Nonoperative Management of Complicated Diverticular Disease

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ABSTRACT

The complications of diverticular disease of the colon can be divided into those related to inflammatory conditions (diverticular abscess, fistula, and perforation) and those related to noninflammatory conditions (lower gastrointestinal hemorrhage and non-inflammatory stricture or obstruction). Nonoperative management of uncomplicated diverticulitis includes bowel rest and antibiotics. For abscesses, percutaneous drainage by radiologic guidance often turns complicated diverticulitis to an uncomplicated condition. In very select instances, fistulas or even perforation may be managed without operation. Strictures may be dilated or stented. Diverticular hemorrhage may be controlled with colonoscopic and angiographic techniques. For colonoscopy, these include cauterization, epinephrine injection, and endoclips. For angiography, these include arterial infusion of vasopressin and selective embolization of bleeding vessels. For both diverticulitis and diverticular bleeding, these nonoperative therapeutic modalities may be utilized as a bridge to surgery, or in select instances as a definitive therapy obviating the need for surgery.

KEYWORDS: Diverticulitis, diverticular bleeding, nonoperative management

Objectives: Upon completion of this article, readers should be able to recognize the nonoperative or less invasive options available for the treatment of complicated diverticular disease.

Traditionally, the complications of diverticular disease have been categorized as either inflammatory conditions (diverticulitis with associated abscess, perforation, or fistulization) or noninflammatory conditions (lower gastrointestinal bleed, benign stricture, or non-inflammatory obstruction). Both aspects of this disease process have been associated with considerable morbidity and mortality. As such, the traditional treatment of complicated diverticular disease has been surgical. However, the last few decades have seen advances in the use of pharmacology, endoscopy, and radiology to treat these complications. In some instances, these treat-

ment modalities have obviated the necessity for surgery altogether. In other instances, they have acted as a bridge to elective operation. We present a summary of these treatment modalities.

DIVERTICULITIS

Diverticulitis is best defined as the microperforation or macroperforation of colonic diverticula causing localized inflammation that may progress to localized abscess, frank peritonitis (purulent or feculent), stricture, or fistulization to adjacent structures.¹⁻³ In the United

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Figure 1 Sigmoid diverticulosis. Note that there are diverticula in an incisional hernia.

States, diverticulitis is primarily a disease of the sigmoid colon, but can be pancolonic or limited to the right side. These diverticula are traditionally “false” diverticula, or mucosal outpouchings through the colonic wall at the points of penetration of the vasa recta (Fig. 1).¹ Right-sided diverticula are more commonly true diverticula (all layers of the bowel wall) and are more commonly seen in younger males of Asian descent.⁴

Diverticulitis can be further classified as simple diverticulitis or complicated diverticulitis. Simple diverticulitis (Fig. 2) is best defined as inflammation without abscess or perforation that is readily controlled through conservative measures (analgesia, antibiotics, and bowel rest). Complicated diverticulitis can be further subdivided into abscess, perforation, fistulization, stricture, and obstruction. Before computed tomography (CT scan) was readily available, complicated diverticulitis

Figure 2 Classic sigmoid diverticulitis. Note the thickening and inflammatory changes in the pericolic fat.

required operative management. Now, however, these complications can often be controlled without surgery. While percutaneous drainage of diverticular abscesses has been studied extensively, little more than anecdotal data exist regarding the nonoperative management of some of these other complications.

NATURAL HISTORY

The natural history of diverticulitis has been extensively studied and well documented. In 1966, Bolt and Hughes published their data on 100 consecutive patients.⁵ They reported a 7% operative mortality and 52% immediate laparotomy following a variety of procedures. Of the 52 surgical patients, 33 required either suture repair, drainage, or both, and 19 required colostomy with or without resection. In the remaining 48 patients treated without surgery, 37 underwent interval resection (the majority of these underwent a one-stage procedure). Even prior to radiologic-guided drainage and modern antibiotics, their data indicate that a proportion of people are amenable to simple surgical drainage and another group is amenable to simple medical management. Thus, while the complications of diverticulitis often lead to surgical intervention, it has long been known that nonoperative or less invasive management strategies have a role in the treatment of this disease process, either as a bridge to surgery or as a primary treatment modality.

