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# Restorative Proctocolectomy: When to Propose and When to Avoid

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## Abstract

Restorative proctocolectomy with ileal pouch-anal anastomosis (RPC-IPAA) is a surgical procedure performed when excising the entire colon and rectum is needed and reconstitution of the intestinal transit through an ileal pouch is made with anastomosis to the anus. It is mainly used to treat patients with familial adenomatous polyposis (FAP) and ulcerative colitis (UC). It is a complex surgery with potential complications, and the functional outcomes can be worse over time. So, it is essential to select the appropriate patient, proceed to a correct surgical technique, and know-how to deal with and solve the main ileal pouch complications. This chapter intends to be a reflection on this subject.

**Keywords:** restorative proctocolectomy, ileal pouch-anal anastomosis, ileal-anal pouch complications, ileal-anal pouch failure, ileal-anal pouch results, familial adenomatous polyposis, ulcerative colitis, Crohn's disease

## 1. Introduction

Restorative proctocolectomy with ileal pouch-anal anastomosis (RPC-IPAA) is a complicated colorectal surgical procedure. It is mainly used to treat patients with familial adenomatous polyposis (FAP) and ulcerative colitis (UC). It is also performed to treat selected patients with Crohn's disease (CD), indeterminate colitis, and synchronous colorectal cancer (CRC) [1]. Among these pathologies, ulcerative colitis is the primary postoperative histopathological diagnosis, as Fazio data show, in 2013 [2].

IPAA surgery, first described by Parks and Nicholls in 1978 [3], aims to definitively cure disease and prevent malignant degeneration while providing adequate continence and avoiding a permanent stoma.

The majority of patients experience long-term success but are not absent from significant surgical complications. The main ones are pelvic sepsis, pouchitis, pouch failure, fecal incontinence, female infertility, and sexual dysfunction. Others, like stenosis, pouch dysplasia/cancer, IPAA prolapse, preileal IPAA pouchitis, and anemia, are rare [4].

IPAA results depend on several factors, such as the pathology underlying and specific features, gender, age, IBM, patient comorbidities, surgical techniques, and surgeon experience.

So, before to propose or avoid RPC with IPAA, there are aspects to take into account:

- What is the underlying pathology, and if the RPC indication is absolute or relative;
- if the patient needs a total proctocolectomy or if it is possible to spare part of the rectum;
- rule out the presence of relative or absolute contraindication for IPAA and also,
- evaluation of all elements that increase the risk of IPAA failure.

## 2. Indications for proctocolectomy: the underlying pathology and specific features

There is specific colorectal pathology that, during its natural development, requires a colectomy or a proctocolectomy, with or without restorative gest. Let us analyze the characteristics of the different underlying pathology and how they can influence the surgical decision.

### 2.1 Familial adenomatous polyposis

FAP is an inherited disease classically characterized by the development of hundreds to thousands of adenomas in the rectum and colon during the second decade of life (**Figure 1**). A less aggressive variant of FAP is the so-called attenuated FAP (aFAP), where the rectum is frequently spared.

Although FAP is responsible for less than 1% of colorectal malignancies, untreated individuals with FAP carry a 100% risk of colorectal cancer by 40–50 years.

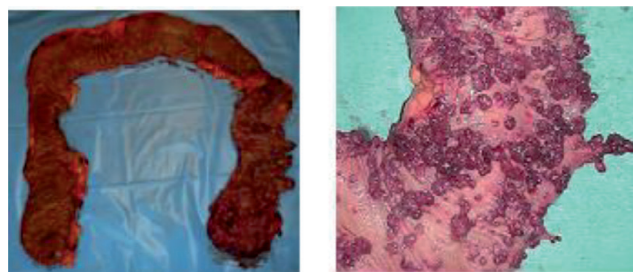
Thus, for patients with FAP, the single way to prevent colorectal cancer is surgery.

Nowadays, it is widely accepted that RPC-IPAA is the procedure of choice to treat patients with classical FAP.

We can choose for aFAP, total abdominal colectomy with ileorectal anastomosis (TAC-IRA), or proctocolectomy with stapled ileal pouch distal rectal anastomosis (CP-IPDRA).

FAP highlights:

- young population; absolute indication for surgery; if present rectal involvement, proctocolectomy is required; higher risk of desmoid in some family; RPC-IPAA is the procedure of choice to treat patients with classical FAP; RPC-IPAA easier in FAP than in UC [5].



**Figure 1.**  
*Familial adenomatous polyposis – colon details.*

## 2.2 Ulcerative colitis

UC is a chronic inflammatory condition characterized by continuous mucosal inflammation of the colon and rectum.

Nowadays, surgery is required in a limited number of patients with UC, either in an elective or in an emergency setting.

In patients with UC and indication for surgery, RPC is widely considered the gold standard surgical procedure. However, TAC-IRA is justified for some particular cases.

Emergent colectomy in UC is indicated in acute severe UC, not responding to medical therapy, or when complications occur such as severe bleeding, toxic megacolon, and colon perforation [6].

### 2.2.1 Acute severe ulcerative colitis, not responding to medical therapy

Acute UC is considered severe when the patient has at least 10 stools per day, tachycardia, fever, anemia, and increased erythrocyte sedimentation rate (ERS)/C reactive protein (CRP). The severity of ulcerative colitis classification by Truelove and Witts distinguishes acute severe ulcerative colitis from fulminant ulcerative colitis [7]. All authors do not recognize this division, but it makes it possible to infer the probability of failure with corticosteroid therapy and the need for a total colectomy (**Table 1**).

Acute severe UC, not responding to medical therapy, is one of the few cases that require emergent colectomy in UC. As shown in the management of flowchart in ASUC situations (**Figure 2**), about 30% of cases do not respond to corticosteroid therapy, and 50% of the ASUC will require surgery during the following year [8].

