Key Concepts

- Patients with ulcerative colitis should be managed by a multidisciplinary team of gastroenterologists, surgeons, pathologists, enterostomal therapists, and nutritionists.
- Preoperative weight management, improvement of nutrition, and optimization of medical therapy before proceeding with construction of the ileal pouch anal anastomosis are critical steps to achieve optimal long-term functional results.
- Laparoscopy should be considered the standard of care for elective surgery for ulcerative colitis.
- While ileal pouch anal anastomosis should be considered the standard of care in the surgical treatment of ulcerative colitis patients, the surgical plan should be individualized both in terms of staged approach and restoration of intestinal continuity.
- Long-term follow-up of patients with an ileal pouch anal anastomosis is mandatory, even though the risk of malignant degeneration remains quite low.

Indications for Surgery

Approximately 25–30% of patients with UC will undergo surgical intervention in their lifetime, with up to 10% of patients requiring surgery within the first year of diagnosis due to a variety of elective and emergent causes (Table 50-1) [1]. The timing of surgery depends on the indication and severity of disease.

Elective Surgery

Elective indications for surgery include failure of medical management, complications or side effects associated with medications, dysplasia or invasive cancer, extraintestinal manifestations, and growth retardation in children and adolescents. Patients with active disease despite optimization of maintenance therapy are often in better general health than patients with fulminant colitis, but may undergo surgery in order to avoid corticosteroid dependency.

A diagnosis of high-grade dysplasia (HGD), dysplasia-associated lesion or mass (DALM), or invasive carcinoma in a patient with UC is an absolute indication for surgery. The diagnosis of dysplasia or cancer can be challenging in the setting of UC; therefore, it is imperative to obtain confirmation from two experienced GI pathologists [2]. The overall rate of colorectal cancer in patients with UC is 3.7% with a risk of 2% at 10 years, 8% at 20 years, and 18% at 30 years [3]. Synchronous and metachronous dysplasia and carcinoma are more common in patients with UC than in the sporadic colorectal cancer population. Kiran et al. recently reported a 14% synchronous cancer and 55% synchronous dysplasia rate in 176 UC patients with colorectal cancer [4]. The recommended procedure for UC patients with colorectal cancer or HGD is therefore proctocolectomy with end ileostomy or ileal pouch anal anastomosis (IPAA).
The need for and timing of surgery in patients with low-grade dysplasia (LGD) remains highly debated. The 5-year progression rate from LGD to HGD or colorectal cancer is reported to be as high as 54% [5, 6]. In addition, patients may progress from LGD to colorectal cancer without intervening evidence of HGD. However, there are a number of small, observational studies which do not show a clear progression of dysplasia and have resulted in the recommendation by some that LGD can be followed with close endoscopic surveillance with surgery reserved for patients developing HGD or colorectal cancer. Recently, endoscopic mucosal resection and endoscopic submucosal dissection have emerged as possible therapeutic techniques in the treatment of UC-associated dysplasia [7, 8].

There are two widely accepted elective surgical options: total proctocolectomy with an end ileostomy or restorative proctocolectomy with ileal pouch anal anastomosis (IPAA), which may be performed in one, two, or three stages. Total abdominal colectomy with an ileorectal anastomosis is a third but rarely used option. The choice of elective procedure is individualized based on the patient and the clinical setting, and it will be discussed later in this chapter.

Emergent Surgery

Emergent indications for surgery include toxic megacolon, sepsis, or fulminant disease not responsive to medical therapy, perforation, and severe bleeding. Perforation and massive hemorrhage occur less frequently than fulminant colitis but are absolute indications for surgery, whereas toxic megacolon and severe acute flares may respond to intense medical therapy.

Toxic megacolon is a life-threatening complication of UC and there should be a low threshold for surgical intervention. An initial trial of conservative therapy with bowel rest, intravenous fluids, broad-spectrum antibiotics, and close monitoring for 24–48 h may be cautiously attempted. While infliximab and cyclosporine have been demonstrated to successfully treat toxic megacolon secondary to UC in 25–40% of patients, associated morbidity and mortality rates are high [9]. Worsening clinical signs or evidence of increasing colon dilation with “thumb printing” or pneumatosis on radiologic imaging are indications for surgery.

Severity of UC can be characterized as mild, moderate, severe, or fulminant depending on the number of daily bowel movements, systemic symptoms, and inflammatory markers (Table 50-2) [10]. While advances in medical therapy have resulted in the avoidance or delay of surgical intervention in some patients with severe or fulminant disease, a colorectal surgeon should be consulted in these cases, particularly if the patient requires hospital admission. Early collaboration between the medical and surgical teams ensures that the patient understands that colectomy is an alternative if the colitis is refractory to medical management or if their clinical status deteriorates.

In patients admitted to the hospital with fulminant UC, steroids and other rescue therapies will often be initiated. It is important to objectively assess these patients on a regular basis by monitoring hematologic parameters, C reactive protein (CRP) levels, stool frequency, abdominal exams, and abdominal imaging. Colectomy is generally advocated for clinical deterioration or if there is no significant clinical improvement in 4–7 days [11]. Concomitant infection with cytomegalovirus or Clostridium difficile needs to be ruled out and appropriately treated if identified.

Critical examination of current practice reveals that the threshold for elective surgery is too high and it is important to consider surgery an alternative to medical therapy, rather than representing failed management [12]. Roberts et al. compared 3-year mortality in over 28,000 patients hospitalized for UC who had urgent or elective surgery versus medical management [13]. The elective colectomy group had the lowest mortality rate (3.7%), while the medical management and urgent colectomy groups had similar mortality rates (13.6% and 13.2% respectively, p = 0.001). A recent review of the literature further illustrates the risks of urgent surgical intervention for severe colitis by reporting a 40.1% morbidity rate [14].

In the emergent setting the most common procedure performed is a total abdominal colectomy with an end ileostomy, leaving the rectum in situ. Resection of the diseased colon eliminates the majority of the disease, alleviates symptoms, and usually allows the patient to discontinue immunosuppressive medications and return to an improved overall state of health. Completion proctectomy with or without an IPAA can then be addressed in an elective setting. Resection of the rectum at the time of emergent surgery should be avoided as it hinders future restoration of intestinal continuity and is associated with a higher risk of bleeding and injury to the autonomic nerves. Emergent proctectomy may also significantly increase the length of the procedure and the risk of postoperative complications.

Staged Operations

In the authors’ experience, there are several indications for a staged approach to surgical therapy for UC patients (Table 50-3) and this strategy is commonly utilized in clinical practice in many major IBD centers [15]. Obesity and other patient comorbidities play a significant role in the decision tree and will be discussed throughout this chapter.
In our practice, a two-stage approach (for both open and laparoscopic cases) includes a restorative proctocolectomy with an IPAA and diverting loop ileostomy as the first stage and reversal of the loop ileostomy at the second operation. A three-stage approach involves a total abdominal colectomy and an end ileostomy as the first stage, followed by a restorative proctectomy with an IPAA and diverting loop ileostomy as the second stage, and reversal of the ileostomy at the third and final operation.

The staged approach to pouch construction among complex UC patients seeks to decrease the incidence of pelvic sepsis, often related to a leak at the ileal-anal anastomosis [16, 17], and to minimize long-term sequelae of a postoperative septic complication including poor pouch function [18]. Pelvic sepsis is a frequent and serious complication of IPAA for UC and is reported to occur in up to 23 % of patients [19, 20]. Long-term outcomes after IPAA are worsened by the occurrence of pouch-related septic complications [16]. Although acceptable functional results can be achieved in highly motivated patients, multiple procedures are often necessary to achieve complete healing of an IPAA leak [17]. Hence efforts should be made to reduce such complications and to identify patients at risk of pouch-related sepsis.