Hinchey and colleagues graded diverticulitis according to the degree of perforation.⁶ These gradations are summarized as follows:

- I. Confined pericolic abscess
- II. Abscess in the pelvis or retroperitoneum (distant abscess)
- III. Purulent peritonitis
- IV. Feculent peritonitis

Grades III and IV generally require resuscitation and stabilization of the patient followed by surgery. Grade I is usually amenable to conservative treatment with antibiotics and bowel rest.¹ Grade II (Fig. 3) often can be managed by radiologic-guided drainage and conservative treatment.³

SIMPLE DIVERTICULITIS

The nonoperative management of simple diverticulitis begins with appropriate antibiotics, bowel rest, and analgesia. A recent survey of members of the American Society of Colon and Rectal Surgeons (ASCRS) found that most inpatients are treated with either a second-generation cephalosporin (cefotetan or cefoxitin) or ampicillin/sulbactam (40%).⁷ Other combinations included one or more of the following: ampicillin,

Figure 3 Same patient as Figure 1, now with a diverticular abscess (arrow).

gentamicin, clindamycin, metronidazole, and ciprofloxacin. Of note, 65% of the ASCRS respondents treated their patients on an outpatient basis. The antibiotics used in this setting were ciprofloxacin and metronidazole in 28%, ciprofloxacin alone in 18%, and metronidazole alone in 7%. Other combinations used included metronidazole and trimethoprim sulfamethoxazole, amoxicillin and clavulanic acid, and doxycycline as a single agent. Other findings in the ASCRS survey related to dietary modifications and follow-up studies, namely flexible sigmoidoscopy, colonoscopy, and barium enema.⁷

Krukowski and colleagues reviewed their experience with conservative management of acute diverticulitis.⁸ Fifty-seven patients were admitted with acute left-sided diverticulitis, of which 37 were successfully managed with bowel rest, antibiotics, and percutaneous drainage where applicable. Another five patients failed conservative therapy and required operation. This series, which accrued patients as far back as 1977, indicated that the antibiotics used are remarkably similar to our current choices: primarily ampicillin, gentamicin, and metronidazole.⁸

Munsun and associates reviewed their experience with diverticulitis in 65 patients.⁹ Thirty-two of these patients were treated medically, the remainder requiring surgery at first admission during their study period. The review did not specify if any of the surgical patients were treated conservatively and had failed medical treatment, and it did not indicate the reasons for surgical treatment. The authors' results indicated that many of the surgically treated patients had had prior episodes of diverticulitis and that all had an anastomosis performed at the primary

surgery. Of the medically treated patients, the majority went on to have recurrent symptoms (62.5%) following successful medical management. No patients who presented to their medical center were reported to require emergency surgical treatment.

Reisman and coworkers followed 119 patients with acute diverticulitis.¹⁰ Eighty-three were treated conservatively with bowel rest and parenteral antibiotics, 71 of whom were discharged from the hospital without surgery. Of these, 38 had recurrent abdominal pain, of which 26 had documented recurrence of diverticulitis. The majority of recurrences occurred within 1 year (82%). Overall, 55 of the 119 underwent surgery for diverticulitis. Interestingly, using 60 years of age as a cutoff, no significant differences were seen between older ($n = 77$) and younger ($n = 42$) patients with respect to complications or recurrence of disease. Those with right-sided disease did have surgery more often at first admission, and this was more common in younger individuals.

A randomized multicenter prospective trial of single agent cefoxitin (CFX) compared with a combination of gentamicin and clindamycin (G/C) was reported by Kellum and colleagues.¹¹ Ninety percent of the CFX patients ($n = 27$) were cured with antibiotics alone, while 85.7% of the G/C patients ($n = 18$) were cured in the same fashion. No significant differences were found between the groups with respect to cost or cure, but in the CFX group a significantly larger number of patients did go on to single-stage elective surgery (all had had prior episodes of diverticulitis).