According to Saha et al., the policy of early colectomy, within 7 days, in patients with ASUC who fail to respond to intensive steroid-based therapy improves perioperative outcomes with significantly low in-hospital mortality and morbidity [9].

Disease severity	Features
Slight	<4 stools/day with +/- blood, normal ESR, Without sepsis signs
Mild	4–6 stools/day with occasional blood loss, minimal signs of sepsis, CRP ≤30 mg/L
Severe	≥6 bloody stools/day with any of the following parameters: <ul style="list-style-type: none"> <li>• temperature &gt; 37.8°C</li> <li>• tachycardia &gt; 90 ppm</li> <li>• anemia, Hgb &lt; 10.5 g/dL</li> <li>• ERS &gt; 30 mm/h,</li> <li>• CRP &gt; 30 mg/L</li> </ul>
Fulminant	10 stools/day with continued bleeding, abdominal distension and tenderness, need of blood transfusions, toxic megacolon in X-ray.

CRP = C reactive protein; ERS = erythrocyte sedimentation rate; Hgb = hemoglobin.

**Table 1.**  
 Ulcerative colitis severity classification. Adapted from Truelove and Witts criteria.

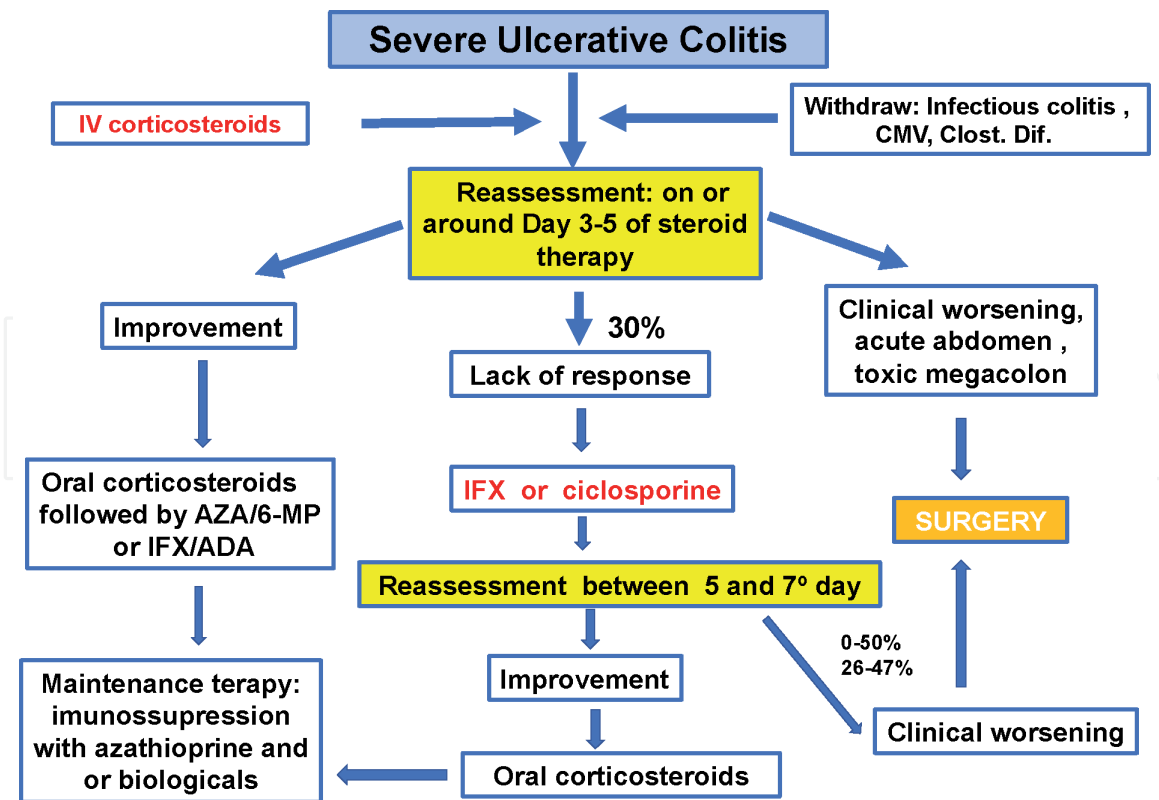


Figure 2. Management of flowchart in acute severe ulcerative colitis.

On the other hand, when complications occur in severe ASUC, such as severe bleeding, toxic megacolon, and perforation, emergency surgery is mandatory. In these particular situations, the timing of colectomy is of utmost importance to reduce the postoperative complication rates.

### 2.2.2 Complications of acute severe ulcerative colitis

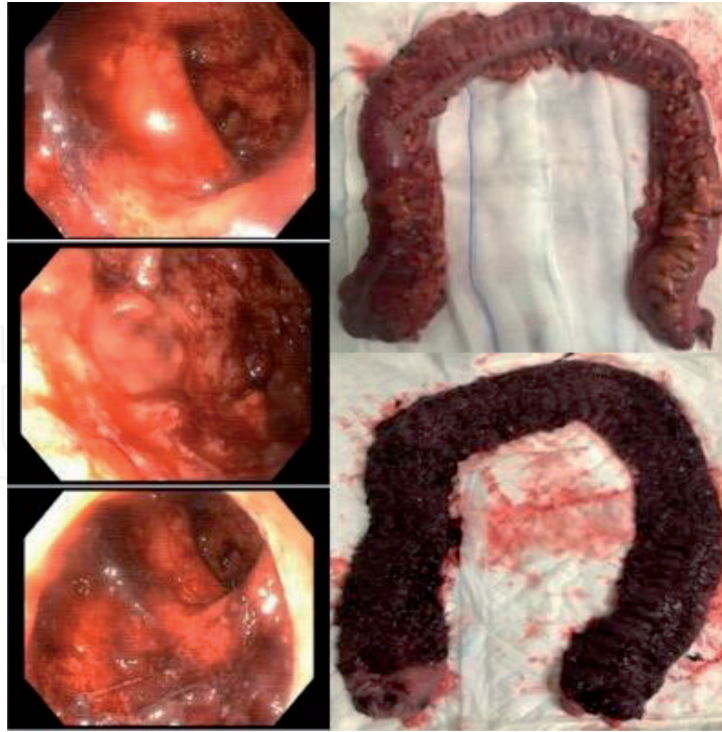
Severe bleeding, toxic megacolon, and perforation are the main complications of ASUC (Figures 3 and 4).