Several risk factors have been postulated for postoperative pouch-related septic complications in UC including steroids [20, 21], infliximab [22, 23], and immunomodulators [24]. While the role of corticosteroids as a risk factor for postoperative complications has been described in various publications [16, 19–21], the role of infliximab has not been clearly defined to date [25–29]. Lim et al. reported that the use of corticosteroids was an independent risk factor for complications after IPAA in a dose-dependent fashion and concluded that patients receiving more than 20 mg/day of prednisone should undergo multistage pouch procedures [20]. Using this threshold as an indication for diversion, Gorfine et al. reported similar septic complication rates and functional results between patients on aggressive medical therapy and those taking no immunosuppressive and less than 20 mg of prednisone daily in the month preceding surgery [17, 30]. It is important to recognize that these studies were all conducted before the introduction of biologic therapy.

Since 2005, biologic therapy has become a significant component of medical therapy for many UC patients [31]. Unfortunately, aggressive medical management of acute flares of UC in the era of biologic therapy seems to be associated with increased postoperative infectious complications [23, 24], as patients are often referred to the surgeon malnourished, immunocompromised, and suffering from significant side effects of treatment.

Selvasekar et al. [23] found that UC patients treated with infliximab before IPAA have substantially increased odds of postoperative pouch-specific and infectious complications. In this study, the authors reported that anastomotic leaks (p = 0.02) and pouch-specific (p = 0.01) and infectious (p < 0.01) complications were more common in the group receiving biologic therapy. Similar findings were demonstrated by Mor et al. [24]. The authors found that the odds of postoperative septic complications were 13.8 times greater (p = 0.011) and the odds of late complications 2.19 times greater (p = 0.08) in the group receiving biologic therapy. Although not in a standardized fashion, the surgeons involved in this study were 2.07 times more likely to perform a staged procedure for patients receiving biologic therapy (p = 0.011) [24].

Ferrante et al. [21] reported their experience looking at 141 IPAA patients, 22 receiving biologic therapy. A moderate to high dose of corticosteroids (p = 0.003) and an IPAA without ileostomy (p = 0.001), but not the use of biologic therapy, were independent predictors of short-term postoperative infectious complications. However, they also noticed that patients on biologic therapy were more likely to undergo IPAA with a diverting ileostomy (p = 0.022). Schluender et al. [22] reported that while preoperative biologic therapy alone did not significantly increase the incidence of postoperative complications, its use in combination with cyclosporine before colectomy in refractory UC was associated with higher surgical morbidity.

Finally a meta-analysis conducted by Yang et al. [32] on five studies and 706 patients found that biologic therapy increased short-term overall postoperative complications in UC, even if there was no association when analyzing separately short-term infectious and noninfectious complications,

### Table 50.2. Ulcerative colitis disease severity scale

<table>
<thead>
<tr>
<th>Mild</th>
<th>Severe</th>
<th>Fulminant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of bowel movements/day</td>
<td>&lt;4</td>
<td>&gt;6</td>
</tr>
<tr>
<td>Rectal bleeding</td>
<td>Rare</td>
<td>Frequent</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>Normal</td>
<td>&lt;75 % of normal</td>
</tr>
<tr>
<td>ESR (mm/h)</td>
<td>Normal</td>
<td>&gt;30</td>
</tr>
<tr>
<td>Body temperature (°C)</td>
<td>Normal</td>
<td>&gt;37.5</td>
</tr>
<tr>
<td>Heart rate</td>
<td>Normal</td>
<td>Normal to slightly tachycardic</td>
</tr>
</tbody>
</table>

Modified from Truelove and Witts [10]

### Table 50.3. Indications for a staged surgical approach

<table>
<thead>
<tr>
<th>Indications for a staged surgical approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
</tr>
<tr>
<td>Medical treatment (Biologics, Steroids)</td>
</tr>
<tr>
<td>Fulminant disease/toxic megacolon</td>
</tr>
<tr>
<td>Patient comorbidities</td>
</tr>
</tbody>
</table>

Ferrante et al. [21] reported their experience looking at 141 IPAA patients, 22 receiving biologic therapy. A moderate to high dose of corticosteroids (p = 0.003) and an IPAA without ileostomy (p = 0.001), but not the use of biologic therapy, were independent predictors of short-term postoperative infectious complications. However, they also noticed that patients on biologic therapy were more likely to undergo IPAA with a diverting ileostomy (p = 0.022). Schluender et al. [22] reported that while preoperative biologic therapy alone did not significantly increase the incidence of postoperative complications, its use in combination with cyclosporine before colectomy in refractory UC was associated with higher surgical morbidity.

Finally a meta-analysis conducted by Yang et al. [32] on five studies and 706 patients found that biologic therapy increased short-term overall postoperative complications in UC, even if there was no association when analyzing separately short-term infectious and noninfectious complications,
except for a trend toward increased postoperative infections. This study was in part limited by the quality of the studies included and the small number of patients, further underpowered in the subgroup analysis.

The theoretical advantage of a three-stage approach is the opportunity to optimize the general medical condition, improve nutritional status, and wean off medical therapy during the interval following the total abdominal colectomy. While not extensively evaluated in the literature to date, this preparation period is considered important prior to attempting the more complex elements of surgical therapy, namely pelvic dissection with pouch construction and anastomosis, in order to reduce pouch-related septic complications and long-term pouch dysfunction. Recently this concept has been challenged by several authors [27, 33, 34], but this literature must be critically interpreted.

The series from Mount Sinai Hospital in Toronto concluded that preoperative treatment with TNF-alpha antagonists in IBD patients was not associated with early postoperative complications, after reporting similar rates of wound infection among patients with detectable preoperative infliximab levels compared with those with undetectable levels. However, this analysis included operations for both Crohn’s disease and UC; among the 69 UC patients evaluated, only 11 pouches were constructed on patients on anti-TNF-alpha antagonists, thus limiting the validity of the conclusion for this specific subgroup [25]. Our own experience is similar: among 518 IBD surgical patients treated laparoscopically, we noted no differences in postoperative infectious complications. However, only 15 pouches (10.6%) were constructed on patients while on infliximab [27].

In our practice, we have found that a more conservative surgical approach to UC patients with multiple comorbidities receiving aggressive medical management has allowed us to achieve excellent results with acceptable morbidity [35]. A retrospective analysis of our own prospectively collected data comparing a three- versus a two-stage approach in this population revealed no difference in overall postoperative complications. Despite significantly higher utilization of corticosteroids (96%) and biologic therapy (43%), as well as higher incidence of active C. difficile infection (14% vs. 5.8%) among patients in the three-stage group, we identified lower incidence of infection complications (21% vs. 38.2%, p < 0.05) compared to the two-stage group [35]. In order to minimize complications, an accurate preoperative risk assessment, combined with the surgeon experience, is crucial to assign patients to the safest surgical approach. In our practice, patients receiving aggressive medical management undergo staged procedures, while single-stage pouch surgery is still offered only to the healthier, more elective group. Our interpretation of the data available in the literature suggests that by deferring the critical surgical step of the pelvic dissection with pouch construction and anastomosis to a time when patients are medically optimized, we are able to limit complications. Nevertheless, we believe that there are certain characteristics that define the group of patients who may benefit from the avoidance of a stoma and its complications [30]: young, healthy patients who are not on immunosuppressants or steroids preoperatively; surgical indication of dysplasia; uneventful operation; pouch with optimal blood supply and tension-free anastomosis. We usually leave a rectal tube in these patients for a few days to avoid pouch distension and discomfort due to the initial diarrhea and possible perianal skin irritation.

Operative Technique and Surgical Decision-Making

Once the decision is made to proceed with surgery, it is important to remember that, with UC patients, one size definitely does not fit all. In the following section, we will discuss the pros and cons of different approaches based on patient and disease characteristics and surgeon skill and judgment. While these opinions are based on the available evidence, there is a certain component of personal preference.

