Emergency Management of Diverticulitis

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ABSTRACT

Diverticulitis is a common problem, and although most cases will respond to conservative measures, surgeons will frequently need to treat patients requiring emergency surgery. Surgical management has progressed over the past 30 years, with a change in practice from routine drainage and proximal diversion (necessitating two further major procedures) to primary resection and anastomosis in selected cases. In 2004, surgeons must use clinical judgment to determine which approach will optimize outcomes both in terms of morbidity and mortality and in terms of quality of life for their patients.

KEYWORDS: Diverticulitis, surgical management, emergency

Objectives: Upon completion of this article, the reader should be able to summarize the emergency surgical treatment for right- and left-sided diverticulitis.

Although rarely described prior to the 20th century, diverticular disease and complications of diverticular disease are now a major burden on society, affecting large numbers of the population. In 1998 there were 2.2 million cases of diverticular disease in the United States, with over two billion dollars spent in the treatment of complications of this disease.[1] Fortunately, most individuals with diverticulosis will remain asymptomatic throughout their lifespan. However, about 10 to 25% will develop symptoms, most commonly from inflammation secondary to microperforation. Overall, the rate of hospital admissions for perforated sigmoid diverticular disease appears to be increasing. In the United Kingdom, the rate of hospital admissions for diverticulitis is 23 per 100,000 per year for males and 32 per 100,000 per year for females.[2] These age-standardized rates have increased over 10% from rates in 1990. The majority of such patients will improve with conservative medical management (bowel rest and antibiotics) and do not require further intervention.

Despite this, because diverticulitis is so common, many patients will require emergency surgery for complications of diverticular disease each year. In fact, although uncommon, the rate of frank diverticular perforation has actually increased over time to the current rate of approximately 4.0 per 100,000 per year in Western countries.[3,4] The mortality rate of colonic perforations remains high (up to 20%) despite advances in medical and surgical care, and these patients also suffer substantial morbidity. In addition, many patients with diverticular disease surgically treated in an emergency setting will live with a colostomy for the remainder of their lives. Appropriate surgical management of diverticular disease is essential to optimize patient outcomes.

RIGHT-SIDED DIVERTICULITIS

Although rare in the West, up to 50% of diverticula in Asian populations are right sided, generally involving the cecum and/or ascending colon.[5] Right-sided diverticula

Diverticular Disease; Editor in Chief, David E. Beck, M.D.; Guest Editor, Richard E. Karulf, M.D. *Clinics in Colon and Rectal Surgery*, volume 17, number 3, 2004. Address for correspondence and reprint requests: Nancy N. Baxter, M.D., Division of Colon and Rectal Surgery, Department of Surgery, University of Minnesota, MMC 450, 420 Delaware St. SE, Minneapolis, MN 55455. E-mail: baxte025@umn.edu. [1]Department of Surgery, University of Minnesota, Minneapolis, Minnesota. 1531-0043,p;2004,17,03,177,182,ftx,en;ccrs00181x.

may be congenital. In such cases there is usually a single diverticulum which pathologically includes all layers of the bowel wall. These patients tend to be younger and are more likely to be male than those with left-sided diverticula. However, the rate of right-sided diverticula is increasing in Asian countries and has been found to be associated with a decrease in fiber intake.[6,7] In addition, although Asian immigrants to Western countries have an increased incidence of diverticular disease, they continue to have a right-sided predominance of diverticula.[7] Thus it appears that there may be two distinct causes of right-sided diverticula in Asian patients, congenital and acquired. However, overall complications from right-sided diverticulosis (particularly inflammatory complications) are less frequent than in left-sided diverticulosis.[8]

