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Operative Management of Crohn's Disease of the Colon Including Anorectal Disease

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Inflammatory bowel disease (IBD) is an idiopathic, ulcerogenic, inflammatory condition of the gastrointestinal tract, including Crohn's disease and ulcerative colitis. Despite being included under the broad umbrella of IBD, Crohn's disease differs distinctly from ulcerative colitis. Because Crohn's disease occurs anywhere along the alimentary tract from the mouth to the anus and is marked by multiple recurrences, surgical excision is not a curative procedure. In fact, up to 90% of patients require at least one operation during their lifetime [1]. The surgeon must then not only take into account the appropriate treatment of the acute problem at hand but also balance the ramifications of that therapy with potential future exacerbations in what is most often a palliative procedure. Surgeons therefore need to be exceedingly aware of the indications, surgical options, and expected outcomes for the patient who has Crohn's disease. Furthermore, although the precise cause of the disease remains unknown, our understanding of the principles guiding surgical treatment has expanded greatly and continues to evolve.

Crohn's disease of the colon and rectum

Clinical presentation

Crohn's disease most commonly affects the terminal ileum and cecum, followed by colonic, small bowel, and finally perianal disease. Although

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isolated colonic disease can occur in approximately 25% of patients, it is most often seen in conjunction with terminal ileal disease or with concomitant perianal disease [2]. The distribution within the colon remains at a consistent pattern, with approximately one third of patients having total colonic involvement, 40% showing segmental disease, and approximately 30% having disease only on the left side [3]. In general terms, Crohn's disease falls into one of three broad categories: fistulizing, fibrotic (stricturing), or inflammatory. Regardless of the type, the most common symptoms patients who have colorectal involvement experience are abdominal pain, rectal bleeding, and malnutrition [2]. In addition, patients can experience diarrhea, hip and pelvic pain from abscess and fistulas, and obstructive symptoms. Unlike ulcerative colitis, rectal bleeding is not a common presenting symptom [4]. Physical examination may have a paucity of findings, although perianal disease and extracolonic manifestations, such as oral ulcerations, skin lesions, and joint problems, may be present.

Diagnosis

Patients presenting with the above symptoms often undergo extensive radiologic work-up. In the past, contrast studies, such as a barium enema, would identify patterns of extensive longitudinal and transverse linear ulcerations creating a cobblestone and nodular pattern, skip lesions, and strictures [5]. CT scan has largely replaced the barium enema, although the luminal findings remain the same. In addition, CT may demonstrate extraluminal findings, such as segmental thickening of the colon with mesenteric fat stranding, terminal ileal or small bowel thickening, and abscesses [6,7]. Endoscopic evaluation and biopsy remain the gold standard, and patients should undergo complete colonoscopy with evaluation of the terminal ileum [8]. Early changes of the colon include aphthous ulcerations, erosions, and serpiginous ulcers all in a skip-type pattern. As the full-thickness inflammatory cycle continues, these ulcerated areas progress, enlarge, and coalesce forming the cobblestone-type pattern. Finally, other patients may show strictures that may be difficult to navigate for the endoscopist. Biopsy results showing granulomas are classic for Crohn's disease, although this is only found in 25% to 42% of patients, and may only represent a marker of more virulent disease [9]. In addition, long-standing ulcerative colitis may show granulomas on biopsy, thus enhancing the difficultly of differentiating the two conditions at times [10]. Other, albeit not exclusive, histologic evidence of Crohn's disease is architectural distortion of the crypts (ie, varying size, shape, symmetry), ulcerations, and skip areas [11]. The patient should also undergo an upper gastrointestinal and small bowel follow-through evaluation to exclude concomitant gastroduodenal and small bowel involvement. Finally, MRI and video capsule endoscopy are being used more to aid in the diagnosis and evaluation of patients who have Crohn's disease [12,13].

Medical management

Although not the focus of this article, medical treatment of Crohn's disease is a largely expanding field with ever-improving outcomes. Most importantly and often underemphasized, nutritional support remains paramount, whether the enteral route can be used or total parenteral nutrition is required. Most patients have been tried on antibiotics, aminosalicylates, corticosteroids, or other immunosuppressive medications to include biologic agents, such as anti-tumor necrosis factor antibodies, 6-mercaptopurine, or azathioprine. Surgeons should be aware of the various treatment regimens because medical therapy is often a lifelong requirement and may affect perioperative decision making (ie, pulse dose steroids, wound healing).