Preoperative Planning

The patient and family should meet with the surgical team prior to surgery to discuss the nature and necessity for the surgery, alternative options, risks and benefits of the procedure, and long-term functional outcomes. If a temporary or permanent ileostomy is planned, it is imperative that a certified enterostomal therapist evaluate the patient for preoperative marking. Preoperative anesthesia and medical consult evaluation may be needed preoperatively, depending on the patient’s comorbidities, to optimize any underlying conditions and limit operative risk. Patients undergo bowel prep with a mechanical cleansing agent and oral antibiotics the day before surgery. In our practice, unless contraindicated, patients receive an epidural preoperatively as part of an enhanced recovery pathway. Antibiotics, thromboembolic prophylaxis, and in some cases stress-dose steroids are administered prior to induction of anesthesia.

Brooke Ileostomy

In 1952, Professor Bryan Brooke described his technique for evertting an ileostomy in order to minimize skin excoriation [36, 37]. The Brooke ileostomy remains the preferred approach for patients who are not candidates for restoration of intestinal continuity in our practice.

When determining the placement of the ileostomy, the patient’s abdomen should be assessed in the sitting and standing positions. The ideal location for the ileostomy is in
a flat area over the right rectus muscle that is away from previous scars, deep abdominal folds or creases, and bony prominences. It is essential that a patient be seen by an enterostomal therapist to preoperatively mark the best site for the stoma [38].

Operative Details

A circular incision is made in the skin and carried down through the subcutaneous tissue until the anterior rectus sheath is encountered. The anterior rectus sheath is incised vertically and the rectus muscles are bluntly separated with handheld retractors. The posterior rectus sheath and peritoneum are then incised to create an opening that will accommodate two fingerbreadths. After ensuring no twisting of the bowel or mesentery, the terminal ileum is delivered through the opening (Fig. 50-1a). The ileostomy is matured with 3–0 chromic suture. A full thickness suture is placed at the open end of the ileum; a seromuscular bite of the bowel wall is then taken at the skin level and followed with a subcuticular bite through the dermis (Figure 50-1b). Four to five everting sutures are placed (Figure 50-1c), with particular care taken at the mesentery to avoid injury to the mesenteric vessels (a simple suture may be placed at this site). After placing the everting sutures, they are tied, and simple sutures are placed circumferentially between the cut edge of the ileum and the dermis to complete approximation of the mucocutaneous junction.

Operative Considerations

While obesity remains a relative contraindication to IPAA, management of obese patients with a stoma also presents significant challenges. Stoma-related complications occur in up to 36% of patients [39], with obesity representing a key risk factor for stoma failure. Obese patients present technical difficulties caused primarily by mechanical factors: the foreshortened mesentery and the thick layer of the subcutaneous fat through which the intestine has to be placed. Stoma necrosis, retraction, parastomal herniation, and mucocutaneous separation are among the possible complications of a permanent end Brooke ileostomy, although not exclusively among the morbidly obese patients. In order for this group of patients to achieve the best possible long-term outcome, strict collaboration between the enterostomal therapist and the surgeon is critical. Revision of an ileostomy is often a very challenging operation in the obese patient; thus, proper placement, with appropriate preoperative evaluation for sitting, is imperative. The impact of a poorly functioning ileostomy on patient’s quality of life should not go

Figure 50-1. Construction of a Brooke Ileostomy. (a) The terminal ileum is extracted from the stoma site without tension on the Figure

50. Ulcerative Colitis: Surgical Management
unnoticed, especially considering the fact that several of the UC patients are young with an active lifestyle.

**Outcomes**

To evaluate the Health-Related Quality Of Life (HRQOL) of patients who had a permanent Brooke ileostomy compared to the general population, Camilleri-Brennan et al. [40] conducted a mail survey using the quality of life questionnaire SF-36 version 2 (SF-36II) [41]. The authors evaluated the difference between patients and the general population for all dimensions and summary scores. The scores directly relating to physical well-being as well as the Physical Component Summary were similar between the two groups. Comparable results were also achieved for the energy and vitality dimension and pain scores. Scores in the mental health and role-emotional dimensions, as well as in the social functioning dimensions, and general health perceptions were analogous to that of the general population. This study suggested that despite the presence of a permanent ileostomy, HRQOL was very similar to that of the general population. The results clearly underscore the notion supported by other authors that a perceived negative impact of the ileostomy does not appear to affect HRQOL. Therefore, a permanent end ileostomy remains a viable option for UC patients requiring surgery and should always be discussed when counseling the patient regarding surgery.

**Continent Ileostomy**

There have been several modifications of the original description of the continent ileostomy popularized by Nils Kock in 1969 [42]. Creation of a continent ileostomy, or Kock pouch, requires an elaborate operation that involves the building of an ileal pouch with an internal valve to prevent and control the flow of enteric contents into the ostomy bag. With improvements in our understanding of inflammatory bowel disease and surgical technique, there are few patients today for whom the Kock pouch is an appropriate alternative to IPAA anastomosis following proctocolectomy. Specifically, this operation should be offered in specialized centers to patients with UC and a locally advanced low rectal cancer that will need adjuvant therapy postoperatively; patients who already have a Brooke ileostomy after proctocolectomy and wish to improve their quality of life; patients who are not candidates for an IPAA because of poor sphincter function; patients who prefer a continent ileostomy to an IPAA as a personal choice; and lastly, patients who have failed an IPAA but prefer a continent-preserving procedure to a Brooke ileostomy [43, 44]. Contraindications to this procedure include Crohn’s disease, obesity, critically ill patients, and the psychologically unfit patients because of the inability to intubate. This procedure has also been performed in the pediatric population with satisfactory results [43–45].

**Operative Details**

About 50 cm of small bowel is used to fashion a continent ileostomy (Kock pouch) (Figure 50-2). The outlet is constructed from the distal 3–5 cm of this segment, the nipple valve is created from the next 18 cm of bowel, and the remaining 30 cm is used for the pouch. Excising the peritoneum and mesentery on both sides of the arcade skeletonizes the mesenteric vessels of the small bowel used to build the nipple valve (Figure 50-3).

The pouch is generally created in an S-shape by folding the 30 cm length of small bowel into 10 cm limbs with one more cephalad to the other. A posterior row of sutures is placed between each limb and an enterotomy made along the S-shape (Figure 50-4). The incision will be antimesenteric along the middle limb and closer to the mesentery along the two outer limbs. A second posterior layer of sutures is created to re-approximate the cut edges (Figure 50-5). The nipple valve is then created with three passes of a GIA stapler without the knife (two along either side of the mesentery and one along the anterior aspect) (Figure 50-6). A two-layer closure of the anterior portion of the pouch is then performed. A circumferential row of interrupted sutures are placed between the outlet and the pouch to help maintain the position of the nipple valve (Figure 50-7).

To create the stoma aperture a small circular incision is made in the skin and carried through the subcutaneous tissue. A vertical incision is made in the fascia, the rectus muscle is retracted, and the peritoneum incised ensuring that the opening can accommodate two fingerbreadths. The outlet is brought...
up to the opening and the pouch secured to the abdominal wall by placing sutures laterally and medially (Figure 50-8). The outlet is transected at a location that will enable the matured stoma to be flush with the skin. A curved Medina catheter is placed into the most dependent portion of the pouch and secured in place by suturing the rubber collar on the catheter to the skin (Figure 50-9).

Operative Considerations
The two main long-term problems with a continent ileostomy are malfunction of the valve and pouchitis. Malfunction of the valve causes incontinence and difficult intubation of the pouch and occurs in 11–20% of patients [46–48]. When the continence mechanism fails, a traditional Kock pouch does not necessarily become a conventional ileostomy, but rather the “slipped valve” creates a functional obstruction requiring further surgery for revision or conversion to a standard Brooke ileostomy. Valve revision is successful in most patients. The incidence of pouchitis in Kock pouches is nearly identical to that after IPAA and management is similar.

