects on the long-term outcome of the disease. However, it should be taken into account that there is no complete unanimity regarding the characterization of endoscopic lesions and their significance. The role of the continuously added new biologic agents in the prevention of postoperative complications is expected to be determined shortly. New surgical techniques, *e.g.*, the Kono-S technique, may improve postoperative recurrence rates.

SURGICAL TREATMENT OF UC

A better understanding of the natural history of UC, the possibilities and complications of drug therapy, and the creation of surgical modalities that preserve bowel continence with satisfactory quality of life have led to an expanded role for surgery in patient management since removal of the entire affected colon is the only treatment that achieves the definitive elimination of the disease, at the same time eliminating the possibility of developing of malignancy. The likelihood of colectomy in patients with UC depends on many factors. The severity of the disease, age, tolerance, and response to medication, as well as the degree of acceptance of surgical modalities by both patients and treating physicians, are important parameters that should be assessed before a patient with UC is guided to the operating room. In recent years there have been significant developments in surgical techniques (transvaginal surgery and robotics), indications for staged procedures, adoption of the multidisciplinary approach to the patient's problem, surgical alternatives to ileal pouch-anal anastomosis, and pharmaceutical treatment before and after surgery[64].

Regarding the rate of UC patients undergoing surgery, Dai *et al*[65] in a recent systematic review and meta-analysis of 31 studies including 294359 adult UC patients found that colectomy rates at 1, 5, and 10 years after diagnosis were 3%, 5%, and 10%, respectively. The pooled relative risk for colectomy after the introduction of biological agents into our pharmaceutical arsenal was 0.68 at 1 year and 0.71 at 5 years after diagnosis. It is therefore demonstrated that the overall colectomy rate in the last three decades has decreased to some extent and that the therapeutic use of biological agents has contributed to this decrease[65]. Biological factors, with the reduction of surgical intervention rates in patients with severe disease, have shifted surgical interventions in the direction of treating dysplastic lesions and colon cancer. Surgical treatment is still recommended in patients with severe extraintestinal manifestations such as pyoderma gangrenosum or in cases of hemolytic anemia resistant to cortisone and splenectomy.

The following conditions should also be evaluated before surgery: Patients undergoing colectomy who have been treated with at least 20 mg prednisolone daily for more than 6 wk, as well as patients treated with biological agents who do not respond to therapy, are initially treated with subtotal colectomy, due to the increased risk of surgical complications (five times the risk of infections and the pouch). Administration of azathioprine preoperatively does not increase the risk of postoperative complications. Colectomy performed immediately after cyclosporine administration does not have a greater risk of postoperative complications. Administration of anti-TNF agents may predispose to postoperative complications, especially in cases of emergency colectomy.

Scientific care of hospitalized patients with severe CD requires coordination among a multidisciplinary team[66]. If the patient does not improve, the digestive surgeon should be consulted. During hospitalization, there should be frequent communication between the gastroenterologist responsible for the patient and the surgeon who will take over the patient in case of surgery. This collaboration will make it possible to make joint decisions about the time of surgery, the regulation of the received conservative treatment, but also the planning of a coordinated postoperative course[67]. **Table 2** shows the indications for surgery in UC patients.

EMERGENCY SURGERY FOR UC

UC may appear in a severe form either as an initial manifestation or during the progression of a disease that has already been diagnosed. Toxicity is clinically manifested by tachycardia, fever, pallor, lethargy, or collapse from dehydration or sepsis. Abdominal tenderness, hypotension, electrolyte disturbances, anemia, dehydration, confusion, and more than 8 bowel movements per 24 h are often present, which are often bloody. The clinical picture is not always complete, which may lead to an underestimation of the severity of the disease, especially in patients receiving immunosuppressives. So, the frequency of bowel movements is often reduced when a toxic megacolon develops, while the presence of decreased