Indications for surgery

Regardless of the disease location, operative indications in Crohn's disease remain remarkably consistent. In broad terms, indications for operative management are for failure of medical therapy or complications from the disease. These indications include intractable disease (ie, steroid dependency), fistula, abscess, obstruction (stricture), growth retardation, perforation, extraintestinal disease, and malignancy. Acute large-volume bleeding in Crohn's disease is not as common as ulcerative colitis, but may occasionally occur. As stated, despite improvements in medical therapy, more than 75% of patients require surgery at some point in their lives [14,15]. In fact, failure of medical management is still the most common reason for surgery in patients who have Crohn's disease of the colon [15,16]. Fortunately, with improvements in medical therapy, elective operations have increased from 70% in the 1970s to 81% from 1992 through 2002 [17], although rates of hospitalization still double those of ulcerative colitis [18].

Specific conditions and surgical options

Overview

Patients who have terminal ileum and cecal or right colonic disease are the most common anatomic distribution encountered in practice, accounting for approximately 40% of those patients undergoing surgery [3]. Classically, these patients present with obstructive symptoms or those mimicking acute appendicitis. In either case, resection of the diseased segment with ileocolonic anastomosis is the preferred option. Traditionally, those patients presenting with symptoms of appendicitis undergoing laparotomy and discovered to have Crohn's disease would undergo an appendectomy if the cecum was normal, or withhold on resection and undergo medical treatment only. In a study by Weston and colleagues [19], 50% of patients undergoing ileocolic resection required no further surgery as a result of their Crohn's disease. This finding was significantly less than 92% requiring further surgery in those undergoing appendectomy only, including 65% requiring an

operation within the subsequent 3 years. The authors concluded that early ileocolic resection may be in the patient's best interests to avoid further problems. If possible, it is important to save as much of the right colon as possible to preserve the water absorption capability and lessen problems with diarrhea.

Isolated involvement of the colon occurs in up to 25% to 30% of patients. Just like Crohn's disease of the small intestine, preservation of bowel length with the goal of maintaining normal function is paramount in patients who have colonic disease [20]. Extent of resection depends on multiple factors, including extent and duration of disease, ability to exclude malignancy, rectal compliance, sphincter function, and prior resections. Similar to the small bowel, segmental resection is common with ileocolonic or colocolonic anastomosis found to be safe and easy to perform [21]. In those patients who have pancolitis, total abdominal colectomy with ileorectal anastomosis or total proctocolectomy with end ileostomy are commonly performed. Total proctocolectomy with ileal pouch–anal anastomosis (IPAA) is rarely done, but more commonly occurs in the setting of a misdiagnosis of ulcerative colitis. Proctectomy is more often required secondary to ongoing symptoms, such as pelvic sepsis, poor function, or rarely hemorrhage. When performing a proctectomy for Crohn's disease, it is important to consider the potential for a delayed- or nonhealing perineal wound. An intersphincteric approach, maximizing the amount of healthy muscle and tissue to close, lessens the chances of this difficult and highly morbid problem to occur. In those unfortunate patients who do develop a chronic perineal fistula or sinus, ensuring the patient does not have recurrent disease with a fistula from bowel followed by a conservative approach with local wound care is the preferred initial approach. Many of these patients require more extensive procedures with debridement and flap closure with gracilis muscle or other well-vascularized tissue [22,23].

Fistulas

The large bowel is occasionally the site of fistulous disease with patients who have Crohn's disease. It is important to determine the site of origin of the fistula, because often the colon is secondarily involved with active inflammation in the stomach, duodenum, or small bowel. In cases that require surgical therapy, often the colon may need only debridement and closure of the fistula site. Evaluation of the colonic mucosa is therefore important, because active inflammation at the site may predispose to healing problems and may require segmental resection. Primary colonic involvement can result in transmural inflammation and fistulous communication with other bowel [24], lung [25], skin [26], bladder [27], or vagina [28]. In these cases, the colon often requires segmental resection with closure of the secondarily involved organ. Occasionally the inflammatory process is so intense that safe dissection is not possible and the entire phlegmon needs to be resected en bloc. Lapidus and colleagues [3] have shown that in patients who have Crohn's disease, a fistula is

associated with an increased lifetime probably of undergoing surgical resection (relative risk = 1.7). The question of this trend continuing in the era of monoclonal antibodies against tumor necrosis factor (TNF) was investigated by Portiz and colleagues [29]. In a study of 26 patients receiving infliximab for fistulizing Crohn's disease (perianal, enterocutaneous, rectovaginal, peristomal, and intra-abdominal fistulas), 6 patients (23%) had a complete response to infliximab, 12 patients (46%) had a partial response, and 8 patients (31%) had no response to the medication. Fourteen (54%) patients still required surgery (10 bowel resections and 4 perianal procedures), and 6 additional patients refused surgery. Of the 6 patients who had closure of the fistula with infliximab, 5 had perianal or rectovaginal, not intra-abdominal. Almost 75% of patients still required surgery or had continued open fistulas. The surgeon therefore must continue to understand the principles of resection for fistula disease, because most patients, especially with intra-abdominal fistulas, may still need surgical intervention.