Outcomes
Kock pouch procedures have recently fallen out of favor. The largest series were published in the late 1970s [46–48] and since the early 1980s fewer continent ileostomies have been performed as the great majority of appropriate patients choose to undergo an IPAA. However, recent data suggest that continent ileostomies in well-selected and properly motivated patients can be durable with long-term pouch survival rates approaching 80% [49]. Overall long-term follow-up showed excellent results: between 70 and 89% of patients have continence for gas and stool, and ultimately 95% never had to wear an appliance [46–48].

Nessar et al. [50] reviewed the Cleveland Clinic continent ileostomy experience comparing HRQOL in continent ileostomy patients and those whose Kock pouch failed requiring removal and conversion to an end ileostomy. Results were evaluated using the continent ileostomy surgery follow-up questionnaire and the Cleveland Global Quality of Life (CGQL) scale. Patients with an end ileostomy were more than twice as likely to report social, work, and sexual restrictions and to require a higher antidiarrheal medication.
and fiber intake compared with patients with a continent ileostomy. Patients with a continent ileostomy reported having a better appetite and less abdominal pain than the end ileostomy group and rated a higher score for overall happiness. CGQL measurements were better on all scales as well as the summary scale in the continent ileostomy group. Kohler et al. compared quality of life between Brooke ileostomies, Kock pouches, and IPAA [51]. Patients with IPAA had fewer restrictions in sports and sexual activities than those with Kock pouches, whereas those with Kock pouches had fewer restrictions in these activities but more restrictions in travel than those with Brooke ileostomies. In contrast, performance in the categories of social life, recreation, work, and family was similar between groups. They concluded that a well-functioning IPAA is superior to both Brooke ileostomies and Kock pouches in terms of overall quality of life.

Total Abdominal Colectomy with Ileorectal Anastomosis

Until the 1950s, total proctocolectomy with end ileostomy was the only available approach for UC patients failing medical management. In the 1940s reports of subtotal colectomy with
Figure 50-8. Sutures are then placed between the pouch outlet and the posterior sheath of the abdominal wall on the lateral and medial aspects.

Figure 50-9. A Medina catheter is placed into the most dependent aspect of the pouch and secured to the skin.
ileorectal anastomosis (IRA) as an alternative to total proctocolectomy in selected patients were first published. Prior to the description of IPAA, this procedure quickly became a valid alternative to total proctocolectomy in highly selected patients with minimal rectal inflammation and adequate rectal compliance to avoid a permanent stoma [52, 53]. Advantages included lack of a permanent stoma, performance of a one-stage, less invasive operation, and avoiding pelvic dissection with its associated risk of sexual dysfunction [54].

In 1978, Parks et al. described the IPAA and Utsonomiya popularized it in the 1980s [55, 56]. Since then, IPAA has become the procedure of choice for patients affected by UC with excellent long-term functional results and a low risk of persistent cuff inflammation or neoplastic degeneration in the retained rectum [57, 58]. Consequently, many surgeons have abandoned IRA in favor of IPAA or total proctocolectomy in patients not candidates for IPAA. The pros and cons of the different surgical approaches are listed in Table 50-4 [17, 54, 59–61]. Patient selection is clearly critical in assuring long-term favorable outcomes in patients undergoing an IRA. Total abdominal colectomy with ileorectal anastomosis (TAC-IRA) is now generally reserved for patients with limited rectal involvement, good rectal compliance, and no dysplasia or cancer. Adequate rectal compliance and normal anal sphincter function are critical for good long-term results. This can be initially assessed by digital rectal examination, but is more accurately characterized by rigid/flexible proctoscopy and anal manometry. Patients with poor sphincter function, severe rectal disease, and a non-distensible rectum should not be offered an IRA. TAC-IRA may be done via a minimally invasive or open approach depending on the nature and severity of disease, previous surgical history, comorbidities, and surgeon experience.

Operative Details: Open Approach

The procedure is performed with the patient in the modified lithotomy position with the legs supported by stirrups, ensuring that all pressure points are appropriately padded. A vertical midline incision is made and the abdomen is explored with careful examination of the bowel for possible manifestations of Crohn’s disease or the presence of malignancy.

The ascending colon and terminal ileum are fully mobilized by incising the lateral peritoneal reflection from the cecum up to the hepatic flexure. The right ureter and gonadal vessels and duodenum should be identified and separated from the mesentery to prevent inadvertent injury. The transverse colon is separated from its attachments to the stomach with or without preservation of the greater omentum. In our practice, the greater omentum is generally resected with the transverse colon (Figure 50-10). The lesser sac is entered and the omentum separated from the greater curvature of the stomach caudal to the gastroepiploic vessels. Dissection is carried to the splenic flexure exercising care to avoid splenic injury. Traction on the omental or colonic attachments to the splenic capsule may result in an avulsion injury and can often be avoided by dividing any omental attachments before applying traction. The dissection is then carried along the descending colon. Adhesions of the sigmoid colon to the abdominal and pelvic sidewall are divided and the lateral peritoneal reflection is incised. Care is taken to identify the left ureter and gonadal vessels to ensure their safety. Dissection is continued superiorly up to the splenic flexure, and with a combination of blunt and sharp dissection from the proximal and distal aspects, the splenic flexure is completely freed. At this point, full mobilization of the colon from the terminal ileum to the rectosigmoid junction has been accomplished.

The terminal ileum is transected with a GIA stapler and the mesentery of the colon is ligated and divided. If malignancy is not suspected, high ligation of the named vessels is not necessary and the mesentery can be divided close to the bowel wall. Larger vessels should be doubly ligated or divided with a vessel-sealing device. The inferior mesenteric artery is generally preserved in order to avoid injury to the hypogastric plexus and preserve adequate blood supply to the rectal stump. The rectosigmoid junction is divided at the level of the sacral promontory.

The ileorectal anastomosis can either be performed in an end-to-end or side-to-end fashion via a handsewn or stapled technique. We generally prefer to create a side-to-end ileorectal anastomosis. A flexible sigmoidoscopy is then performed to ensure that the anastomosis is patent, hemostatic, and healthy appearing, and an anastomotic leak test is conducted.

<table>
<thead>
<tr>
<th>IRA (ileorectal anastomosis)</th>
<th>IPAA (ileoanal pouch anal anastomosis)</th>
<th>TPC (total proctocolectomy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Function</td>
<td>+ Low cancer risk</td>
<td>+ Cancer risk</td>
</tr>
<tr>
<td>+ One surgery</td>
<td>+/- Defecatory function</td>
<td>+ One surgery</td>
</tr>
<tr>
<td>+ Low risk of sexual/urinary dysfunction</td>
<td>- Risk of sexual/urinary dysfunction</td>
<td>- Permanent fecal diversion</td>
</tr>
<tr>
<td>- Recurrent disease</td>
<td>- Multiple surgeries</td>
<td>- Risk of sexual/urinary dysfunction</td>
</tr>
<tr>
<td>- Cancer risk</td>
<td>- Decreased fertility</td>
<td>- Decreased fertility</td>
</tr>
</tbody>
</table>

Table 50-4. Pros and cons in ulcerative colitis surgery
Operative Details: Laparoscopic Approach

The procedure is performed with the patient in the modified lithotomy position with the legs supported by stirrups and both arms tucked, ensuring that all pressure points are appropriately padded. An infraumbilical (supraumbilical for a hand-assisted procedure) port is placed via an open technique. The abdomen is explored with careful examination of the bowel for possible manifestations of Crohn’s disease or the presence of malignancy and ability to perform the procedure laparoscopically is assessed. If a laparoscopic approach is feasible, then four additional trocars are placed in the right and left upper and lower quadrants for a straight laparoscopic procedure. If the surgeon elects to perform hand-assisted approach, two additional trocars in the bilateral lower quadrants and the hand-assisted port are placed via a Pfannenstiel incision about two fingerbreadths above the symphysis pubis.