Right-sided diverticulitis generally presents with fever, leukocytosis, and right lower quadrant peritonitis and is often indistinguishable from acute appendicitis.[9] In general, patients with diverticulitis have had symptoms for a longer period of time and have a lower frequency of nausea and vomiting than those with appendicitis.[9,10] Given that the ratio of appendicitis to cecal diverticulitis is 150:1, in Western countries the diagnosis of cecal diverticulitis is most often made intraoperatively, but because of the degree to which cecal diverticulitis mimics appendicitis, this is true even in countries with right-sided diverticular predominance.[9,11,12] Of patients undergoing surgery for diverticulitis, those with right-sided disease tend to be younger than patients with left-sided disease. Those with right-sided diverticulitis are more likely to have localized peritonitis, are less likely to have comorbid conditions, and have generally not had a course of conservative management.[13]

When cecal diverticulitis is diagnosed at laparotomy, treatment options include appendectomy and drainage, diverticulectomy, ileocecectomy, or right hemicolectomy. Several reports from Asian centers have documented good results from simple drainage and appendectomy for cases of cecal diverticulitis without frank perforation; however, these results have not been replicated in Western populations.[9,14,15] In general, resection is recommended.[9,11,12] When a single diverticulum is present without the presence of a cecal phlegmon, a simple diverticulectomy is recommended, as this procedure is associated with a low morbidity and recurrence rate.[9,13] However, in many patients more extensive inflammation may be present. Such inflammation may make diverticulectomy impossible and an ileocecectomy should then be performed. It may be difficult to differentiate cecal diverticulitis from perforated carcinoma when a phlegmon is present, particularly when the diverticulum is hidden. In fact, a definitive intraoperative diagnosis is difficult in between 15 to 35% of cases of cecal diverticulitis.[9,16] In this situation, right hemicolectomy with primary anastomosis should be performed and is associated with a low morbidity and mortality.[9,12,13,17]

An increase in the preoperative diagnosis of right-sided diverticulitis is expected with the widespread use of computed tomography (CT) scanning in the evaluation of acute right lower quadrant pain. The management of preoperatively diagnosed patients is highly controversial. Several case series demonstrate successful conservative management for right-sided diverticular disease; in the Netherlands, 37 of 44 cases of right-sided diverticulitis diagnosed by CT scanning were successfully managed conservatively.[18] In a study of 81 patients with right-sided diverticulitis diagnosed by CT or barium enema in Japan, only 6 patients required operative intervention with nearly a 3-year average follow-up time.[19] Although other authors have found a conservative approach less uniformly successful,[12] if appendicitis can be definitively ruled out, conservative management clearly has a role in this disease. Experience in the management of preoperatively diagnosed patients with right-sided diverticulitis will no doubt increase as the number of these patients increases. Of note, if conservative management is successful, all patients should undergo interval colonoscopy to rule out neoplasm.

LEFT-SIDED DIVERTICULITIS

Although substantial progress has been made in the conservative management of sigmoid diverticulitis, a significant number of patients require operative management emergently or urgently after presentation. Such patients are often critically ill and their management presents unique challenges.

Most patients with sigmoid diverticulitis present with the classic triad of signs: left lower quadrant tenderness, fever, and leukocytosis. Medical therapy is successful in the majority of such patients, and in fact, with advances in interventional radiology even patients with abscesses can safely be conservatively managed. However, between 15 and 30% will fail medical management and require surgical intervention during admission.[20] Some patients will not respond to antibiotics, bowel rest, with or without CT-guided drainage. They will continue to manifest symptoms and signs of sepsis without improvement. In such cases, it is important to review the entire case to ensure that the treatment being administered is appropriate and adequate and that the presentation is not due to an alternative diagnosis. In mild cases, further expectant management may be tried, but the majority of these patients will require urgent surgical intervention, particularly if the patient actually worsens on medical therapy. A smaller number of patients will respond to medical therapy but will develop recurrent abdominal pain and fever as diet is introduced or antibiotics discontinued. While an additional course of conservative management and repeat imaging to rule

out interval abscess formation are recommended, many of these patients with "grumbling" diverticulitis will require semi-urgent surgical management. In contrast, a small proportion of patients will present in extremis with peritonitis and a clear need for emergent resuscitation and operation. Diffuse peritonitis, although an uncommon presenting feature, is dramatic and frequently must be definitively managed without the help of ancillary studies.