Obstruction and stricture

Obstruction as a result of colonic stricture occurs in up to 17% of patients [30]. Because of transmural inflammation, it is not uncommon to have luminal narrowing within the colon, especially with repeated flares. Malignancy may be present in approximately 7% of colonic strictures, however [30]. It is often difficult to differentiate malignant from benign strictures on a strictly clinical basis. All colonic strictures should therefore be evaluated by endoscopy and biopsy. Should malignancy be present, appropriate resection following standard oncological principles is mandatory. Other benign Crohn's strictures, especially at prior anastomotic sites, are often amenable to dilation [31]. In 20 patients who underwent dilation for either colonic or ileocolonic anastomotic strictures, Nomura and colleagues [32] found initial symptomatic relief in 75% of patients following the first dilation. Approximately one third of patients developed recurrent strictures in the first 2 years. Complications of dilation included fistula, fever, bleeding, and perforation. Although medical therapy is useful in other aspects of the disease, these strictures are often fibrotic in nature and nonresponsive, thus requiring resection for symptomatic strictures even when found to be benign. Strictures at sites of prior anastomoses may be secondary to recurrent disease or technical problems from the first surgery. To prevent this, there is some evidence that stapled side-to-side anastomosis in patients who have Crohn's disease have a decreased rate of postoperative strictures and leaks [33–36]. In a study including 72 ileocolic and 7 colocolic resection and anastomoses, only 2% of those patients who underwent stapled side-to-side anastomosis developed recurrent symptoms at 46 months, versus 43% of those undergoing hand-sewn end-to-end repair [37]. It is unknown whether these differences are related to technical problems, such as relative obstruction at the anastomotic site or ischemia leading to stenosis, but it does emphasize how the surgeon can potentially influence disease recurrence.

Hemorrhage

Hemorrhage in Crohn's disease is much less common than in ulcerative colitis [38]. Although patients who have Crohn's disease may develop occasional bloody diarrhea, massive lower GI bleeding rarely occurs and when present may be secondary to deep ulcerations, toxic colitis, or an underlying mass. Patients require continued resuscitation, correction of any coagulopathy, and transfusion as indicated. Endoscopy is the most useful diagnostic and therapeutic maneuver for bleeding from a colonic or terminal ileal source [39]. Often medical therapy or endoscopic therapy can control bleeding. Should bleeding continue or recur, segmental resection is preferred when the site of the hemorrhage is localized, and is required in up to 40% in some series of acute lower gastrointestinal bleeding [40]. In the setting of nonlocalizable disease, every effort should be made to identify the source of bleeding should the patient's clinical condition permit. This effort may include upper and lower endoscopy, nuclear medicine imaging, angiography, or small bowel evaluation (push endoscopy, video capsule endoscopy, or small bowel follow-through). In the unstable or nonlocalizable lower source, a subtotal colectomy with end ileostomy may be required [41].

Toxic colitis

Toxic colitis in the patient who has Crohn's disease is similar to ulcerative colitis. Even in patients who have had a thorough resuscitation, intravenous steroids or other immunosuppressants, and maximal nutritional support, emergent surgical intervention may be required. Indications for operative intervention include free perforation, worsening acidosis, clinical deterioration, or lack of improvement with medical management. In the operating room the colon is inflamed and friable, and the surgeon must be careful to avoid perforation and spillage of colonic contents. In the past, many patients underwent the Turnbull et al [42] procedure—a loop ileostomy and decompressive transverse and possible sigmoid colostomy. Although this procedure rarely is performed today, it may still play a role in the sickest of patients as a temporizing procedure only. Although primary anastomosis is an option, patients should most often undergo a subtotal colectomy with end ileostomy, which has been shown to be safe with low rates of morbidity and mortality [43]. The dilemma of what to do with the rectal stump remains. Options include dividing the colon more proximally in the distal sigmoid, with construction of a mucus fistula or implantation into the subcutaneous space [44], or local reinforcement of the rectal remnant. In a study of 62 cases of colectomy and stump closure involving ulcerative colitis and patients who have Crohn's disease in the setting of toxic colitis, leakage occurred in 3 of 9 patients who had a short rectal stump versus only 1 of 53 patients who had a rectal stump above the peritoneal reflection [45]. In another study of 147 patients who had intra-abdominal closure of the rectal stump, only 3 patients (2%) developed pelvic abscess that were able to be drained percutaneously, and none had stump blowout [46].