The patient is then placed in the Trendelenburg position with the right side up. The cecum is retracted anterolaterally and the ileocolic artery and vein are identified (Figure 50-11). An incision is made just inferior to the vessels and a mesenteric window created. The duodenum should be visualized not only to avoid inadvertent injury but because it is an important landmark used to confirm correct identification of the ileocolic artery and vein. The vessels are then divided away from the origin if malignancy is not suspected. Mobilization continues superiorly, sweeping down the second portion of the duodenum and separating it from the posterior aspect of the transverse mesocolon (Figure 50-12). The dissection then continues laterally in the plane between the mesocolon and Gerota’s fascia. The appendix is then retracted toward the splenic flexure and the lateral peritoneal reflection is divided from the cecum to the hepatic flexure until the site of medial mobilization is met (Figure 50-13). Care is taken to avoid injury to the duodenum.

Dissection continues with serial ligation and division of the transverse mesocolon and omentum caudal to the gastroepiploic arcade (Figure 50-14a, b). This mobilization may be aided by placing the patient in reverse Trendelenburg. In the presence of benign disease, the mesocolon can be ligated and divided close to the bowel wall with a vessel-sealing device. Through a combination of blunt and sharp dissection, the splenic flexure is mobilized ensuring no undue traction on the spleen (Figure 50-15a, b). The patient is placed with the left side up and the small bowel retracted toward the right side. The left mesocolon is serially ligated and divided and the left-sided peritoneal reflection is divided. The sigmoid colon is retracted medially and the lateral attachments of the sigmoid colon are incised taking care not to injure the left ureter or gonadal vessels. The sigmoidal branches are ligated and divided. Once the colon has been mobilized up to the rectosigmoid junction, it is extracted through a Pfannenstiel incision, the bowel is transected, and the anastomosis is created in the same way as the open approach.
Outcomes

In UC, an IRA is a safe procedure with a reported overall morbidity between 8 and 28% [60–63] including small bowel obstruction, anastomotic leak, abdominal abscess, pulmonary embolism, sepsis, rectal bleeding, wound infection, abdominal wall dehiscence, urinary tract infection, transient urinary retention, hematoma, and stoma complication. In addition IRA does not involve extensive pelvic dissection, unlike IPAA or total proctocolectomy, minimizing the risk of sexual and urinary dysfunction. Hence, higher fertility rates may be expected in IRA patients compared to IPAA although definitive studies providing evidence for better fertility rates in UC patients are lacking. Nonetheless, IRA should be considered and discussed with women in their reproductive age [64].

Disease recurrence in the rectal remnant in continuity is significant and these patients should be monitored and followed up endoscopically. The cumulative probability of having a functioning IRA at 5 years has been reported as high as 84% [63, 65], 69% at 10 years [62, 65], and between 46 and 69% at 20 years [64]. In the Cleveland Clinic series comparing 22 IRA with 66 IPAA patients matched for age, gender, and follow-up time, the cumulative probability of having a functioning IRA at 5, 10, 15, and 20 years was 81, 74, 56, and 46%, respectively, in accordance with previously published work [60]. Functional results are typically described in terms of number of bowel movements and incidence of soiling or urgency. The Cleveland series of 22 IRA patients reported six bowel movements per day (range 2–11), 5% incidence of nighttime seepage, and 68% mostly/sometimes grade of urgency [60]. Pastore et al. described a median number of six bowel movements per day (range 2–20), with median number of one nocturnal bowel movement (range 0–10) among 90 patients undergoing total abdominal colectomy and IRA. Three patients had more than eight daily stools with frequent soiling and urgency. At the time of follow-up, antidiarrheal medications were taken by 53.3% of patients, whereas 31.3% required low doses of systemic or topical steroids. More than 90% of patients considered that their health status had improved after the operation. Quality of life was improved in 84% [63].

The main indication for proctectomy is recurrent proctitis refractory to medical management [60, 62, 63, 65], followed by dysplasia or cancer, and the development of Crohn’s disease. Options for these patients include IPAA, Brooke ileostomy, or a continent ileostomy (Kock pouch). IPAA can often be safely performed in the majority of these patients, thus preserving bowel continuity and avoiding permanent fecal diversion [60]. Among 86 patients undergoing IRA for UC, 46 (53%) required completion proctectomy for refractory proctitis.
(n=24), rectal dysplasia (n=15), and rectal cancer (n=7) at a median interval of 10 years (range 1–33) [60].

Endoscopic monitoring of the rectal remnant is essential given the high rate of disease recurrence, as well as the risk of dysplasia/cancer which increases with time. In the Cleveland Clinic series, the overall cumulative probability of rectal dysplasia in the retained rectum increases from 9 % at 10 years to 25 % at 20 years [60]. The overall incidence of rectal cancer after an IRA varies in the literature based on the length of follow-up, ranging from 0 to 8 %. In the Cleveland Clinic series, the incidence of cancer was 0, 2, 5, and 14 % at 5, 10, 15, and 20 years, respectively [60]. In the Scandinavian series, no cancer was reported at 13-year and 18-year follow-up, respectively [62, 65], thus emphasizing the importance of strict patient selection.

Most patients who develop rectal cancer in the retained rectum presented at an advanced stage (stages III–IV), suggesting the possibility of a more aggressive biology and making close surveillance imperative [60, 66]. Rectal biopsies every 6–12 months are advised following IRA in UC patients. If dysplasia is found, completion proctectomy is indicated. Patients with long-standing UC who are not able or willing to undergo surveillance should not be offered an IRA. It is also important to emphasize that colectomy with IRA should not be offered to patients with preexisting dysplasia or cancer due to the increased risk of further neoplastic degeneration [67]. However, patients with advanced metastatic disease may benefit from an IRA due to their short life expectancy and the palliative nature of their treatment.

Total Proctocolectomy with End Ileostomy

Proctocolectomy with Brooke ileostomy was the standard of care for the treatment of ulcerative colitis until the early 1980s when Utsonomiya popularized the IPAA [56]. While restorative proctocolectomy with IPAA with the intent of maintaining intestinal continuity is now the gold standard in the surgical management of UC, certain patients are not candidates for this procedure, typically due to patient or disease-related factors or personal preference (Table 50-5). Once these patients are referred to the surgeon with an indication for surgical intervention, they should be evaluated and offered a total proctocolectomy with a permanent ileostomy, or in certain circumstances an ileorectal anastomosis as discussed previously.

By removing all diseased epithelium, a proctocolectomy cures patient disease, eradicates the associated risk of malignancy, and eliminates the need for costly medications and time-consuming lifelong follow-up. The disadvantages of this operation include the presence of a permanent ileostomy, the potential for nerve injury during pelvic dissection, and
the risk of perineal wound healing problems. A proctocolectomy with an end ileostomy is indicated in patients who are not candidates for an IPAA (Table 50-5) or a Kock pouch. The operation may also be indicated if other medical problems make a more complex, longer operation too risky [68, 69]. Finally, a total proctocolectomy should be considered in patients who desire a single operation for cure or whose work and other daily activities make an ostomy appliance easier to manage than frequent bowel movements.

There are no absolute contraindications to this procedure. However, in the emergent setting, it is advisable to stage the procedure with an initial abdominal colectomy. This strategy avoids the morbidity associated with rectal dissection, which can be potentially difficult and time-consuming in an unstable patient. This procedure can be performed through a laparotomy incision, single incision, hand or laparoscopic assisted, or totally laparoscopically as the authors have previously described [70]. There are no large studies comparing these approaches in this very selected group of patients. Intuitively, a totally laparoscopic approach should result in lower incidence of hernias, with the exclusion of parastomal hernias. As with an abdominal colectomy with ileorectal anastomosis, the choice of a minimally invasive or open approach is dependent on nature and severity of disease, previous surgical history, comorbidities, and surgeon experience.