DIVERTICULAR ABSCESS

The treatment of acute diverticulitis complicated by abscess (Hinchey II) has been dramatically altered by the advent of radiologically guided percutaneous drainage.¹²

This can be done with the aid of computed tomography (CT scan) or ultrasound.² Drainage catheters may be placed percutaneously or transrectally.¹³ This technique has become such a mainstay of treatment for complicated diverticulitis that, in 1999, the European Association of Endoscopic Surgery endorsed a modified Hinchey classification in its consensus statement.² Here Stage II was subdivided as follows:

- IIa. Distant abscess amenable to percutaneous drainage
- IIb. Complex abscess associated with or without fistula

Stabile and associates successfully converted multi-stage operative approaches to single-stage operations with the use of radiologically guided (CT or ultrasound) catheter drainage of pericolic and pelvic abscesses in 14 of 19 patients (74%) who presented with acute diverticulitis complicated by abscess.¹⁴ In this study, Gram stain and culture of the aspirate guided antibiotic therapy,

and sinograms were used to follow cavity size. In addition, the percutaneous attempt identified fecal fistulas in three patients who were subsequently immediately operated on with resection and diversion.

Saini and colleagues prospectively evaluated 17 patients with acute diverticulitis using CT scans.¹⁵ Eleven patients had a documented abscess, eight of whom had a collection large enough to drain. This allowed for single-stage elective operations in seven (one patient with ovarian carcinomatosis and diverticulitis was simply diverted). Similar results were obtained by Mueller and coworkers in 24 patients with percutaneously drained diverticular abscesses.¹⁶ Fourteen of these went on to single-stage elective resections, five required a two-stage procedure, and five did not undergo surgical resection. However, only one of these patients remained asymptomatic 10 months after discharge (three required surgery at a second admission, and one died of complications related to comorbidities).

Percutaneous drainage is best approached under CT guidance, as this permits visualization of adjacent structures and may allow for more complex drainage procedures, including transgluteal drainage and transpiriformis drainage.^{17,18} With this approach, Neff and vanSonnenberg were able to convert 70% of patients with Stage II disease to elective single-stage operation.¹⁹

In a series of 22 patients with diverticular abscesses without peritonitis, reported by Ambrosetti and associates, conservative treatment was successful in 15.²⁰ Two of these patients were drained, one percutaneously and one transrectally. While the patient drained percutaneously required single-stage resection 11 months later, the patient drained transrectally remained asymptomatic 2 years later at the time of reporting. Seven other patients conservatively treated with single-agent broad-spectrum antibiotics were free of disease at a mean follow-up of 24 months.

Schechter and colleagues percutaneously drained spontaneous abscesses in 21 patients, 10 of whom had diverticular abscesses. All 10 were successfully converted to elective single-stage operations at a later date.⁷

The traditional treatment of diverticular abscess has been surgical. However, recent trends have indicated a tendency to treat these complications either conservatively or less invasively. No prospective data exist, however, that clearly show nonoperative treatment to be either equivalent or superior to surgical treatment. The question must be asked: Should the conservative treatment of diverticular abscess be considered a bridge to definitive therapy, or is there a place for watchful waiting? According to the ASCRS, up to 80% of patients with acute diverticulitis are treated with conservative therapy, and approximately 85% of these successfully avoid an emergent or urgent operation.^{21,22} Approximately one third of patients never have a second attack, and only another one third have documented recurrence

of diverticulitis, leading to an overall readmission rate of 2% per year for diverticulitis.²² One must keep in mind that, prior to CT scan, many patients who responded to antibiotics may have had small pericolic or mesenteric abscesses which did not require drainage. It therefore seems reasonable, with appropriate patient education, that operation may be avoided in select patients.

A final technical note: while laparoscopy is an operative approach to the management of complicated diverticulitis, a newer conservative approach for the treatment of diverticular abscess includes laparoscopic drainage without resection. Franklin and colleagues reported on 18 patients who underwent laparoscopic drainage of Hinchey II abscesses without resection.²³ In follow-up (range, 4 to 34 months), only three had subsequent resections, while the remainder remained asymptomatic. O'Sullivan and colleagues treated eight patients with purulent peritonitis (Hinchey III) with laparoscopic washout, and without subsequent resection.²⁴ With 12- to 48-month follow-up, no patient required operative resection for recurrent disease.