Although described as the procedure of choice in the 1970s [47], rarely does a patient who has toxic colitis undergo a proctocolectomy with end ileostomy in the acute phase, because it is associated with a much higher morbidity and mortality. In a study of 70 patients who had toxic megacolon, only 4 patients underwent proctocolectomy, with 3 of the 4 (75%) developing surgical complications, compared with 4 of 49 (8%) of those undergoing subtotal colectomy [48]. Should the patient have a rectal perforation or persistent hemorrhage despite subtotal colectomy, proctectomy at a subsequent procedure may be performed.

Dysplasia & malignancy

The development of malignancy with long-standing Crohn's disease is increased 4 to 20 times that of the average population [49,50]. Although in the past it was believed to be a lower risk than ulcerative colitis [51], a plethora of studies have shown Crohn's colitis to have equivalent risk for cancer [52–54]. Many authors have examined the risk factors associated with development of malignancy, and extent of colonic disease (at least one third) and disease duration (>8 years) are most often associated with an increased relative risk [55]. Age at diagnosis of Crohn's disease has had inconsistent findings, with some authors finding older age at diagnosis [55] versus others identifying younger age (<30 years old) with increased risk for neoplasm [56]. The malignancies, however, tend to present at a younger age and are more often multiple and left sided [57]. In a retrospective review of 222 patients undergoing surgical resection for Crohn's colitis, Maykel and colleagues [55] found the incidence of dysplasia was 2.3% and adenocarcinoma was 2.7%. Of those 11 patients, only 3 were identified preoperatively, demonstrating the difficulty of following these patients who have long-standing Crohn's colitis.

Endoscopic surveillance strategies to detect malignancy have had mixed results [58,59]. In a recent Cochrane Review, surveillance colonoscopy has not been shown to affect survival in these patients, despite detecting the cancers earlier [60]. Still, recommendations for surveillance in patients who have Crohn's colitis mimic those for ulcerative colitis, with surveillance beginning 8 to 10 years after disease onset for pancolitis and approximately 15 years for left-sided disease, with colonoscopy increasing from every 3 years during the second decade of disease to annual endoscopic evaluation after 30 years of colitis [61]. Even when detected, dysplasia can be difficult to diagnose and grade histologically. Substantial evidence indicates that diagnosis of dysplasia in the setting of active colitis, or within a polyp in a setting of colitis (dysplasia-associated lesion or mass [DALM]), carries a significant risk for malignancy and is a strong indication for resection [62,63]. Low-grade dysplasia outside the setting of a DALM and even in areas of flat mucosa warrants close follow-up, although the need for immediate resection remains unproved [64,65]. Treatment of malignancy in the patient who has Crohn's disease is similar to that of the general population, with ligation of the

primary blood supply along with the resection of the corresponding mesentery. With synchronous lesions occurring in up to 10% [49] and reports of metachronous lesions [66,67], consideration should be given to a subtotal colectomy with ileorectal anastomosis.

Special situations

Extent of resection

For those patients who have rectal sparing in the setting of Crohn's colitis, a total abdominal colectomy with ileorectal anastomosis (TAC-IRA) is an appropriate option. Because patients who have Crohn's disease are prone to diarrhea, it is important to perform a thorough evaluation of the rectal capacity and sphincter function to minimize the chances of fecal incontinence postoperatively. Whether or not to perform segmental resection or TAC-IRA in the patient who has Crohn's colitis continues to be a matter of debate. Bernell and colleagues [21] reviewed a series of 833 patients who had Crohn's colitis and found a higher rate of recurrence at 10 years for those undergoing TAC-IRA (58%) versus those undergoing a segmental resection (47%). Andersson and associates [68] confirmed these findings in a study of 57 patients in which the re-resection rates were similar, although those undergoing segmental resection had less symptomatic recurrence and overall improved bowel function. In contrast to the above findings, Tekkis [69] performed a meta-analysis of all studies between 1998 and 2002 encompassing 488 patients and demonstrated no significant differences in overall recurrence rate, complications, or need for a permanent stoma. Time to recurrence was longer in the TAC-IRA group by 4.4 years ($P < .001$), however. The authors concluded that subtotal colectomy may be better for patients who have two or more segments involved, yet the issue remains unresolved. Further complicating this matter, patients who have diffuse disease, including proctitis, after undergoing total proctocolectomy with ileostomy, have been shown to be less likely to require medications 1 year after resection and have an increased time interval to first recurrence than either subtotal or segmental colectomy [70]. One thing remains certain: once a decision is made to perform a colonic segmental resection, length of resection margins does not influence the risk for relapse. Only resection to grossly normal bowel is required [71].