Table 2 Main indications for surgery in ulcerative colitis

Indications	Treatment
Emergency situations	
Acute severe UC refractory to medical treatment	70% of patients will eventually need surgery
Uncontrollable sepsis	
Colonic perforation	Surgery - antibiotics
Toxic megacolon	Emergency operation
Severe bleeding	Emergency operation. Colectomy should not be delayed
Elective indications	
Dysplasia	Endoscopic surveillance with targeted biopsies for early detection. In cases of dysplasia endoscopic resection and continued surveillance. Surgery for unresectable dysplasia, and multi-focal low-grade dysplasia
Cancer	Surgical treatment
Medically refractory disease	Surgical treatment (preferably IAPA)

UC: Ulcerative colitis; IAPA: ileo-anal-pouch anastomosis.

bowel sounds or abdominal tenderness often indicates severe disease even if the patient is relatively well. Worsening diarrhea or bleeding even when there is no acute abdomen is of equal value. Severe anemia, severe electrolytic disorders, dehydration, and impaired renal and/or liver function are parameters that reflect the severity of the disease. The therapeutic effect of treatment should be constantly clinically and laboratory evaluated. If the patient does not respond sufficiently or shows any serious complications, he is urgently taken to the operating room.

Today the mortality rate of severe UC attacks does not exceed 2%. This impressive change is due to the establishment of clear criteria for discontinuing the conservative treatment of severe disease in favor of early surgery, to the shift in surgical tactics from emergency proctocolectomy to subtotal colectomy with terminal ileostomy and preservation of the rectum, usually in the form of a mucous fistula at the level of sigmoid, as well as in preoperative treatment with cyclosporine and anti-TNF- α factors (IFX)[68].

Subtotal colectomy

The subtotal colectomy with end ileostomy and preservation of the rectum excised as a rectosigmoid mucosal fistula represents a good choice in emergency UC surgery for many surgeons. This type of operation is less traumatic because it removes the cause of the toxicity and allows the gradual discontinuation of medications, without requiring the creation of an anastomosis or manipulations in the inflamed pelvis, while leaving open all surgical possibilities later on. Moreover, it can be performed even by surgeons who have no special experience in UC surgery. Total colectomy with convergence of the Hartmann stump in the acute phase is indicated when there is a perforation in the rectosigmoid or when there is a very intense inflammation that prevents this part of the intestine from reaching the level of the abdominal wall and being excised[69]. In the acute phase, total proctocolectomy with permanent ileostomy usually has no place. It is an operation with significant morbidity and should be avoided.

Total proctocolectomy with permanent ileostomy

This kind of operation eliminates the disease as well as the need for medication, and the patient quickly returns to his work and activities. It can be performed one or two times if the first operation is performed urgently. The ileostomy is constructed at the level of the terminal ileum and is created in the right lower quadrant of the abdominal wall. The resection of the lower third of the rectum is performed in the trans-sphincteric space, thus allowing the integrity of the pelvic floor to be preserved, ensuring faster healing of the perineal wound. The operation can be applied to patients in poor general condition or very advanced age, with sphincter insufficiency, or those who cannot cope with the increased care required in the case of moderate ileostomy or ileoanal anastomosis. It is also the final solution when other interventions have failed[70]. In patients with malignancy of the middle or lower third of the rectum, it is (at least for some surgeons) the operation of choice.

This kind of operation is not without complications *e.g.*, bleeding, effusion, and delayed healing, especially when performed urgently. The main disadvantages of the method are the permanent ileostomy with medical (high flow, strictures) and social implications, the possibility of injury to the pelvic nerves, and the possible complications from the perineal trauma. An ileostomy is a cause of significant morbidity in 15% of cases, for which surgery is usually required *e.g.*, obstruction, or peristomal hernia. Other choices are local skin irritation (40%), water and electrolyte disturbances, and an increased incidence of nephrolithiasis and gallstones. Ultimately, however, patients gradually adapt and more than 90% achieve an almost normal life and declare themselves satisfied with the result.

Subtotal colectomy with ileorectal anastomosis

The operation was developed in an attempt to avoid ileostomy. The possibility of injuring the pelvic nerves is small and the patient avoids both permanent ileostomy and perineal trauma. Its functional results are acceptable, 4 or 5 bowel movements per day on average with periodic use of antidiarrheal drugs and a high degree of patient satisfaction (55%-89%). The best functional results seem to be achieved in patients with a relatively short duration of the disease. Overall, however, it appears that in experienced centers ileorectal anastomosis has no advantage in perioperative morbidity, continence, or long-term functional outcomes.