They are rare, but their presence increases surgery morbidity and mortality. If the UC surgery is urgent or emergent, the decision to perform surgery should be made in a multidisciplinary team, including the gastroenterologist and colorectal surgeon. In those cases, surgery is usually performed in three-step. Total colectomy, the first step, is made in an emergency room. The other steps electively, after confirmed diagnosis in the resected specimen.

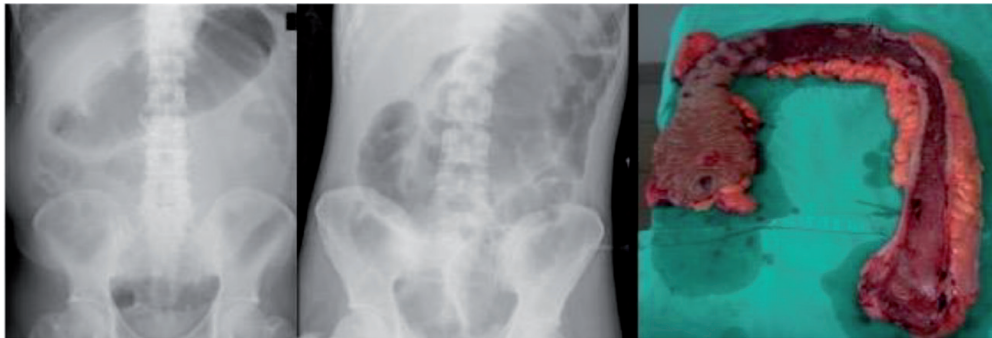
### 2.2.3 Chronic refractory UC

Elective RPC for UC is indicated in chronic refractory UC (Figure 5) and also in the presence of high-grade dysplasia (HGD) or colorectal malignancies.

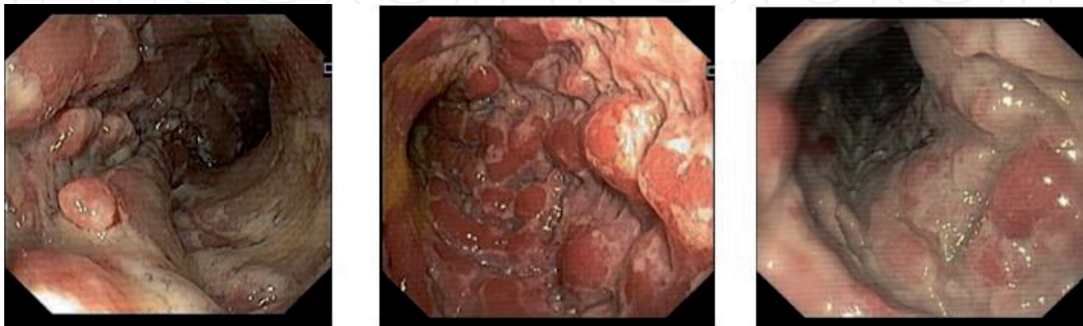
The introduction of biologic therapy has added further complexity to medical management decisions, surgery, and the relative timing of these choices. Appropriate medical management of UC may induce and maintain remission and may prevent surgery. However, medical management also carries risks of adverse effects, and recent data suggest that delay of surgery during ineffective medical therapy can increase the chances of adverse surgical outcomes. To make individualized, timely treatment decisions, early collaboration between gastroenterologists and surgeons is essential, and more data on predictors of treatment response and



**Figure 3.** Severe bleeding in acute severe ulcerative colitis not a responder to corticosteroids and infliximab. Surgery was performed in the emergency room.



**Figure 4.** X-ray and surgical specimen of toxic megacolon reports. There are more frequent in extensive ulcerative colitis than in ulcerative proctosigmoiditis. Surgical mortality is 1–8% that rises to 40% in colon perforation with peritonitis.



**Figure 5.** Endoscopic images of chronic refractory ulcerative colitis.

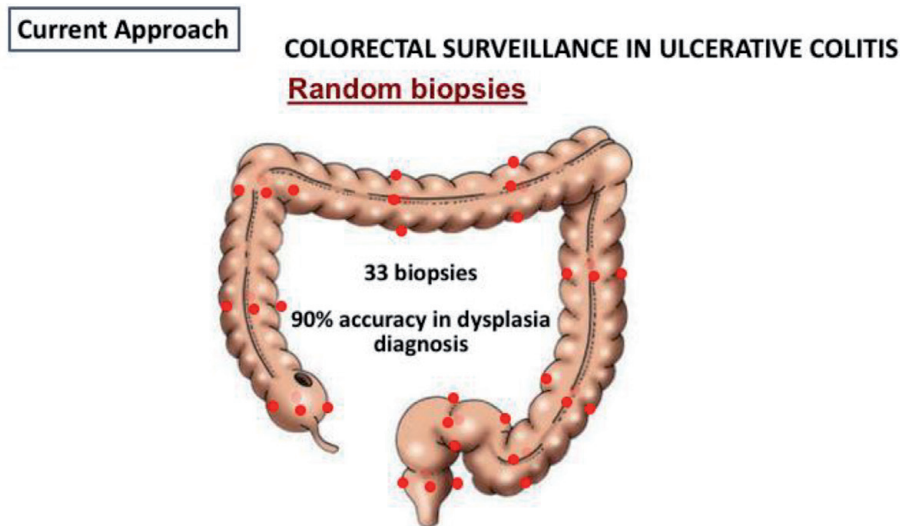
positive outcomes are needed. Early identification of patients who would benefit from biologic therapy or surgery is challenging, and the definition of chronic refractory ulcerative colitis (CRUC) difficult. In CRUC (**Figure 4**), several therapeutic