Because perforation (microscopic or macroscopic) is the common cause of diverticulitis regardless of severity, in general the use of the phrase "perforated diverticulitis" should be avoided when attempting to describe the severity of the process. Hinchey recommended four distinct categories to describe the spectrum of disease: Stage I, pericolic or mesenteric abscess located in the peridiverticular area; Stage II, pelvic abscess; Stage III, generalized purulent peritonitis; and Stage IV, generalized fecal peritonitis. These categories remain clinically meaningful.[21]

The emergency surgical management of diverticulitis has changed dramatically in the past 30 years. Classically, a three-stage approach to the management of these patients was advocated. At the first operation, a proximal colostomy (often a loop transverse colostomy) was performed and the septic focus drained. At the second operation, the inflamed bowel was resected. At the third operation, intestinal continuity was restored.[22] With this approach, the septic focus was left in situ after the initial procedure and some authors began to note high rates of complications with the three-stage procedure.[23] In addition, many patients treated in this fashion did not progress through all stages and remained with a permanent transverse colostomy.[24] Case series appeared indicating that resection of the diseased segment with an end sigmoid colostomy and rectal stump (the Hartmann procedure) with subsequent colostomy reversal (the two-stage procedure) was at least as safe (potentially safer) in terms of morbidity, mortality, and length of hospitalization as the three-stage procedure.[25,26] In addition, over the long term, the patients tolerated the sigmoid colostomy created for the Hartmann procedure better than the transverse loop colostomy traditionally performed for the drainage and diversion procedure. In a review of the literature on emergency surgery for diverticulitis in 1984, Krukowski and Matheson found an 11% mortality rate in patients when the diseased segment was resected emergently versus 25% when proximal diversion and drainage were used alone.[23] However, some mortality rate differences identified in the studies reviewed by these authors may represent the selection bias inherent in case series addressing this issue. In a recently published randomized trial comparing primary versus secondary sigmoid resection for patients with Hinchey Stage III or IV diverticulitis in 105 patients, no difference in mortality was found between those randomized to primary resection and those randomized to diversion and drainage, although the overall mortality rate (21%) was high.[27] Patients who underwent primary resection did, however, have a lower rate of postoperative peritonitis, fewer early reoperations, and a shorter hospital stay than those undergoing secondary resection.

There continue to be rare circumstances where proximal diversion and drainage is the safest course of action: if the patient is extremely unstable intraoperatively; if the surgeon does not have the skills, expertise, or assistance to manage the problem; or if the degree and extent of inflammation precludes resection without compromise of adjacent retroperitoneal structures.

The current standard of care in the emergency treatment of diverticulitis is to remove the diseased segment of bowel, eliminating the source of sepsis. Traditionally the surgical approach is through a midline incision. Initial laparotomy should be performed to confirm the diagnosis and rule out other potential diagnoses, to assess the degree of inflammation, and to assess the degree of peritoneal contamination (Hinchey stage). The diseased bowel should then be mobilized and although this may appear difficult initially due to presence of an acutely inflamed mass adhered to the peritoneum and/or adjacent structures, the diseased segment can usually be bluntly dissected from surrounding structures. A proximal to distal approach to the mobilization is safest, as noninflammed tissue planes can be identified proximally and then followed. The lateral peritoneal reflection should be divided and the dissection carried inferiorly and posteriorly. This is generally facilitated by early division of the proximal bowel.[28] The bowel can then be elevated anterior-medially, allowing the dissection to progress. The ureter should be identified and placement of ureteric stents (if possible within the constraints of emergency or urgent surgery) can prove invaluable. In acute diverticulitis requiring operative intervention, the mesentery is generally thickened and inflamed, and therefore should be divided with care. Small bites of mesentery should be taken, as often it is difficult to identify or isolate vessels, and if necessary the mesentery may be taken close to the bowel.