Operative Details: Open Proctectomy

If the severity of disease or other patient factors necessitate a staged approach, the initial total abdominal colectomy proceeds as above, but rather than creating an ileorectal anastomosis, the rectal stump is left in situ and the terminal ileum is fashioned into an end ileostomy. The rectosigmoid is transected with a linear stapler at the sacral promontory (Figure 50-16). The staple line can be reinforced with interrupted Lembert sutures if there is increased concern for dehiscence, but this is not our common practice. A rectal tube is left in place for 5 days postoperatively to ensure adequate evacuation of rectal contents and decompression of the rectal stump. The proctectomy with or without ileal pouch can be performed several months later when the patient’s overall health improves and they are no longer on medications.

Whether the rectal dissection is done at the same time as the colonic mobilization or as the second operation of a staged approach, the dissection begins with division of the terminal branches of the inferior mesenteric artery (the superior rectal arteries) and complete posterior mobilization of the rectum. Bilateral ureters and the sympathetic neural plexus, which lies directly posterior to the inferior mesenteric artery at the pelvic brim, are identified and swept free. The terminal branches of the inferior mesenteric artery and vein are ligated and divided at the level of the sacral promontory.

The parietal peritoneum is incised inferiorly and laterally to gain access to the presacral space between the fascia propria of the rectum and the presacral fascia. The rectum is retracted anteriorly and sharp dissection is carried out in the areolar tissue. Care must be taken to ensure that the presacral venous plexus remains covered to avoid bleeding that can often be difficult to stop and may be life-threatening. Dissection should be carried down in the posterior plane beyond the coccyx and Waldeyer’s fascia is incised. The lateral rectal stalks are then divided as close to the rectal wall as possible to avoid injury to the pelvic plexus. Attention is then turned to anterior dissection in the rectovaginal or rectovesicu-lar space posterior to Denovilliers’ fascia. At this point, the rectum should be circumferentially mobilized to the levator ani muscles. If the colostomy had not been done at a prior operation, the terminal ileum is transected at its junction with the cecum with a GIA stapler. Then the abdominal wound is closed, the ileostomy is created, and attention turned to the perineal dissection.

A pursestring suture is placed to close the anus at the level of the anal verge. A circular incision is made in the intersphincteric groove and carried through the subcutaneous tissue (Figure 50-17). The anococcygeal ligament is divided and the pelvic cavity is entered posteriorly. The incision is extended circumferentially mobilizing the entire distal rectum and anus. Care should be taken anteriorly to avoid injury to the vagina or prostate. The specimen is extracted through the perineal opening and the wound is then closed in layers (Figure 50-18).

Operative Details: Laparoscopic Proctectomy

As with the open approach, the rectal dissection begins with division of the terminal branch of the inferior mesenteric artery (the superior rectal artery). The rectal stump and distal sigmoid colon are retracted superiorly and anteriorly out of the pelvis exposing the inferior mesenteric artery (IMA). The peritoneum to the right of the superior rectal artery is

<table>
<thead>
<tr>
<th>Absolute</th>
<th>Relative</th>
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<tbody>
<tr>
<td>Severe fecal incontinence</td>
<td>Severe morbid obesity</td>
</tr>
<tr>
<td>Locally advanced low rectal cancer involving the sphincters</td>
<td>Locally advanced low rectal cancer requiring neoadjuvant treatment</td>
</tr>
<tr>
<td>Perianal Crohn’s disease</td>
<td>Crohn’s disease</td>
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<tr>
<td>Previous extensive small bowel resections</td>
<td>Personal preference</td>
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IPAA—ileoanal pouch anal anastomosis

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Figure 50-16. Distal transection at the level of the sacral promontory.

Figure 50-17. Perineal dissection—circular incision made along the intersphincteric groove.

Figure 50-18. Closure of perineum.
incised starting at the sacral promontory and extending cephalad to the origin of the IMA. A mesenteric window is created allowing the visualization of the left ureter and gonadal vessels. The hypogastric nerves are swept posteriorly and the superior rectal artery is ligated and divided with a vessel-sealing device. The retrorectal space is entered and the rectum is completely mobilized circumferentially as above down to the pelvic floor. After ensuring no twisting of the bowel or mesentery, the cut edge of the ileum is brought out and the end ileostomy matured. The perineal dissection proceeds as above with the specimen brought out through the perineal incision.

Restorative Proctocolectomy with Ileal Pouch Anal Anastomosis

Before proceeding with an IPAA, fecal continence should be fully evaluated particularly in patients presenting preoperatively with impaired function. Multiparous women, particularly after multiple vaginal deliveries with episiotomies or lacerations, should be asked about their continence function. While it is important to note that continence significantly worsens in all patients during a flare, with multiple bloody and liquid bowel movements, the report of incontinence should be further discussed and investigated. A digital rectal examination performed by the operating surgeon often provides enough information to decide if evaluation by manometry and a rigid probe 3-D endoanal ultrasound should be entertained. Gearhart and colleagues [71] prospectively evaluated 42 women with anorectal manometry and endoanal ultrasound. All patients were continent at the time of evaluation. Endoanal ultrasound revealed significant sphincter defects in 19 patients, 4 of whom had involvement of both sphincters, as a result of an obstetric trauma. The findings of the endoanal ultrasound correlated with anal physiology studies which revealed significantly decreased resting pressures, squeeze pressures, and shorter anal canal length. All patients underwent an IPAA. The participants were surveyed postoperatively with the Cleveland Clinic Florida scale (Wexner score), Fecal Incontinence Severity Index (FISI), or Fecal Incontinence Quality of Life (FIQL) scale. The authors did not find a correlation between the size of the sphincter defect and postoperative incontinence. Almost all responders reported episodes of seepage. Three patients with sphincter defects (15.8%) were dissatisfied with the functional outcome of the IPAA and said they would not undergo this procedure again. Finally 5% of them underwent pouch excision. Given these outcomes among patients without reported preoperative incontinence, the existence of problems with defecation prior to surgery (incontinence, diabetic neuropathy, or other neurogenic disorders) should be considered a relative contraindication for IPAA.

Patients who present with very low rectal cancer requiring abdominoperineal resection for oncologic reasons obviously are not candidates for an IPAA. The standard oncologic principles for treatment of rectal cancer apply to rectal cancer in ulcerative colitis. Patients with stage II–III disease benefit from and should receive neoadjuvant chemoradiation therapy to decrease the risk of local recurrence and to increase the chances of achieving an R0 resection as previously shown by the Dutch and German rectal cancer trials [72, 73]. Neoadjuvant chemoradiation therapy does not represent an absolute contraindication to an IPAA for appropriate patients, but does clearly worsen long-term outcome. In a recent study from the Cleveland Clinic, pouch failure rate in rectal cancer patients was 42.9% after radiation versus 17.6% in patients who did not receive radiation [74]. A multidisciplinary approach to these patients is mandatory to balance oncologic principles, quality of life, and patient preference. Adjuvant radiation therapy should be avoided at all costs and it is typically not recommended or utilized [75, 76].