options have already been tried, such as infliximab, adalimumab, cyclosporine, azathioprine with 6-mercaptopurine, tacrolimus, or fecal transplantation, without success. When the therapeutic side effects are unbearable, or despite treatment, the patient has no quality of life, and RPC with IPAA may be the best solution.

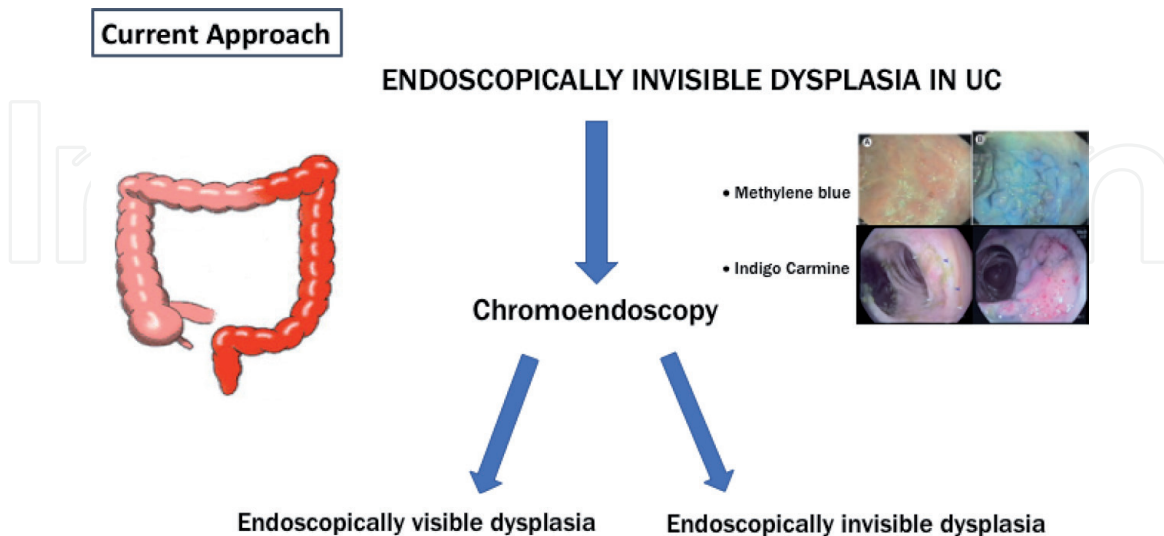
### 2.3 Presence of high-grade dysplasia or colorectal malignancies

The presence of high-grade dysplasia (HGD) or colorectal cancer is another indication for elective RPC with IPAA in IC.

Colorectal surveillance in UC obeys specific rules (**Figure 6**) [10], and chromoendoscopy has an essential role in dysplasias identification (**Figure 7**) [11, 12]. In UC surveillance, the chromoendoscopy allows to split the cases in visible dysplasia and invisible dysplasia (**Figure 7**) [13, 14].

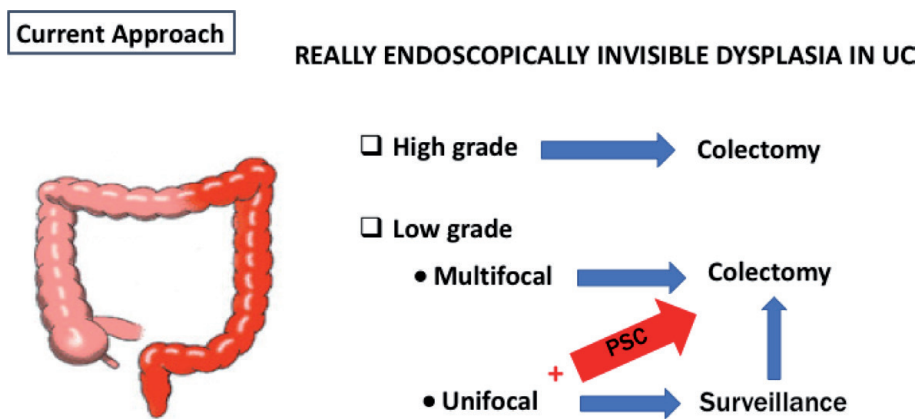
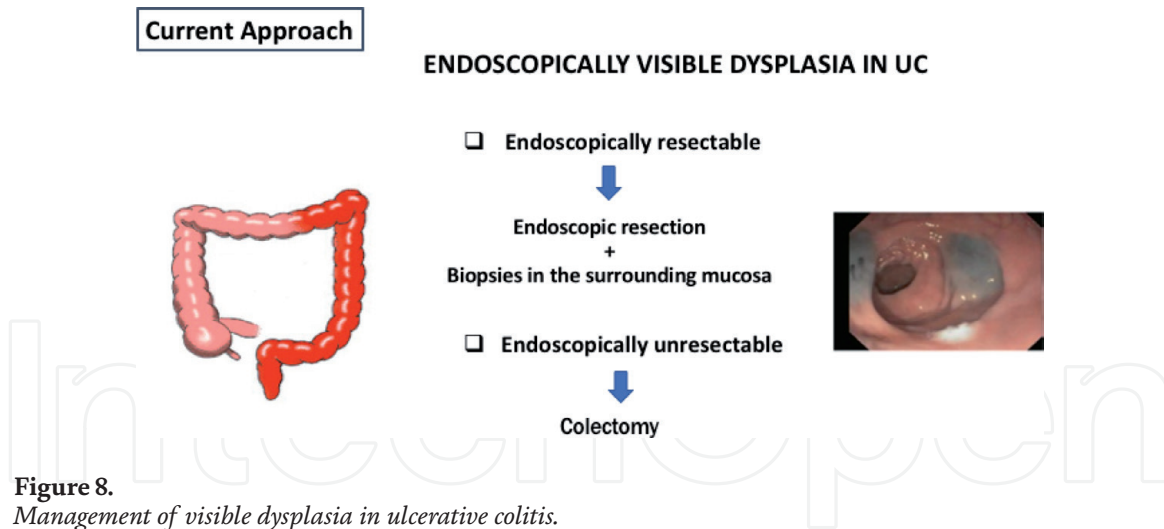