It is not necessary to remove all colon affected by diverticulosis proximal to the sigmoid: however, all thickened and inflamed bowel should be resected. Distally, the resection margin should be the upper rectum, where the bowel is soft, pliable, and free of diverticula. This will minimize the risk of ongoing sepsis postoperatively and will provide the healthiest bowel for anastomosis. The superior hemorrhoidal artery should be preserved to maintain blood supply to the stump. The rectum is generally stapled and can be oversewn if there is any concern regarding the staple line. In general, if the entire sigmoid is removed there is insufficient bowel length to create a mucus fistula. The specimen should be opened and examined at the time of the laparotomy, as a

perforated carcinoma may mimic diverticulitis in appearance. The presence of carcinoma may mandate a wider mesenteric resection if this is safely feasible.

In the 1980s and 1990s, the Hartmann procedure was considered to be the standard of care for the emergency surgical management of acute sigmoid diverticulitis.[29] In this approach after resection of the diseased segment of bowel, a sigmoid colostomy is fashioned and a rectal stump (the Hartmann pouch) is left in situ (Stage I). Then 6 weeks to 6 months later (depending on the degree of inflammation and the patient's condition) a second laparotomy would be performed and the colostomy reversed (Stage II). Although there is significant morbidity and mortality associated with the Hartmann procedure, given the acuity of the patients treated, results with this procedure are good and serve as a benchmark for alternative treatment strategies.[30] The Hartmann procedure, however, does commit the patient to a major laparotomy for colostomy take-down, with a nontrivial risk of morbidity and mortality. Because of this, significant numbers of patients (from 16 to 46%) will never have reversal but will live with a permanent colostomy.[30–32] Even temporary stomas have a significantly negative impact on the quality of life and sexual function of patients.[33,34] To improve outcomes for patients with stomas, patients should have stoma marking done preoperatively, if time allows by an enterostomal therapist, otherwise by the surgeon.

Clearly treatment of patients with resection of the inflamed segment and primary anastomosis without a diverting stoma would minimize the impact of surgery on quality of life and avoid the need for further surgery. However, the presence of a septic process in a medically unwell patient with an unprepared bowel has discouraged surgeons from adopting such an approach, fearful of anastomotic dehiscence in an already acutely ill patient. Nonetheless, given the wide spectrum of patients and stages of disease requiring emergency intervention, there are patients that can be safely managed with anastomosis with or without diversion. Clinical judgment must be exercised to determine which patients are best served with primary anastomosis and which patients require a Hartmann procedure to be managed safely.

Gregg was the first to report a series of patients successfully managed with primary anastomosis in 1955.[35] These were patients in whom the bowel was free of edema, well vascularized, and empty of feces. Rothenberger and Garcia-Aguilar described absolute and relative contraindications to primary anastomosis.[36] Patient factors (including hemodynamic stability, presence of anemia, nutritional status, and immunosuppression), disease factors (including degree and nature of peritoneal contamination), and technical factors must be evaluated by the treating surgeon to determine if a patient is a good candidate for a primary anastomosis (Table 1).

Table 1 Contraindications for Primary Anastomosis after Resection for Diverticular Disease

ABSOLUTE
Hemodynamic instability
Diffuse fecal or purulent peritonitis
Ischemia or edema of the proposed site of the anastomosis
Severe anemia, malnutrition, or immunocompromise
RELATIVE
Unprepared bowel
Technical complications
Chronic abscess cavity
Mild anemia, malnutrition, or immunosuppression

From Rothenberger DA, Garcia-Aguilar J. Diverticular disease of the colon. In: Cameron JL, ed. Current Surgical Therapy. St. Louis, MO: Mosby Inc; 1998: 178, Table 4. Reprinted with permission.