Diverting stoma and bypass

Diverting stoma or bypass procedures are not performed as much as in the past; however, they may be required in select situations. A diverting stoma is useful for patients who have severe rectal and perianal disease to help resolve active inflammation while trying to maximize medical therapy. Although the disease often has recurrence following restoration of intestinal continuity, diversion remains a valuable tool for patients who have severe fistulous disease or in patients undergoing attempt at repairs (endorectal

advancement flap) either concomitantly or before the surgical procedure. Bypass procedures are an option in the septic patient who has a large terminal ileal-ascending colon phlegmon with involvement of retroperitoneal structures in which mobilization or resection brings about concerns for proper identification and protection of the ureter and vascular structures. In this case diversion or bypass can allow resolution of the inflammation followed by resection and restoration of continuity at a later date. The cumulative risk for permanent ileostomy continues to be high, with a study of 507 patients showing a 25% rate at a follow-up of 10 years [3]. This finding highlights the severity of the disease and underscores the need to counsel patients in depth regarding potential complications and outcomes.

Ileal pouch–anal anastomosis in Crohn's disease

IPAA in the patient who has Crohn's disease still should be the rare exception. The common scenario in which this occurs is the patient who has a firm diagnosis of ulcerative colitis who undergoes a total proctocolectomy with IPAA and then subsequently is diagnosed with Crohn's disease. Another common scenario is the patient who has indeterminate colitis who after extensive counseling elects to undergo a restorative proctectomy. Different authors have examined this scenario, each with similar outcomes, but have come to different conclusions. In a European study, 41 patients, including 26 who had a preoperative diagnosis of Crohn's disease, underwent elective IPAA over a 13-year period. No patient had a prior history of perineal or active small bowel disease. Of the 20 patients followed for at least 10 years, 35% developed Crohn's disease–related complications, such as pouchitis, abscesses, and pouch-anal fistulas, with 2 patients (10%) requiring pouch excision. The authors proposed that restorative proctocolectomy can be considered in patients meeting select criteria [72]. Hartley and colleagues [73] from the Cleveland Clinic identified 60 patients who underwent IPAA for presumed ulcerative colitis and were subsequently determined to have Crohn's disease. Approximately one third of these patients developed recurrent Crohn's disease, with 10% undergoing pouch excision, and an additional patient needing permanent diversion. Although 50% of patients still had urgency and 40% had persistent continence issues, the authors concluded that most patients having an intact functioning pouch had symptoms controlled with medication, supported pouch placement in selected patients with Crohn's disease. In contrast, Braveman and colleagues [74] from the Lahey Clinic retrospectively looked at 32 patients who had a postoperative diagnosis of Crohn's disease following pouch construction. They identified complications in 93%, including fistula (63%), pouchitis (50%), and anal stricture (38%), resulting in diversion or pouch excision in 29% of patients. Of those patients who had a functioning pouch, one half continued to require medication to treat active Crohn's disease. The authors recommended that no patient who has Crohn's disease should undergo pouch construction. Brown and associates [75] also recommend that

Crohn's disease should remain a contraindication to pouch construction, because more than one half of their 36 patients who had Crohn's disease following restorative proctocolectomy required diversion or pouch excision compared with only 10% of indeterminate colitis and 6% of ulcerative colitis. In addition, 64% of Crohn's patients developed pouch-related complications. Finally, Reese and colleagues [76] looked at 10 studies with 225 patients who had Crohn's disease undergoing restorative proctocolectomy and found patients who had Crohn's disease developed more anastomotic strictures, higher pouch failure, and higher rates of urgency than ulcerative colitis or indeterminate colitis patients. Whether or not improvements in future medications to control postoperative symptoms or future diagnostic techniques will determine which Crohn's patients can have successful outcomes with IPAA remains to be determined.

Anorectal Crohn's disease

Clinical presentation

Bissel [77] was the first to recognize the anorectal component of Crohn's disease, nearly 2 years after its original description, and approximately 30 years before the identification of a colonic component. Since that time, anorectal disease has been recognized as one of the most challenging aspects of the patient who has Crohn's disease. The most common perianal manifestations include edematous (elephant ear) skin tags, hemorrhoids, blue discoloration of the anus, recurrent abscesses, and fistulas. Fissures are also common—most often multiple, off the midline, deep, and with associated large skin tags. Patients who have long-standing Crohn's disease often have stenosis or stricture of the anal opening associated with chronic inflammation. Although isolated perianal disease is the presenting symptom in only 10% to 15% of patients [78], it is seen in up to 90% [79] of patients overall and more common in those who have concomitant rectal or colonic disease [3,80].