**Figure 6.**  
*Colorectal surveillance in UC (33 biopsies allow 90% accuracy in dysplasia diagnosis).*



**Figure 7.**  
*Role of chromoendoscopy in dysplasia endoscopic visibility.*

Nowadays, dysplasia management in UC takes into account the grade and number of dysplasia, whether visible or not, and the presence of primary sclerosing cirrhosis (PSC) (**Figures 8 and 9**) [11, 15, 16].



Risk factor	Magnitude of the risk	References
Primary sclerosing cholangitis	OR: 4.0	Soetikno RM et al. <i>Gastrointestinal Endoscoc</i> 2002 [19]
Disease duration		
Cumulative incidence 20 years	2.5–8.0%	Eaden et al. [20]
Cumulative incidence 30 years	7.5–18.0%	Lakatos PL et al. <i>World J Gastroenterol</i> [21]
Extent of inflammation		
Pancolitis	SIR: 5.1–14.8	Eaden et al. [20]
Left-sided colitis	SIR: 2.1–2.8	Soderlund S et al. <i>Gastroenterology</i> 2009 [22]
Pseudopolyposis	OR: 2.1–2.5	Velayos FS et al. <i>World J Gastroenterol</i> . 2013 [23] Rutter MD et al. <i>Gut</i> . 2004 [24]
Family history of CRC	RR: 2.4–9.2	Velayos FS et al. <i>World J Gastroenterol</i> . 2013 [23] Rutter MD et al. <i>Gut</i> . 2004 [24]
Degree of inflammation		
Endoscopy	OR: 2.5	Rutter MD et al. <i>Gut</i> . 2004 [24]
Histology	OR: 5.1	

**Table 2.**  
 CRC risk factors in ulcerative colitis.



In a systematic review of the literature, Fumery et al. found that among patients with UC-LGD under surveillance, the annual incidence of progression to CRC was 0.8%. Concomitant primary sclerosing cholangitis, invisible dysplasia, distal location, and multifocal LGD are high-risk features associated with dysplasia progression [17].

In UC patients with high-grade dysplasia or colorectal cancer (CRC), the colon and rectum should be removed with *en bloc* oncologic resection of lymph nodes in all colonic segments due to the high risk of multiple synchronous tumors and preoperative under staging (ECCO statement 9A) [18].

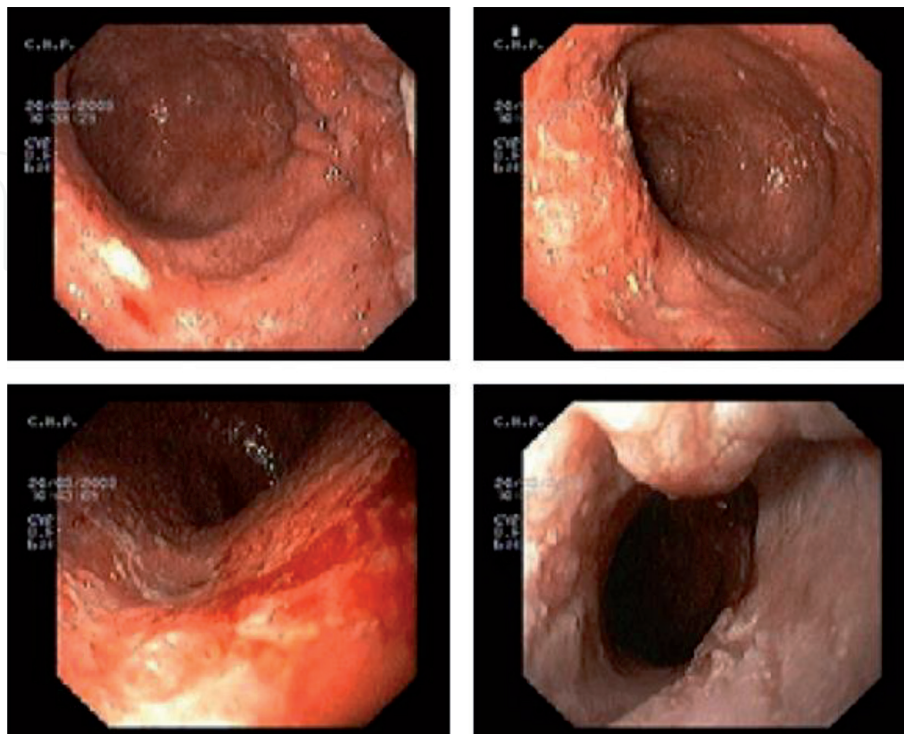
The risk of colorectal cancer in UC is increased compared with the general population (Table 2) [19–24]. Moreover, it is estimated to be around 18% after 30 years of UC duration [20].

Occasionally, total abdominal colectomy with ileorectal rectal anastomosis (TAC-IRA) can be considered.