If conditions are favorable, a primary anastomosis may be fashioned using a hand-sewn, stapled, or double-stapled technique using a circular stapler. As is standard practice, there must be no tension on the anastomosis or it will be predisposed to dehisce. To avoid this, it is often necessary to take down the splenic flexure; the added time required to mobilize the flexure must be considered when contemplating primary anastomosis. Other than those few patients with very indolent disease, the majority of patients requiring emergency surgery for diverticulitis will not have had a mechanical bowel preparation. Although the utility of mechanical bowel preparation is currently in question, it is our practice to perform an on-table lavage when a primary anastomosis is performed in these circumstances.[37] On-table lavage can be performed quickly, with minimal contamination, and does not require the mobilization of the hepatic or splenic flexure. At the University of Minnesota, we have developed a simplified approach to on-table lavage. The lavage is performed *after* completion of the anastomosis. A large Foley catheter is inserted through an appendicostomy and secured with a purse-string. If a temporary ileostomy is planned, the Foley is placed in the distal ileum at the site of the ileostomy, guided through the ileocecal valve into the cecum, and temporally secured with a purse-string. A proctoscope is inserted into the anus, guided through the anastomosis, and held in position proximal to the anastomosis. Five to six liters of warm saline are then infused via the proximal catheter and allowed to flow through the opened proctoscope into a large basin. One operator must control the rate of saline infusion at the cecum to ensure that the bowel does not become over distended and that the flow does not overwhelm the capacity of the operator using the proctoscope. At the end of lavage, the effluent should be largely clear and free of particulate matter. After the lavage is finished, the appendectomy is completed or the ileal purse-string tied to close the defect until the stoma is fashioned. The anastomosis is then tested under water by insufflating air into the rectum using the proctoscope.

The anastomosis may then be oversewn at the surgeon's discretion.

If conditions are not completely favorable to a primary anastomosis, proximal diversion is an excellent option, a proximal stoma preventing peritoneal contamination should the anastomosis break down. Although primary anastomosis with proximal diversion is also a two-stage approach, completion of the anastomosis during the first stage greatly reduces the magnitude of the second procedure, increasing the probability (as compared with the Hartmann) that the stoma will be reversed. Proximal diversion may be achieved by formation of a transverse loop colostomy or a loop ileostomy.[38] Stoma-related complications occur more frequently with a transverse loop colostomy, and therefore it is our practice to perform a loop ileostomy when diversion is necessary.[38–42] The use of a bioresorbable adhesion barrier (e.g., Seprafilm™, Genzyme Biosurgery, Cambridge, MA) during formation of the ileostomy may facilitate closure.[43]

Several case series have demonstrated the safety of primary anastomosis without diversion for the treatment of acute diverticulitis and have found that the morbidity and mortality of primary anastomosis compared favorably to patients treated with the Hartmann procedure.[44–47] When evaluating the results of such case series, it is important to note that patients selected for the Hartmann procedure likely differed substantially from those selected for primary anastomosis in ways that would affect the rate of morbidity and mortality (e.g, degree of peritoneal contamination, nutritional status, etc.). Thus, although these studies indicate that many patients may be safely treated with primary anastomosis without diversion, even in the presence of peritonitis, this does not apply to all patients. Selection of patients still requires surgical judgment taking into consideration all patient and disease factors.

Prior to closure, the abdomen should be copiously irrigated with saline. If there is an established abscess cavity, drainage should be considered, otherwise routine drainage is unnecessary. The fascia should be closed as per usual routine, but in the case of Hinchey Stage IV or in the immunocompromised patient, consideration of internal retention sutures should be given. The skin should be closed unless there has been gross peritoneal contamination. In this case, it may still be useful to place a few sutures to approximate the skin and reduce the size of the wound. Placement of a vacuum-assisted closure device as soon as possible in the postoperative period greatly reduces the morbidity associated with wound closure by secondary intent (Vacume Assisted Closure Abdominal Dressing System, KCI, San Antonio, TX).

Laparoscopic sigmoid resection for chronic diverticulitis is a well-established option for many patients, but in the acute setting, laparoscopic surgery has a more limited role.[48–50] The presence of a large phlegmon and/or inflammatory adhesions may make a pure laparoscopic approach impossible.[51] The use of a hand-assisted device may facilitate blunt dissection of adhesions and elevation of the phlegmon, and a surgeon attempting a laparoscopic approach in the acute setting should be experienced in laparoscopic colon resections in the elective setting.[52,53] If laparoscopic surgery is attempted in the acute setting, the need to convert must be determined early so that time is not wasted in an acutely ill patient.

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