The procedure should not be performed at one time in emergency UC surgery, because of the increased chance of rupture of the anastomosis. The increased risk of developing neoplasia in the remaining rectum (6%-15%), is a serious disadvantage of the procedure since it requires lifelong endoscopic monitoring of the patients. Furthermore, technically, the ileorectal anastomosis assumes that the rectum has been relatively spared from the disease without showing significant fibrosis or reduction of its contractility and size, factors that further limit the indications for the intervention, which ultimately can only be applied to 20% of patients. A significant percentage (30%) of patients with an ileorectal anastomosis will experience significant problems from the rectum, eventually leading to resection and permanent ileostomy or IAPA. In this sense, subtotal colectomy with ileorectal anastomosis can be considered as an "intermediate operation" that postpones the definitive solution to the future, more specifically in young male patients who wish not to expose themselves to impairment of their sexual function, due to injury of the nerve plexuses during the preparation of the rectum. The complication rate after surgery is high due to the underlying chronic inflammation, the effect of corticosteroids and immunosuppressants as well as the inherent complexity of the surgical procedures. Postoperative complications are divided into early and late. Specific complications are associated with extensive surgical procedures such as proctocolectomy, or with complex reconstructive procedures such as ileoanal pouch and continent ileostomy[71].

IAPA

The disadvantages of proctocolectomy with permanent ileostomy, as well as functional problems and the possibility of developing rectal cancer after ileorectal anastomosis, led to the search for new surgical techniques. This operation corresponds to total colectomy and ileoanal anastomosis with the insertion of an artificial ileum made from the terminal ileum. The method has gained wide acceptance and application in recent years and is today the surgery of choice for UC patients, because it provides the patient with near-normal functionality in terms of defecation and continence, ensuring complete eradication of the disease[72].

Although it is a relatively complex surgery, the mortality rate is relatively low (less than 1%). On the contrary, the morbidity is significant (13%-58%). The nosological background and the use of corticosteroids are blamed for some of the complications, the great majority of which are directly related to the surgical technique. Nevertheless, the rate of complications is decreasing with experience. Contraindications to the intervention are disorders of the sphincter mechanism, the existence of known CD, the patient's mental instability, and his non-compliance with the postoperative treatment. Technical problems may be caused by the patient's body type and previous intra-abdominal operations. The presence of neoplasia should alter the operative strategy. If the malignancy is located in the lower third of the rectum, performing an ileoanal anastomosis is contraindicated, while in tumors of the upper rectum and colon, resection should be performed according to the rules of surgical oncology.

For the successful outcome of IAPA, it is essential that the pouch reaches the dentate line without tension and having adequate vascular supply. The surgical techniques that have occasionally been used are reported in a recent systematic review in which the authors analyzed the relevant data of 1181 patients included in 19 clinical studies. A total of six different surgical techniques aimed at mesenteric lengthening were described, such as pouch folding, construction of different types of pouches, stepladder incisions, skeletonization of vessels, division, and ligation of mesenteric vessels, and using an interposition vein graft. The disadvantage of these studies is the absence of randomization or prospective character[73].

Satisfactory results regarding continence during the day and solid stools are reported in the literature. Over 60% of patients report that the bowel movement is perfect, without pain and the patient can delay the bowel movement for at least 20-30 min. The results are not ideal in terms of nocturnal continence and it is not uncommon to experience minor leaks or even incontinence at bedtime. Bowel frequency and nocturnal continence improve during the first year after surgery. Patients average about 6 semi-formed bowel movements per day. Bowels are more frequent in elderly patients (patients over 50 have 8 ± 4 bowel movements per day, while patients under 50 have 6 ± 3 bowel movements per day). There is no difference in the number of bowel movements between men and women. Usually, patients do not need to empty the bladder during sleep, although one or two nocturnal bowel movements are acceptable. Complete incontinence rarely occurs.