More than one-third (34.9% or 78.6 million) of US adults are obese and the obesity epidemic has not spared the IBD population [77]. While studies from the Cleveland Clinic and other large volume centers have shown equivalent functional outcomes in obese patients undergoing IPAA [78], the authors consider morbid obesity a relative contraindication to immediate IPAA [79]. In a recent series from Washington University, obesity was associated with an increased risk of overall (80% vs. 64%, p=0.03) and pouch-related (61% vs. 26%, p<0.01) complications following IPAA [80]. In patients with an elective indication for surgery, performing an abdominal colectomy first as part of a staged approach has been proposed as a way for the patient to subsequently undergo weight reduction surgery before proceeding with the definitive restorative procedure. In the super obese (BMI>50) [81], this may never become an option given the time required for such a significant weight loss and therefore either permanent fecal diversion or abdominal colectomy with an ileorectal anastomosis should be considered. In order to avoid serious complications, increased hernia formation, and the need for multiple reoperations, with increased morbidity, mortality, and costs, meticulous preoperative evaluation using a strategic multidisciplinary team approach is mandatory. When safe to postpone surgery for a reasonable time, we have referred patients in our practice for weight reduction surgery in preparation for a procedure that could otherwise result in a permanent stoma. In these cases, laparoscopic gastric banding, or more recently a gastric sleeve procedure, has been performed given the need for these patients to maintain their entire intact small bowel for a successful IPAA. If the long-term use of corticosteroids is the primary reason for the increased BMI, they should undergo a staged procedure which allows them to discontinue corticosteroid therapy to facilitate weight loss. A goal of a BMI of ≤28 should be the target in mutual agreement with the patient.
before proceeding for the IPAA in order to maximize the chances of a functional pouch and to avoid a permanent stoma.

Although advanced age was once considered a relative contraindication to IPAA, this has been reevaluated in the setting of optimized surgical and medical management and minimally invasive approaches [82, 83]. It is clear that IPAA can be safely offered to selected elderly UC patients who are strongly motivated and possess normal defecatory function. Their results seem to be stable over time and comparable to those of younger patients [83].

**Operative Technique**

If the patient is to undergo an RPC-IPAA, the resection of the colon and rectum is performed as described previously, but the rectum is divided with a TA stapler leaving a short rectal cuff. An ileal pouch can be created in the J, S, or W configuration (Figures 50-19 and 50-20), but the preference of the authors is the J-pouch construction.

The length of the ileal J-pouch should be about 15–20 cm in length (Figure 50-21). The stapled end of the terminal ileum is oversewn with 4–0 silk Lembert sutures. After ensuring adequate blood supply to the terminal ileum, the apex of the pouch is chosen by bringing the ileum over the pubis and identifying the longest section of mesentery to enable a tension-free anastomosis. A stay suture is placed along the antimesenteric side of the apex. The two limbs are approximated and sutures are placed between the proximal and distal limbs at the ileomesenteric junction (Figure 50-22a, b). Corresponding longitudinal enterotomies are made on the proximal and distal limbs. Serial firings with a GIA stapler are used to create the pouch (Figure 50-23a, b) with care taken to ensure that the mesentery is not included in the staple line (Figure 50-24). The pouch is everted by gently applying Babcock clamps after each staple fire to aid in creating a common channel (Figure 50-25a, b). After the last firing (Figure 50-26a, b), the staple line is inspected for bleeding (Figure 50-27a, b) and the pouch reduced with gentle traction on the apical stay suture (Figure 50-28a, b, c). The anvil of an EEA stapler is brought out through the apex and secured in
place with a pursestring suture (Figure 50-29). The common enterotomy is closed in two layers (Figure 50-30). The EEA stapler is inserted transanally and after ensuring no twisting of the bowel or mesentery the ileoanal anastomosis is created. A flexible sigmoidoscope is then inserted to inspect the staple lines and perform an anastomotic leak test. It is our practice to divert patients with a temporary loop ileostomy for 3 months.

Special Considerations

Pouch Configuration

The introduction of restorative proctocolectomy and IPAA into clinical practice has improved quality of life in the majority of UC patients seeking surgical intervention for disease management. There have been several modifications of the technique since the original description by Parks and Nicholls [55] and Utsunomiya and Iwama [56]. Parks’ initial ileal reservoir was a triple loop S-pouch, with a 5 cm long exit conduit, which created problems with emptying [55]. Subsequently the limb was shortened to less than 2 cm with significant functional improvement [84]. Currently, other pouch designs in use include the double loop J-pouch [56] and the quadruple loop W-pouch [85, 86]. The lateral isoperistaltic H-pouch is now of historical interest only [87]. Each pouch design has its own advantages, and while the J configuration is most commonly used currently due to relative technical ease and speed of performance [88, 89], there is a role for the other two in very selected situations. The S-pouch with the long exit limb allows for further reach in tall male patients with short mesentery [90], while the W-pouch has a large capacity and better compliance [85]. When comparing the W-pouch with either the S- [90] or the J-pouch [86, 91, 92] in the so-called “maturation period” (immediately following ileostomy closure), the W-pouch group patients have significantly less frequent bowel movements compared to either group. However, two randomized prospective trials comparing the J-pouch to the W-pouch did not confirm those findings and the two configurations had the same functional results at 1 year of follow-up [93, 94]. We prefer a J-pouch for the vast majority of our patients because of the lower complication rate and the excellent functional results in our hands [88, 89].

Anastomosis

The second topic of major controversy is the type of the anastomosis and the fate of the anal transition zone (ATZ), the so-called stapled ileal pouch distal rectal anastomosis versus a handsewn ileal pouch anal canal anastomosis with mucosectomy. The potential advantages of preserving the ATZ include preservation of the highly specialized anoderm, therefore better function; decreased trauma to the sphincter mechanism, therefore better continence; less tension on the anastomosis, therefore fewer septic complications; ease of construction, therefore shorter operative times. The disadvantages include the theoretical risk of malignant degeneration of the rectal cuff mucosa. We will discuss the functional results and the risk of neoplastic degeneration separately.

The initial descriptions of IPAA included a mucosectomy to the dentate line [55, 56, 95]. The dilatation necessary for complete mucosectomy [96] or the eversion of anorectum used at that time to facilitate mucosal removal [97, 98] caused significant decrease in the maximum resting pressure [96] and increase of the threshold sensation, which correlated with an increased number of episodes of incontinence [97, 98]. Avoidance of extensive manipulation of the anal sphincter complex limits the degree of trauma. Furthermore, the ATZ retains some of the anoderm sensory capacity, which together with the rectoanal inhibitory reflex allows for the sampling of rectal contents resulting in improved continence, whereas mucosectomy results in loss of this
Several comparative long-term studied have reported better functional results for the stapled IPAA [100–104]. We compared patients with a mucosectomy with patients with intact ATZ and found that even in the presence of chronic inflammatory changes, patients with an intact ATZ have significantly better continence, defecatory function, satisfaction, and quality of life [57]. Gemlo et al. [100] evaluated 235 patients with a mean follow-up of 70 months and found that elimination of a mucosectomy dramatically reduced nocturnal major incontinence, nocturnal minor incontinence, daytime minor incontinence, and daytime pad use. Sagar et al. [104] studied anal physiological results in 20 patients up to 12 months after stapled IPAA. After an initial decrease, at 12 months, resting anal pressure was almost normal, the rectoanal inhibitory reflex was present in 19 patients, and sampling was observed in 17 patients. The compliance and capacity of the reservoir increased significantly. Ability to discriminate flatus from feces was associated with return of the rectoanal reflex and sampling. When the theoretical advantages of a stapled IPAA over a handsewn anastomosis with mucosectomy were evaluated in a prospective randomized fashion, no difference in functional results was noted [105–107]. However, these studies did not examine long-term function and conclusions are difficult to make based on this short follow-up and are limited by inadequate power to detect small differences. Surgeons in favor of stapled IPAA often point to a greater rate of anastomatic complications after mucosectomy and handsewn IPAA. Preserving a short rectal cuff lessens the tension on the anastomosis, supposedly reducing anastomatic complications. The Cleveland Clinic group evaluated 692 patients, 238 with handsewn IPAA and 454 with stapled IPAA. In the handsewn IPAA group, 25 patients (10.5 %) had 32 septic complications, and 24 required 89 reoperations. In seven patients, the pouch was excised. In the stapled IPAA group, 21 patients (4.6 %) had 23 septic complications, and 14 required 40 reparations. One patient needed pouch excision [108]. Again, when the complication rates were evaluated in a prospective randomized fashion, no difference was noted [105–107]. Beyond functional considerations, there are concerns regarding preservation of inflamed rectal mucosa.
**Figure 50-25.** (a and b) The pouch is everted with the gentle application of Babcock clamps along the staple line until the intact apical septum is reached.