Diagnosis and evaluation

Direct observation of the perianal area identifies disease, such as skin tags, external fistula openings, and fissures. All patients should also undergo digital rectal examination and anoscopy to aid in diagnosis, especially those patients who do not have a known history of Crohn's disease. A thorough physical examination to identify any extraintestinal manifestations should also be performed. As an adjunct, flexible or rigid sigmoidoscopy can also be done to evaluate the rectum and sigmoid colon. Although clinical evidence of Crohn's disease as manifested by the large skin tags, fissures, or multiple fistulas are seen as hallmarks of disease, a biopsy should be performed to aid in diagnosis. In the perianal area local septic processes and

tenderness may require an examination under anesthesia to fully identify the extent of the disease. Endorectal ultrasound, CT, and MRI have also proven as useful radiologic adjuncts for the patient who has perianal disease to help diagnose and delineate fistula and abscesses [79,81,82]. Finally, patients presenting with perianal disease consistent with Crohn's disease should undergo a full alimentary tract evaluation with endoscopic and radiologic evaluation.

Medical treatment

Medical therapy for anorectal disease is similar to other intestinal therapies. Antibiotics, such as ciprofloxacin and Flagyl, are often used as first-line agents [83]. Steroids, aminosalicylates, and the immunosuppressive medications 6-mercaptopurine and azathioprine are easier and safer to use with the ability to monitor levels [84]. Immunomodulators, such as monoclonal anti-TNF antibodies and azathioprine, have been found to heal up to 71% of perianal fistulas and 79% of ulcers and fissures in patients who have Crohn's disease [85]. The field continues to expand with other biologic therapies, such as TNF-binding neutralizing fusion proteins and interleukins, and other immunomodulators, such as thalidomide, tacrolimus, and mycophenolate mofetil, with varying results to date [86]. Regardless of the medical therapy these patients are undergoing, a distinguishing characteristic of the surgical treatment of perianal disease in patients who have Crohn's disease is to consider whether or not they are symptomatic. Because this disease process is hallmarked by recurrence, aggressive intervention in the asymptomatic patient is unwarranted and potentially dangerous.

Specific conditions and surgical options

Anal skin tags and hemorrhoids

Patients who have perianal Crohn's disease consisting of the large edematous, blue-colored tags are unfortunately often misdiagnosed with hemorrhoids and undergo excision with poor results. Although these lesions may cause difficulty with hygiene and irritation, they are present in up to 70% of Crohn's patients who have perianal disease and are most often asymptomatic [87]. Before embarking on resection, surgeons should be aware of the propensity for poor wound healing, especially with the underlying diarrhea seen in Crohn's disease. Patients should be counseled as to the risk for non-healing wounds, continence problems, and need for conservative treatment with warm sitz baths and antidiarrheal medications. Although Taylor et al [88] noted that granulomas may be found in the anal skin tags this is rarely needed to help confirm diagnosis of Crohn's disease. Internal hemorrhoids in Crohn's disease tend to be less symptomatic and are best treated medically [89], despite evidence that selected patients who have severe hemorrhoidal symptoms nonresponsive to medical management can safely undergo hemorrhoidectomy with adequate healing [90].

Anorectal abscess

Approximately 50% to 60% of all Crohn's disease patients who have perianal disease experience at least one perianal abscess [91], with up to 60% having a recurrent abscess within 2 years [92]. Treatment of simple abscesses normally involves only incision and drainage. It is important to place the incision as close to the anal verge as possible, while still achieving adequate drainage, to consider the potential for development of a future anal fistula. Alternatively, a small pessar mushroom-tipped catheter may be placed in the cavity, thus evacuating the abscess and allowing the cavity to close around the catheter. Patients may also have an abscess in the presence of fistula disease, in which case concomitant drainage of the abscess and seton placement is the preferred option. It is important for the surgeon to identify all foci of sepsis and provide adequate drainage, including seton placement when needed. This drainage not only avoids the development of systemic symptoms, but prevents local destruction of the tissues, thus preserving sphincter function.

Anal fistula

Perianal fistulas are one of the most difficult management scenarios in this patient population. Because the disease process is hallmarked by extensive recurring inflammation, perianal fistulas are often deep, eroding through sphincter muscle and associated with extensive scarring. They can have high blind tracts, originate at levels well above the dentate line, and are often found in conjunction with rectal inflammation. Just as in fistulas in patients who do not have Crohn's disease, the therapy is intimately associated with the anatomy and degree of sphincter involvement. In Crohn's disease, however, the surgeon must also take into account rectal compliance, concomitant proctitis, and the potential for chronic diarrhea. Anything that impairs overall continence, such as an aggressive fistulotomy, or creates a wound that may not heal, must be avoided. With this in mind, in the absence of overt proctitis, low-lying fistulas with minimum sphincter involvement can safely be treated with fistulotomy [91]. When the fistula is higher or more complex, preoperative imaging studies, such as MRI or endorectal ultrasound, are useful to identify not only the anatomy but also any associated undrained abscess collections that need to be addressed. Surgical options for fistulas include setons, endoanal advancement flaps, and fistula plugs. Many patients who have fistulous disease require chronic indwelling setons, such as silastic vessel loops. Patients should be periodically re-examined to ensure that there is adequate drainage and to examine for the rare development of malignancy. Endorectal advancement flaps can be used selectively in patients who have Crohn's disease. In a study of 31 consecutive endorectal advancement flaps on 26 patients, Joo and colleagues [93] had a 71% success rate at a mean follow-up of 17.3 months. Diverting stoma was only used in 6 patients, with 4 of those patients having successful closure. The authors also found that only 25% (2/8) of patients who had active