Pouch complications could occur with the increased frequency following the application of minimally invasive techniques including laparoscopic and robotic surgery[74]. Recently, reoperation surgery in patients who have previously undergone IAPA has been developed to a satisfactory extent and is expected to improve the quality of life of patients without the need for a permanent stoma. In patients who develop pouchitis, fistulae, or obstruction, they may have CD which predisposes them to pouch failure. In these patients, re-operative access to the ileum can restore these complications by avoiding the removal of the pouch and the creation of a permanent or temporary stoma.

Of the reported postoperative complications, intestinal obstruction is the most common. It occurs in 10%-22% and requires surgical reoperation in a large percentage. Also common is the occurrence of pelvic sepsis (5%-6%), with or without leakage from the anastomosis, as well as the occurrence of intra-abdominal effusion (6%). It is especially important to exhaust all the types of conservative treatment before deciding to re-operate to deal with septic complications: 92% of those treated conservatively will manage to maintain the pouch. Stenosis of the ileoanal anastomosis (4%-

16%) is usually successfully treated and the pouch is preserved in more than 80% of patients presenting with this complication. Inflammation in the pouch (pouchitis) may develop. Conservative treatment in acute and chronic cases is relatively effective although quite complicated. Nevertheless, a small percentage of patients will need to undergo a permanent ileostomy due to non-response to conservative treatment[75].

The appearance of IAPA-related fistulae is one of the most important complications with serious morbidity (repeated surgeries) and significant effects on the preservation of the pouch. A recent systematic review and meta-analysis of 34 studies with 770 patients with IAPA-related fistulae found that the complication incidence ranged from 1.5%-12%. CD was the cause of pouch-vaginal fistula in one-fourth of the cases. Depending on the type of intervention, the overall fistula recurrence rate was 49.4% and was related to repeat IAPA, transvaginal repair, and transanal ileal pouch advancement flap. The overall failure rate was 19% and was related to pouch excision, persistence of diverting stoma, and persistent fistula. In conclusion, the study showed that pouch-vaginal fistulas are more frequent compared to other types of fistulae, often occurring in underlying CD. The risk of recurrence after surgical treatment is 50%. Repeated IAPA is the recommended surgical approach with a 50% recurrence rate[76].

From the technical point of view, it is known that to create the IAPA it is necessary to preserve a small part of the anal canal and the lower part of the rectum, parts which include the anal transition zone corresponding to a more circular part of the dentate line. This part together with the rectal cuff can present endoscopic and clinical pictures compatible with active UC as well as dysplastic precancerous lesions since their mucosa corresponds to colonic mucosa. Because of this, patients are required to be subject to systematic surveillance before and after surgery. The duration of surveillance depends on the presence or absence of dysplasia. In patients without precancerous lesions, monitoring can be done at sparse intervals. The treatment of patients with dysplasia in the anal transition zone is difficult and includes mucosectomy, pouch removal, or a redo pelvic pouch[77]. Restorative proctocolectomy with IAPA is also the surgical procedure of choice in patients with familial adenomatous polyposis[78].

In summary, IAPA significantly improves the quality of life of patients with IBD or familial polyposis. Preoperatively, patients should undergo a thorough evaluation that includes a review of all previous clinical and laboratory (colonoscopy, imaging, and histology) data, bowel cleansing, and the application of prophylactic therapy against deep vein thrombosis. The type of surgery (open, laparoscopic, or robotic) depends on the patient's condition, recent treatment, the urgency or non-urgency of the operation, and the degree of specialization of the surgeon. The most commonly preferred type of pouch is the J-shaped one. Good preoperative evaluation and good postoperative care of patients in centers experienced in performing the procedure are expected to reduce postoperative complications[79].