## 2.4 Colitis in Crohn disease

Some of the patients with an acute severe colitis inaugural picture have indeterminate colitis or Crohn colitis. When they indicate emergency surgery, the first step is the colectomy. The realization of an elective restorative proctectomy with an IPAA must be individually analyzed. Patients with CD after IPAA, when compared with UC, have a fivefold higher risk of failure, twofold risk of strictures, and a sixfold risk of fistulae. This risk is much higher if the diagnosis is performed only after IPAA. However, function in those who retain the pouch seemed similar to that of patients with UC. CD does not increase the risk of pouchitis. IPAA could be offered to a selected population of CD patients after proper preoperative counseling (Figure 10).

Ileal pouch rectal anastomosis seems to be another viable alternative to permanent ileostomy in Crohn's proctocolitis patients. IPRA offers durable preservation



**Figure 10.**  
Nine years after IPAA in a patient with Crohn's disease.

of bowel continuity and proper function and quality of life (QOL) in selected CC patients who might otherwise require a permanent ileostomy [25].

### **3. When the rectum can be partially spare**

When the rectum can be partially spare, total abdominal colectomy with ileorectal anastomosis (TAC-IRA), a less complicated colorectal surgical procedure than RCP-IPAA, is an option. These solutions must be considered in attenuated familial adenomatous polyposis (aFAP) and synchronous colorectal cancer, and infrequently in UC and Crohn's disease.

The assessment of the rectum state is a parameter to consider when the surgical plan procedure is made. In FAP, behind the number of polyps present in the rectum (less than 10), the aggressiveness and development of extracolonic symptoms of the disease are other aspects to take into account. The mutation site on the APC gene is associated with the FAP phenotype, including desmoid tumor (DT) development. The more distal the mutation (closer to 3' end), the higher the risk of the patient being affected by the desmoid tumor [1, 9, 17]. Typical disease symptoms were observed in families who harbored mutations between exon 4 (codon 169) and codon 1393 of exon 15. Mutations beyond codon 1403 were associated with a more varied phenotype concerning the development of extracolonic symptoms, namely desmoid tumor (DT). Their presence is related to aggressiveness disease and usually dictates the outcome of the patient. Despite the possibility of DT arising in any location, DT related to FAP is mostly on the abdominal region: intra-abdominal, on the abdominal wall, and transabdominal. Some of them take a benign course, with slow evolution, stabilization of growth, or even remission. Others show aggressive behavior with rapid growth and mass effect on surrounding structures, particularly in intra-abdominal DT. Possible complications of intra-abdominal DT are intestinal obstruction, ischemia, hemorrhage, and perforation or ureteric obstruction [1, 4, 8]. When DT develops in FAP patients, they can be the reason for the pouch failure case, and they are the second most common cause of mortality [20].

In synchronous CRC, the rectal tumor stage and location define the surgery to perform. If the rectum can be spare, TAC-AIR is the choice. RPC-IPAA with total mesorectum excision and with or without neoadjuvant chemoradiotherapy may be the solution in selected patients with medium or distal rectal cancer, depending on if the tumor is localized or locally advanced.

In IBD with proctocolitis involvement, rectum spare is controversial, mainly in ulcerative colitis. The decision-based in the absence of activity in the rectal mucosa.

### **4. When the rectum cannot be spare**

When the rectum cannot be spare, it is mandatory to rule out the presence of relative or absolute contraindication for IPAA. There are absolute contraindications for IPAA: They are the presence of poor anal sphincter function with fecal incontinence in all pathologies, the distance between the tumor and pectin line inferior to 1 cm or sphincter involvement in distal rectal cancer, and the presence of perianal disease beyond proctocolitis in Crohn disease. The aggressive phenotype in FAP, indeterminate proctocolitis, and Crohn's disease, with involvement limited to the colon and rectum, are the relative contraindications. Morbid obesity increased technical difficulties and can be considered a relative contraindication, as the willingness in young women to get pregnant.

#### 4.1 Evaluation of factors that increase the risk of IPAA failure when rectum cannot be spared

RCP with IPAA is, in fact, a complicated colorectal surgical procedure even in the hands of experienced high-volume surgeons. In an extensive series of 1789 patients undergoing proctocolectomy, IPAA was attempted but abandoned intraoperatively in 4.1% [26].

So, the relative indication for that type of elective surgery must be carefully considered. Several aspects must take into account for surgery plan mainly in UC cases:

- the pathology underlying and specific features;
- if the surgery is elective or urgent;
- patient age;
- patient comorbidities;
- patient anal sphincter and rectum status;
- and the experience of the surgeon.

Moreover, weigh the risk and frequency of IPAA morbidity and the patient is will after informed consent, which are also factors that influence the surgical decision.

#### 5. Surgical alternatives to IPAA after a proctocolectomy/total colectomy

RPC-IPAA is “the gold standard” procedure to treat patients with classical FAP and elective surgery in UC, although other surgical solutions are possible (Table 3).

Operation	Advantages	Disadvantages
Rectal mucosectomy with ileal pouch-anal canal Anastomosis	Complete excision of large intestinal disease Transanal defecation and fecal continence preserved No ileostomy	Two operations required At risk for pouchitis Nocturnal fecal spotting present
Stapled ileal pouch-distal rectal anastomosis	Transanal defecation and fecal continence preserved No ileostomy Easier technically	At risk for pouchitis and cancer from residual rectal mucosa
Continent ileostomy	Complete excision of large intestinal disease Fecal continence preserved No external appliance	Stoma present Intubation of pouch required At risk for pouchitis and need for valve revision
Brooke ileostomy	Complete excision of large intestinal disease One operation	Stoma present, risk of parastomal hernia Incontinent for feces Need of external appliance
Ileorectal anastomosis	Transanal defecation and fecal continence preserved No ileostomy	Diseased rectum remains to produce symptoms, require treatment, and predispose to cancer

**Table 3.**  
*Bowel transit reconstruction types after a proctocolectomy/total colectomy.*

## 6. IPAA surgical procedure and technical aspects that interfere in pouch results

RPC-IPAA is a complex procedure that pouch results also depend on technical surgical details and surgeon experience.