small bowel disease had successful eradication of the fistula versus 20 of 23 (87%) who did not have small bowel disease. This finding highlights the need for consideration of a diverting stoma until the flap has healed, and optimal control of all active disease before attempted repair. Even the addition of fibrin glue to endorectal flap repair has been unable to improve results [94]. The Surgisis fistula plug has had some success with one study of 20 patients showing 80% closure rate, with single tracts having the best results [95]. Unfortunately, even in this era of monoclonal antibodies against TNF, severe anal fistulas may still require permanent defunctioning stomas or proctectomy [96].

Rectovaginal and anovaginal fistula

These fistulas are particularly problematic in the patient who has Crohn's disease. Many of these fistulas are associated with deep erosions and intense inflammation, rectal wall and rectovaginal fibrosis, and associated sphincter damage. Surgical options therefore may be even more difficult. It is important to identify the source of the fistula, because occasionally a presumed rectovaginal fistula may originate from small bowel. After treating the patient medically for Crohn's disease, the surgeon must pay particular attention to look for abscess that may need to be drained initially. Many patients unfortunately require diversion in this setting before any definitive repair. In a study of 48 women who had a low anovaginal fistula from Crohn's disease, 9 patients had severe disease and required proctocolectomy and ileostomy, 4 needed setons only, and the remaining 35 underwent flap procedures [97]. Eight of 9 patients requiring diverting ileostomies successfully healed, and they achieved an overall initial success rate of 54%. Five patients had to undergo repeat flap procedures, all of which were successful. Endorectal flap can thus be used in this patient population, even without diverting stomas, although patient selection is crucial. Infliximab has had mixed results as isolated therapy, with short-term 14-week closure rates of 45% [98], whereas other studies demonstrated the presence of rectovaginal fistulas as a poor predictor for response to infliximab [99,100].

Anal fissure

Patients who have Crohn's disease and anal fissures are a particular challenge. These fissures are often painless. Patients presenting with a predominant complaint of pain should raise the suspicion for an underlying abscess and prompt an examination under anesthesia. Concomitant perianal pathology is present in more than half of patients [101] with approximately one third having multiple fissures [102]. Although most authors suggest conservative management with adequate fiber and fluid intake, control of diarrhea, stool softeners, and sitz baths, other authors have advocated a more aggressive surgical approach. In a study of 56 patients who had Crohn's disease and anal fissures, Fleshner and colleagues [102] found that 49% of patients healed with medical therapy alone. Of those who failed medical

management, 10 of 15 (67%) patients healed their fissure when treated surgically with a lateral internal sphincterotomy (LIS). In addition, 25% of patients who had unhealed fissures that did not undergo LIS went on to develop an abscess or fistula from the base of the fissure, leading the authors to propose a more liberal use of LIS for fissures not responding to medical therapy. In another study of 25 patients who had Crohn's disease with symptomatic fissures, 22 had completely healed their fissure by 2 months following sphincterotomy. At a mean follow-up of 7.5 years, no patient had a direct complication from operative therapy and only 3 eventually required proctectomy for severe recurrent disease [90]. Despite these reports, given the continence risks associated with surgery, medical management is the preferred initial therapy in patients who have Crohn's-related fissures. Surgical intervention should be reserved for those patients who have minimal active anorectal inflammation who have failed conservative therapy. Division of sphincter muscle should be kept to a minimum.

Anorectal stenosis and strictures

Repeated bouts of inflammation may also lead to anal strictures or stenosis. Symptoms include difficulty or pain with bowel movements and decreasing size of stools. Physical examination should evaluate for presence of infection or malignancy with corresponding biopsies or cultures as indicated. Many patients have concomitant fissures or other perianal disease. Most patients who have Crohn's disease with stenosis initially respond to dilation. In a study of 44 patients, Linares et al [103] found that the site of the stricture was rectal in 22, anal in 14, and both in the remaining 11 patients. More than 95% had concomitant proctitis, and although a single dilation was successful in 15 patients, multiple dilations were necessary in 18 other patients. Emphasizing the recurrent severe nature in these patients, 19 of the 44 (43%) ultimately required proctocolectomy and 3 additional patients underwent diversion. Diversion alone is occasionally necessary [104], yet this may lead to worsening anal stenosis with retention of purulent intraluminal fluid leading to systemic symptoms [105]. Although anoplasty and endorectal advancement flap have been described for patients who have high anal or low rectal stenosis [106], it should be avoided in patients who have active proctitis.