MINIMALLY INVASIVE SURGERY IN UC

The past three decades have seen significant advances in the use of minimally invasive techniques in UC patients. The safety, efficacy, and feasibility of performing laparoscopic and robotic approaches *e.g.*, subtotal colectomy, total proctocolectomy, and IAPA have been demonstrated through the publication of the results of several relevant studies. Compared to open procedures, minimally invasive techniques show equivalent or better short-term postoperative results as well as similar or improved bowel and sexual function, and fertility. It is emphasized that while minimally invasive techniques are safe and feasible in selected patients with UC, surgeons must adhere to the principles of proctectomy and pouch creation, and not hesitate to convert the operation to open if necessary[80]. These operations include the following categories: (1) Conventional; (2) Laparoscopic surgery; (3) Hand-assisted laparoscopic surgery; (4) Single incision laparoscopic surgery; and (5) Robotic surgery[40]. Minimally invasive techniques could also be applied in other conditions including uncomplicated small and ileocolonic disease, colon resections, complex CD, stricturoplasty, intracorporeal anastomosis, and natural orifice specimen extraction.

Transanal surgery

Transanal TME was initially used as a surgical technique to treat rectal cancer. Recently, this technique is also used in patients with IBD located in the rectal area. The most appropriate example is patients with rectal stenosis or extensive perianal disease, in whom removal of the rectum is indicated. The technical description is beyond the scope of this review, but it can be asserted with certainty that its application avoids injury to the pelvic nerves and internal iliac vessels. A good overview of the lower pelvis is possible while helping to overcome the difficulties of the anatomical surgical field of the pelvis.

In general, the developments of minimally invasive surgery that refer to the use of single port surgery together with transanal rectal surgery make it even more effective. In 2016, de Buck van Overstraeten *et al*[81] described a technical modification regarding single stapled anastomoses in patients with UC undergoing transanal completion proctectomy and IAPA. Regarding the technical part, they report that all 11 patients included in the study underwent total colectomy with terminal ileostomy in the first phase. Colectomy was performed by multiport laparoscopy in six patients, while in 5 patients the ileostomy site was used as single port access. For the construction of the pouch, the stoma was used to mobilize the root of the mesentery and transfigure the pouch. Completion of the proctectomy was performed transanally. All patients underwent simple suture anastomosis. This technique appears to greatly reduce the invasive character in UC patients undergoing IAPA[81].

Robotic surgery

All types of surgeries required in UC patients (subtotal colectomy and ileostomy, robotic IAPA anastomosis, total proctocolectomy) can be successfully performed using robotic surgery. The so-called "straight-stick" laparoscopy presents some

disadvantages which contribute, among others, to the failure of IAPA. The robotic platform aims to overcome these disadvantages. As a result, robotic subtotal colectomy presents lower conversion rates as well as a quick return to normal intestinal function. Robotic subtotal colectomy requires a longer operating time compared to laparoscopic subtotal colectomy, while it has satisfactory safety in experienced hands, even when performed urgently. Finally, it is accompanied by less blood loss and hospital stay[82]. The advantages mentioned above are particularly evident in surgical interventions involving the pelvic cavity, especially in men and obese patients in whom it offers satisfactory function of the genitourinary system. The disadvantages consist of the high cost of the method and the increase in surgical time compared to conventional laparoscopy.

In conclusion, minimally invasive surgery seems to become more and more popular over time. The inevitable need for the existence of specialized surgeons in the surgical treatment of patients with IBD also contributed to this. All data indicate the need for laparoscopic surgery to be performed by specialized and experienced surgeons. Gaining experience should be done gradually, starting with, for example, simpler technical procedures such as resection of strictures of the terminal ileum and expanding the indications to more complex situations, as experience increases. The decision to treat a patient with minimally invasive surgery should be made, based on the clinical characteristics of the patient and the level of expertise possessed by the surgeon. There is a need to conduct studies with a larger number of patients to adequately document the advantages of the method.

SPECIAL TOPICS IN THE SURGICAL TREATMENT OF UC

Haemorrhoidectomy in patients with UC: Should it be performed?

In a systematic review of 10 retrospective studies that included 222 patients, (54% with CD and 46% with UC) who underwent surgical hemorrhoidectomy (open or closed, elastic band ligation, resection or transection of thrombosed hemorrhoid, and doppler hemorrhoidal artery ligation in 70%, 18%, 6%, and 6%, respectively), some type of complication occurred in 9% (23 patients). The complication rate was more than twice as high in CD patients compared to UC patients. Existing data support that surgical treatment of hemorrhoids in patients with IBD and especially in patients with CD should be done with caution and in inactive disease. Further studies are needed to investigate the effect of applying other techniques[83].