DIVERTICULAR PERFORATION

The ominous sign of free air in the abdomen on a radiologic study usually heralds operative treatment of perforated peptic ulcer disease. Occasionally, however, diverticular perforation is found at celiotomy. Even rarer are those largely asymptomatic patients with perforated diverticular disease who lack peritoneal findings. These patients are amenable to conservative treatment (antibiotics and bowel rest), much in the same way that select patients with small colonoscopic perforations can be managed without operation.²⁵

DIVERTICULAR FISTULA

The common areas affected by fistula from diverticular disease are the bladder (colovesical), the vagina (colovaginal), and the skin (colocutaneous).²⁶ The primary treatment for these fistulas is resection of the affected colonic segment. However, in select instances, nonoperative management may either be indicated due to comorbidity, or presented as an alternative to surgery for patients wanting to avoid the operating room. For instance, in elderly patients with a colovesical fistula, where mild urinary tract infections controlled with antibiotics are the primary manifestation, simple low-dose antibiotic prophylaxis may be a reasonable alternative to surgery. In patients in whom a colovaginal fistula is no more than a minor annoyance, or in select elderly individuals with poor continence or for whom medical issues preclude otherwise elective surgery, it is also reasonable to simply observe (assuming that there is no ongoing intra-abdominal abscess requiring drainage).

STRICTURE

If malignancy can be definitively ruled out, the advent of colonic stents may be a reasonable alternative to surgical resection for select patients. Tamin and colleagues reported on three patients with diverticular strictures successfully dilated with endoluminal colonic stents.²⁷ One of these patients opted not to undergo resection without sequelae, although it is unclear what the long-term follow-up was in this case. In addition, nonobstructing strictures may simply respond to bulk-forming agents, without requiring further intervention.

OBSTRUCTION

Obstruction that does not resolve with treatment of inflammatory diverticulitis, or that is secondary to fibrosis not amenable to stent placement, requires operative treatment (resection or diversion). Currently, there are no recommended nonoperative alternatives to these forms of complete obstruction secondary to diverticular disease.

DIVERTICULAR BLEEDING

The origin of significant lower gastrointestinal bleeding may be from many sources, including arteriovenous malformations, neoplasms, and diverticula.^{28,29} Diverticular bleeds have accounted for 15 to 48% of lower gastrointestinal hemorrhages (LGIB) in various series.²⁹ As diverticulosis may be prevalent in up to 10 to 66% of the population, depending on age (range, 40 to 80 years), it is estimated that 17 to 20% of patients with diverticulosis will manifest with LGIB.^{1,30,31} The bleeding will cease spontaneously in 60 to 80% of these patients, with rebleeding occurring in 22 to 38%.¹ Traditionally, urgent or emergent surgery for colonic sources of hemorrhage has been fraught with morbidity and mortality. Operative mortality in the range of 10%, and rebleeding rates of 42% for blind segmental colectomies, have spurred the development of better diagnostic modalities. Subsequent therapeutic procedures have come from nonsurgical interventions.³⁰

The nonoperative management of LGIB begins with stabilization of the patient, obtaining pertinent history (use of NSAIDs, bleeding diathesis, prior history of LGIB, and other factors), and an appropriate work-up, which often includes technetium-tagged red blood cell scans, mesenteric angiography, and colonoscopy. The two latter modalities can be therapeutic as well as diagnostic.

Jensen and coworkers prospectively evaluated urgent colonoscopy for presumed diverticular bleeding.³² They found that 21% ($n = 10$) of patients with *presumed* diverticular bleeding ($n = 48$) actually had diverticula as the source of the LGIB, and that all of these patients were controlled without rebleeding by colonoscopic

epinephrine injection or bipolar cautery. This is in contrast to a group of patients treated surgically without colonoscopic attempt at control of bleeding ($n = 17$); nine of these patients re-bled within 30 days postoperatively, requiring transfusion.

Bloomfield and colleagues reported on 13 patients who underwent epinephrine injection, cauterization, or both modalities for acute diverticular bleeding.³³ Unlike the Jensen study, they found that five patients rebled within 30 days, four of whom required surgery.