**Figure 50-26.** (a and b) Division of the most distal aspect of the septum is often assisted by gentle passage of a right angle clamp to guide the stapler.

**Figure 50-27.** (a and b) Suture lines inspected to ensure hemostasis.
and associated persistent symptoms associated [109, 110]. The Cleveland Clinic group noticed that in their series symptomatic inflammation of the retained mucosa occurred in 14.7% of patients; 4.1% of patients had inflammation of the anal canal alone, and 10.6% had pouchitis. Surgical intervention was required in 12.9% of the total patients with isolated anal canal inflammation and 10.6% of those with anal canal inflammation plus pouchitis [109, 110]. These patients are usually treated with topical steroids or 5-ASA. If medical management fails, a transanal mucosectomy with ileal pouch advancement is performed with excellent results [109]. When we looked at our stapled IPAA patients with chronic inflammatory changes, we found that their function was still superior to their mucosectomy counterparts, with minimal symptoms of cuffitis and no surgical interventions required at 36 months of follow-up [57, 58].

**Figure 50-28.** (a–c) By placing traction on the apical stay suture and countertraction on the edge of the enterotomy, the pouch is reduced.

**Figure 50-29.** The anvil of an EEA stapler is brought out through the apex.

**Figure 50-30.** The common enterotomy is closed with a two-layer closure.
These outcomes may be explained by the shorter anal cuffs retained in patients undergoing laparoscopic operations.

Advocates of the mucosectomy argue that the entire diseased anorectal mucosa, including the ATZ, must be removed to eliminate the risk for future dysplasia and cancer. Anatomic studies have shown that actual microscopic extent of the ATZ is highly variable. Fenger [111], using Alcian blue staining, found that the mean span of the ATZ was 8.9 mm (range 0–20 mm), starting up to 6 mm below the dentate line. Thompson-Fawcett et al. [112] measured the ATZ by two techniques: whole-mount Alcian blue staining and a computer map of the histological findings based on longitudinal sections taken every 3 mm. They found that the Alcian blue technique overestimates the length of the ATZ, which usually commences just above the dentate line. The median length of the ATZ measured from computer maps of the histology was only 4.5 mm. Due to this variability, mucosectomy does not reliably remove the entire rectal mucosa [113]. Small islets of residual rectal mucosa have been identified in up to 14% of patients and in 7% it was located at the actual ileoanal anastomosis [113]. To determine the long-term risk of dysplasia and cancer in the retained mucosal cuff after stapled IPAA, the Cleveland Clinic group published their series of 210 patients with at least 5 years (median 77 months) of follow-up [114]. Dysplasia developed in seven patients (3.3%) at a median of 11 months postoperatively. Patients with history of cancer or dysplasia in the colon or rectum were at a higher risk of developing dysplasia. Two patients, each with low-grade dysplasia detected on three separate occasions, underwent mucosectomy 29 and 38 months after detection of low-grade dysplasia, but no cancer was found. The five other patients with dysplasia on one or two occasions were treated expectantly and were dysplasia free for a median of 72 months. More importantly, preservation of ATZ did not lead to the development of cancer after 5–10 years of follow-up. The authors recommend long-term surveillance to monitor dysplasia, and if repeat biopsy confirms persistent dysplasia, mucosectomy with pouch advancement was advised [114]. When we looked at our experience with preservation of the ATZ in patients without dysplasia or cancer at the time of surgery, we found no evidence of subsequent dysplasia or cancer in 225 patients over a 36-month follow-up period. Our results suggest that in selected patients, i.e., without dysplasia or cancer, the preservation of the ATZ is safe [57, 58]. We have subsequently changed our surveillance protocol for patients with preserved ATZ from 1- to 3-year intervals [57, 58]. We believe that there is a role for both procedures in clinical practice. We preserve the ATZ in older patients with borderline sphincter function and in tall obese male patients to decrease tension on the anastomosis. Mucosectomy is otherwise advised in the presence of high-grade rectal dysplasia or cancer, in the pediatric population [115], and in patients with primary sclerosis cholangitis known to have a high risk of dysplasia and cancer [116].

Optimizing Reach

An anastomosis between the ileal pouch and anal canal performed under tension is associated with increased risk of dehiscence with severe short-term and long-term sequelae [117]. Described approaches for improving reach include leaving the pouch unattached in the pelvis, diverting the patient proximally, and returning at a later date for pouch anastomosis. Few studies have evaluated and compared the several reported techniques for lengthening the small bowel mesentery, including complete small bowel mobilization to the origin of its mesentery, ileocolic vessel ligation close to their origin from the superior mesenteric pedicle, and transverse mesenteric relaxing incisions [118]. These strategies facilitate a tension-free IPAA in most cases. In our practice, we have found that utilization of a staged approach is the best strategy to avoid finding ourselves in such a situation where the pouch does not reach the pelvic floor or the tension on the anastomosis is causing ischemia. By optimizing body weight, tissue characteristics, and general medical conditions, we have almost eliminated the need for mesenteric lengthening from our practice. For patients with an extremely short mesentery, an alternative strategy has been described by Gose et al. [119]. Multiple vascular ligations are performed between the right colon wall and the marginal vascular arcade, while the right branch of the middle colic artery is preserved and provides the blood supply to the ileal branch of the ileocolic artery. The right colic and ileocolic arteries at their origin and the superior mesenteric trunk at its distal third are divided. This technique is time-consuming and technically challenging and can lead to pouch ischemia, but it offers additional length in extreme situations.

Crohn’s Disease

Ileal pouch surgery is contraindicated in patients with Crohn’s colitis [120, 121]. Despite significant effort to correctly diagnose patients before surgery, some patients undergo surgery with a preoperative diagnosis of indeterminate colitis or ulcerative colitis and are found to have Crohn’s disease on final pathological evaluation of the specimen. Sagar et al. [122] and Deustch et al. [123], in two separate unselected series, reported a pouch failure rate of 45% at 10 years in patients with a preoperative diagnosis of mucosal ulcerative colitis who were subsequently proven to have Crohn’s disease. In another series [124], only one of nine patients with preoperative clinical features suggestive of Crohn’s disease had a functioning pouch, with complications consistently occurring within months of ileostomy closure. In contrast, 15 of 16 patients without preoperative features of Crohn’s disease had maintained their pouch, generally with good results. These studies suggest that the pelvic pouch procedure should not be performed in patients with preoperative clinical features of Crohn’s disease. However, it is possible that there is a subgroup of patients with Crohn’s colitis who might be candidates for an ileal pouch procedure.
Panis et al. [125] reported a series of 31 patients with Crohn’s disease with no evidence of perineal or small bowel disease who were specifically selected for ileoanal pouch as an alternative to ileostomy. Of the 31 patients, only six (19%) experienced specific complications 9 months to 6 years after surgery, and at the 5-year follow-up, there was no significant difference between patients with Crohn’s disease and patients with ulcerative colitis in terms of stool frequency, continence, gas/stool discrimination, leak or need for protective pads, and sexual activity. In the future, more sophisticated diagnostic tests may allow selection of a subgroup of patients with Crohn’s disease appropriate for ileal pouch procedures. At present, we do not offer IPAA in our practice to patients with preoperative clinical features of Crohn’s disease.

The algorithm in Figure 50-31 shows the management of ulcerative colitis.

References


Figure 50-31. Algorithm showing the management of Ulcerative colitis. CD Crohn’s disease, IC Indeterminate colitis, UC Ulcerative colitis, TPC Total proctocolectomy, TAC Total abdominal colectomy, IRA Ileo-rectal anastomosis, IPAA Ileal pouch anal anastomosis, CA Cancer.