IBD in pregnancy

Recent data suggest that all previous surgical procedures performed in female patients with IBD to treat the underlying intestinal disease including IAPA can affect pregnancy outcomes. Of interest is the finding that assisted reproductive technology in female IBD patients does not differ from that of normal women. However, existing data recommend that conception should be attempted during periods of remission. The gastroenterologist should ensure the maintenance of remission throughout pregnancy, a fact that will ensure the smooth progress of pregnancy and delivery[84].

Quality of life in operated IBD patients

It is proven that the quality of life of patients with IBD is significantly lower than in the general population and that the prevalence of depression and anxiety is higher, especially during disease flares. Repeated surgical interventions are not uncommon in the course of the disease resulting in further impairment of the quality of life of the patients. Patient-reported outcome measures are used to determine the degree of impact of the chronic disease on the patient's quality of life. The same approach can be used in the group of patients undergoing surgery, which is believed to help to more accurately assess the effect of different types of surgery on quality of life and also to assess postoperative improvement or deterioration[85].

Relationship between treatment with biological agents and occurrence of postoperative complications

The question regarding the relationship between the occurrence of postoperative complications and previous treatment with biological agents remains unanswered to some extent[86]. A meta-analysis of 20 studies, which included a total of 12494 patients of which 2254 received treatment with biological agents before surgery, attempts to answer this question. The odds ratios of infection-related complications ($n = 8067$) and total complications ($n = 11869$) were 0.98 and 1.14, respectively, suggesting that there was no statistically significant association between the use of biologic agents before surgery and the occurrence of postoperative complications. It was also found that the time interval between the last dose of the biologic agent and the time of surgery did not increase the risk of postoperative infection[87].

CONCLUSION

Surgical treatment of patients with CD and UC represents a life-saving way out for a large proportion of them. Epidemiological data concerning UC show that the overall colectomy rate has decreased over the last three decades by a significant percentage. It is argued that the introduction of biological agents into our pharmaceutical quiver has played a role in reducing the risk of colectomy. The indications for surgical treatment of UC primarily include cases of failure of conventional treatment as well as cases of the appearance of complications (perforation, severe bleeding, toxic megacolon) or high-degree dysplasia and cancer. Indications for surgical treatment of CD include acute and chronic complications (abscesses, peritonitis, fistulas) and cases of failure of the available conservative treatment. Elective surgery

is applied to patients resistant to medical treatment or patients with an obstructive phenotype. In patients with stenotic phenotype, surgery is indicated. In these patients, segmental resection and stricturoplasty have advantages and disadvantages. Kono-S anastomosis appears to be superior to conventional anastomosis. Surgical management of perianal CD is important for the patient's outcome. Drainage of the abscesses before immunosuppressive therapy and a seton placement are important therapeutic modalities. Subsequently, the decision for definitive surgical management of fistulae, advancement flaps, and ligation of intersphincteric fistula tract procedures is made, after the patient's inflammatory burden is removed. Realistic therapeutic goals and a patient-oriented therapeutic approach are vital factors in treating perianal CD. The use of risk stratification models is important to guide management decisions. Early postoperative medical prophylaxis with current therapeutic manipulations is important in preventing disease recurrence. Penetrating CD requires a broad multidisciplinary approach. Particular emphasis should be placed on nutrition, skincare, and management of intestinal failure. Early surgical treatment is currently desirable. Appropriate preoperative imaging, good conservative management and surgical decision-making based on the surgeon's experience and available evidence play a key role in the success of surgery. It is emphasized that a multidisciplinary medical approach to the patient by a team including surgeons, gastroenterologists, radiologists, nutritionists, and nurses specialized in stoma care is required to achieve the optimal therapeutic outcome. The management of emergencies should be individualized based on the patient's age, the type and duration of the disease, and the objective treatment goals of the specific patient.

FOOTNOTES

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