### 6.1 RPC-IPAA procedure

RPC with IPAA is a procedure that can be made in one, two, or three stage, by laparoscopic or open surgery.

The laparoscopic approach, if feasible, allows better cosmetics and outcomes.

One-stage or two-stage procedure is recommended for elective surgery and three-stage for emergent surgery.

Stage 1—An ileal pouch is made, and anastomosed to the anus is made after de proctocolectomy without a protective ileostomy. The operation is made in elective surgery and completed in a single stage (one surgery).

Stage 2—After a PC and IPAA confection, the anastomosis is protected by a loop ileostomy, and ileostomy closure is posterior realized (two surgeries).

Stage 3—At the emergency room, the first step is the total abdominal colectomy and ileostomy. The second step is the IPAA with the anastomosis protected by a loop ileostomy. The third surgery is the ileostomy closure (three surgeries).

Due to anastomotic complications (infection, fistulization, development of Crohn's disease, disease recurrence, or poor function), an ileostomy may be required (stage 2) to prevent complications or if the pouch fails postoperatively. The authors are not unanimous about the need to do a derivative ileostomy by routine during IPAA construction (stage 1 vs. stage 2).

Lovegrove et al. found to be associated with ileostomy omission: stapled anastomosis (odds ratio [OR], 6.4), no preoperative corticosteroid use (OR, 3.2), familial adenomatous polyposis diagnosis (OR, 2.6), cancer diagnosis (OR, 3.4), female sex (OR, 1.6), and age at surgery younger than 26 years (OR, 2.1) ( $p < 0.01$  for all). They are convinced that incorporating a five-point nomogram in the preoperative assessment of patients undergoing RPC might help clinicians identify a select group of patients who may be candidates for ileostomy omission during RPC [27]. Karjalainen et al. showed in their study that a diverting ileostomy is associated with considerable morbidity, and it does not seem to prevent later failure of the pouch. Therefore, they suggest that a diverting ileostomy should only be constructed for high-risk patients [28]. On the other hand, Rottoli et al. demonstrated that closure of ileostomy after three-stage IPAA is associated with a low rate of serious complications, despite the higher number of previous abdominal surgeries, supporting the construction of routine ileostomy during IPAA to reduce the risk of pelvic sepsis [29].

### 6.2 IPAA pouch confection

The most used pouch configurations are the J-pouch and de S-pouch, wherein most centers opt for J-pouch. S-pouch is usually reserved for patients with high IBM, short mesentery, or handsewn anastomosis necessity. Wu et al. recommend using an S-pouch when constructing an IPAA with a handsewn technique. A total of 502 patients included 169 patients with an S-pouch (33.7%). The frequencies of short-term complications in the two groups were similar ( $p > 0.05$ ), but pouch fistula or sinus ( $p = 0.047$ ), pelvic sepsis ( $p = 0.044$ ), postoperative partial small-bowel obstruction ( $p = 0.003$ ), or postoperative pouch-related hospitalization ( $p = 0.021$ ) occurred in fewer patients with an S-pouch. At a median follow-up of 12.2 (range, 4.3–20.1) years, patients with an S-pouch were found to have

fewer bowel movements ( $p < 0.001$ ), less frequent pad use ( $p = 0.001$ ), and a lower fecal incontinence severity index score ( $p = 0.015$ ). The pouch failed in 62 patients (12.4%), but neither univariate nor multivariate analysis showed a significant association with pouch configuration IPAA surgery stage [30].

### **6.3 IPAA-mucosectomy vs. anal transactional zone mucosa and handsewn vs. stapled anastomosis**

The IPAA can be made with transanal mucosectomy and handsewn anastomosis or preserving the anal transitional zone mucosa in a small rectal cuff and stapled anastomosis.

Dafni et al. refer that stapled IPAA and younger age at the onset of UC correlated with better functional results, and the HRQOL scores were high [31].

Kirat et al. studied the influence of stapler size used at IPAA on the anastomotic leak, stricture, long-term functional outcomes, and quality of life. They analyzed the stapled IPAA performed between 1983 and 2007: A (stapler size 28–29 mm) ( $n = 1,221$ ) and B (stapler 31–33 mm) ( $n = 899$ ). They did not find a significant difference in rates of leak (4.5% vs. 6.2%,  $p = 0.08$ ) or stricture (1.9% vs. 2.7%,  $p = 0.1$ ) for groups A and B. There was no significant association between the size of the stapler used at IPAA and long-term complications [32].

## **7. Main surgical complications in restorative proctocolectomy with ileal pouch anal anastomosis (RPC-IPAA)**

Surgical complications in RPC with IPAA are not unusual as functional deterioration of pouch and quality of life (QOL). Fazio et al. encountered in their data early perioperative complications in 33.5% of patients with a mortality rate of 0.1%. On the other hand, he refers to good functional outcomes and QOL in 95% [2]. Nevertheless, these results by Fazio, mainly the functional outcomes of the IPAA, are not reached in all centers, probably depending on the surgeon experience and the high patient volume. The most leading and frequent IPAA complications are described as follows:

### **7.1 Pelvic sepsis**

Pelvic sepsis occurs in 9% of the procedure, and its presence increases the risk of pouch failure. Pelvic sepsis is a common early complication with far-reaching consequences of long-term pouch dysfunction, but prompt intervention (either radiological or surgical) reduces the risk of pouch failure. According to Lavryk et al., 4031 patients who underwent IPAA in 1983–2014 (patients with Crohn's disease or cancer were excluded), 357 (8.8%) developed IPAA-related pelvic sepsis with or without anastomotic dehiscence [33].