Anorectal malignancy

Although rare, adenocarcinoma and squamous cell carcinoma arising in the setting of long-standing Crohn's fistulas has been described [107,108] as well as in defunctionalized rectal stumps [109]. Ky et al [107] described seven patients who had malignancy arising in the setting of chronic fistulas in patients who had Crohn's disease, with deaths occurring despite proper follow-up. Because evaluation is limited by the extent and severity of the disease and painful examination, malignancy may be difficult to detect. Any change in symptoms or inability to exclude malignancy should therefore

mandate examination under anesthesia with appropriate biopsies and curette of the fistula tracts with histologic examination. Sjodahl et al [110] has recommended that annual surveillance examination with proctoscopy of the anorectal region should start after 15 years of disease for those patients who have extensive colitis, chronic severe anorectal disease, rectal remnant after diversion, anorectal stricture, or any bypassed segment in a patient who has sclerosing cholangitis. Patients who are diagnosed with malignancy should undergo appropriate resection with chemoradiation therapy as indicated.

Special situations

Control of the proximal bowel

There remains controversy regarding the exact role proximal bowel disease has on anorectal manifestations. Sweeney and colleagues [111] found that a large majority of patients respond without surgery. In 42 of 61 patients the anal fissure healed solely with medical therapy directed toward their intestinal disease. The remaining patients either developed further anal lesions (16%) or had their fissures removed along with a proctectomy for severe perianal disease. The authors proposed a more conservative nonoperative approach, reserving surgery for cases in which suppurative anorectal complications developed [111]. In a study of 127 patients who had perianal disease, McKee and Keenan [78] also found that the treatment and outcome of patients who had perianal Crohn's disease was in large part determined by the extent and severity of the proximal intestinal involvement. Finally, in a multicenter study of six databases from the United States and Europe, Sachar evaluated 1686 cases of isolated Crohn's ileitis and 1655 cases of Crohn's colitis to determine if there was a correlation specifically for abdominal fistulas and perianal fistula disease. There was a varying association with perianal disease and ileitis across the centers, although Crohn's colitis had a significant association. Control of the proximal bowel thus seems to have an impact on lessening perianal symptoms.

Diversion and proctectomy

In severe cases of nonhealing fissures or fistulas, the physician should always question the underlying diagnosis. A thorough history and physical examination focusing on secondary manifestation of the systemic disease (not only Crohn's disease, but tuberculosis, HIV, and so forth) is mandatory. Cultures should be sent to look for an underlying infectious or immunodeficiency syndrome. In addition, a formal examination under anesthesia with biopsies to exclude malignancy and directed cultures is also helpful. If that is all normal and Crohn's disease is the sole problem, there is evidence that fecal diversion alone may heal perianal disease, at least temporarily. In a study of 31 patients, 25 (81%) had early complete remission of their lesions, including all 3 patients who had deep anal ulcers. Each of these patients developed a late relapse

between 11 and 54 months later, however. At present, diversion is not widely accepted as a therapy for refractory Crohn's disease fissures, although this must be kept in mind as a potential maneuver to quell unremitting inflammation [112]. One of the most common reasons for diversion is continued perineal sepsis. Although diversion may be successful to help with symptoms in up to 80%, relapse with the stoma in place occurs in most of those patients, and unfortunately restoration of intestinal continuity rarely occurs [112]. In a study of 86 patients who had Crohn's disease undergoing 344 operations, 49% ultimately required permanent diversion with predictors of need being active colonic disease and anal canal stricture [104].

Proctectomy is required in up to 25% of patients who have perianal disease, although it is often secondary to the extent and severity of concomitant distal colonic and rectal involvement [78]. McKee and Keenan [78] found that proctectomy was needed in 32 of 99 patients who had concomitant colitis and perianal disease, but in none of the 28 patients who had perianal disease alone. Patients should be counseled that even with the wide range and success of current medications, this unpredictable disease may result in untoward and unwanted outcomes for both patient and surgeon alike.

Summary

Crohn's disease remains a complex disease process with many different manifestations in the colon, rectum, and anus. Although advances in medical therapy continue to evolve and change the way that patients are treated, surgeons still play a major role in disease management. Because of its recurring nature, surgeons must adhere to the dictums of dealing with the complications of the disease versus aiming for cure and focus on maximization of patient functional outcome while minimizing complications.

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