### **7.2 Acute pouchitis**

The inflammation of the IPAA can appear in acute (60%) or chronic (60%) form.

Kayal et al. state 53% that acute pouchitis occurred in 205 patients (53%), 60 of whom (30%) progressed to chronic pouchitis [34].

Hashavia et al. followed prospectively 201 UC patients who underwent IPAA (1981–2009 for a mean of 108 months). A total of 138 (69%) of these had either a regular pouch or episodes of acute pouchitis and 63 (31%) developed chronic pouchitis [35].

### 7.3 Pouch failure rate

Pouch failure rates range from 5.5 to 8.5%, depending upon the length of follow-up [36]. In Fazio data, 3707 patients underwent primary pouch, and 328 (8.1%) redo pouch surgery (primary surgery in other centers). Pouch failure occurred in 197 (5.5%) of the 3707. During a median follow-up of 84 months, 119 patients (3.2%) required excision of the pouch, 32 (0.8%) had a nonfunctioning pouch, and 46 patients (1.2%) had redo IPAA [2].

### 7.4 Fecal incontinence: mild – 17%; severe – 3.7%

Mild fecal incontinence is a common complication of IPAA and seems to worsen with time [37].

Mild and severe fecal incontinence during the day: 17 and 3.7% of patients, respectively.

(Incontinence during the night: 13.1 and 4.5%; urge incontinence during the day: 7.3%).

At 12 months post-IPAA, it has been reported that 19% of patients suffered occasional daytime incontinence, and 49% suffered nocturnal incontinence [7]. Consequently, this can have a significantly negative impact on the quality of life of patients. The evidence to support the use of SNS for fecal incontinence after IPAA remains very limited.

### 7.5 Female infertility

Studies have shown that fertility in women with UC is comparable to the background population but drops following restorative proctocolectomy [38].

This problem can be restricted, opting for a laparoscopic approach and using *in vitro* fertilization.

Laparoscopy was associated with a significantly reduced time to conceive compared with the open approach [39].

Females with RPC for UC have an increased incidence of *in vitro* fertilization by more than a factor of three. The odds that a treatment results in live birth are similar, and six times more children are born due to *in vitro* fertilization compared with females without restorative proctocolectomy [40].

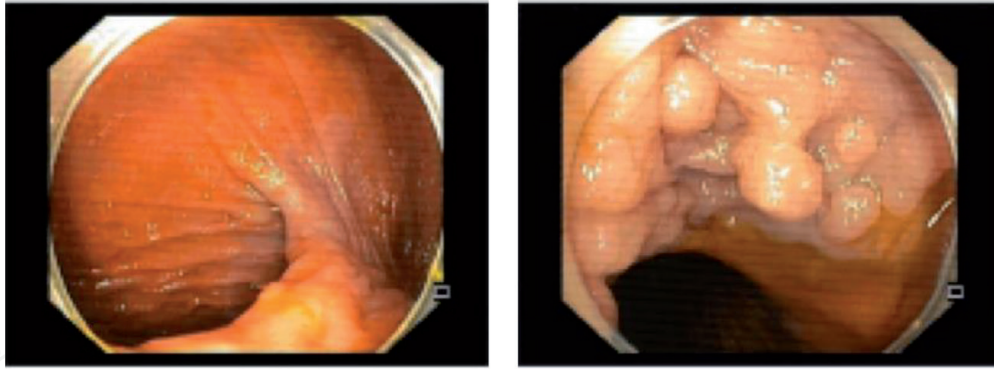
### 7.6 Sexual dysfunction: 1.5–4%

Sexual dysfunction can appear after RCP with IPAA. Postoperative impotence and retrograde ejaculation have been observed in approximately 1.5–4% of men, respectively. Transient dyspareunia occurs in about 7% of women [41].

### 7.7 Pouch dysplasia/cancer: 1%

About 1% of patients develop dysplasia or carcinoma after surgery, which occurs in the retained rectum, anal transitional zone, or ileal pouch, depending upon the procedure performed.

Mark-Christensen et al. analyzed 1723 patients with IPAA operated for ulcerative colitis in the period 1980–2010 that matched to 8615 individuals from the background population. They concluded that pouch cancer following IPAA is sporadic, questioning the need for general, rather than selective, surveillance. The overall cancer risk is comparable to that of the background population (**Figure 11**).



**Figure 11.** *Nine years passed between RCP with IPAA for FAP. The residual polyps were appearing in IPAA, easily handled by endoscopic surveillance with polypectomy.*

The increased risk of hepatobiliary cancer is likely an effect of coexisting liver disease and not causally related to IPAA [42].

## 8. Conclusion

RCP with IPAA in the hands of experienced high-volume surgeons is a safe procedure associated with good functional results, provided that the risk-benefit is appropriately weighted.

## 9. Take-home messages

- RPC with IPAA is the golden standard procedure for FAP and selected UC when the rectum cannot be spared, and the patient has a normal anal sphincter function.
- RPC with IPAA can also be performed in some patients with indeterminate colitis, Crohn's disease, and synchronous CRC.
- IPAA has morbidity and functional results that worsen with time, mainly if the underlying pathology is Crohn's disease or indeterminate colitis.

To propose an RPC with IPAA, it is necessary:

- to confirm a normal anal sphincter function and the need for total proctocolectomy;
- know the underlying pathology and specific features;
- assess the risk of pouch morbidity and dysfunction taking into account beyond the underlying pathology:
  - patient age, gender, IBM, and comorbidities.
  - indication for the surgery.
  - the time between the onset of the disease and surgery.
  - experience of the center in RPC with IPAA and patient's will.

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