The practice parameters of the American College of Gastroenterology state that colonoscopy is the recommended diagnostic tool for the evaluation of LGIB, and subsequent endoscopic therapy has a low complication rate.³⁴ No specific recommendations are made regarding which endoscopic modality should be utilized.

Other colonoscopic methodologies that may aid in control include endoscopic band ligation³⁵ and the use of endoclips.³⁶ While most reports of these are anecdotal, there is clearly a trend toward more conservative management of LGIB secondary to diverticular hemorrhage.

Angiography also plays a major role in the treatment of acute diverticular bleeding (Fig. 4). Injection of vasopressin via catheters is a method for the control of bleeding.³⁴ The use of microcatheters allows for selective embolization of bleeding vessels identified on angiography (Fig. 5).³⁷ Important concerns with these treatment modalities have been ischemic injury to the embolized bowel³⁸ and cardiac toxicity from coronary vasoconstriction with the use of vasopressin.³⁹

Gomes and associates compared vasopressin to embolization, finding the efficacy of vasopressin to be about 70%, but with a 25% ($n = 4$) rebleed rate.³⁹

Figure 4 Angiogram revealing extravasation (arrow) of contrast from an actively bleeding vessel in the upper sigmoid colon (angiogram courtesy of Kimberley Bloomfield, MD).

Figure 5 Superselective embolization (arrow) of a descending branch from the left colic artery (angiogram courtesy of Kimberly Bloomfield, MD).

However, in this study, both upper and lower GI pathologies were evaluated. When only colonic sources of bleeding were evaluated, no rebleeding occurred in this group, yielding an overall efficacy of 67%.

Browder and coworkers found an overall efficacy of 91%, but reported a 50% rebleeding rate for vasopressin infusion.³⁸ These patients were subclassified by pathologic cause. A total of 13 patients had diverticula as the cause of bleeding. Twelve (92%) bleeds were successfully terminated with vasopressin without ischemic complications, but seven (58%) rebled. Patients with a history of myocardial disease were excluded, biasing the results, but no cases of vasopressin-induced cardiac toxicity were noted.

Athanasoulis and colleagues treated 24 patients with bleeding diverticula.⁴⁰ Angiography with localization and vasopressin infusion arrested the bleeding in 22. Ten patients went on to interval surgery (five for recurrent bleeding). Three more patients rebled at 2, 4, and 12 months after treatment, for a 33% rebleed rate. No ischemic events were noted in any patients, although hypertension was noted in one patient without sequelae.

Bandi and colleagues report on the use of superselective embolization of LGIB.³⁷ In this study, patients were embolized using collagen-coated microcoils, polyvinyl alcohol particles, or hemostatic gelatin foam topical agents. The embolization was successful in 39 of 52 patients (73%). Evaluation of ischemia was performed in 25 patients. Six patients (24%) had some mild ischemic

or inflammatory change on endoscopy, but none had clinically evident ischemia, and no adverse sequelae were noted in long-term follow-up.

Guy et al⁴¹ published a series of nine patients with super-selective embolizations with polyvinyl alcohol particles. In each case, embolization was successful in the immediate control of hemorrhage, although rebleeding occurred in three patients. Re-embolization was performed successfully in one patient, the other two requiring surgery. Examining the areas following either surgical resection or endoscopy, the authors found only asymptomatic mild colonic ischemia in two patients following embolization.

In the Gomes series, embolization with various substances was evaluated.³⁹ Only three of 24 patients had lower gastrointestinal pathology as their source of bleeding. Nonetheless, all three were successfully embolized without rebleeding. Ischemic necrosis did occur in a jejunal bleeding source, but none were reported for colonic sources.

Gordon and colleagues also evaluated selective transcatheter embolization in 17 patients with LGIB.⁴² In 13 patients, the bleeding was successfully controlled and no clinically apparent bowel infarctions occurred as a result of embolization (only four patients had either surgery or colonoscopy to confirm this).

Whether utilized as the primary modality for treatment or as a bridge to surgery, both colonoscopic and angiographic interventions can be utilized as the initial therapeutic procedure for LGIB secondary to diverticular disease.

CONCLUSION

The treatment of complicated diverticular disease requires a multimodality approach. Experienced endoscopists and interventional radiologists can provide a safer bridge to surgery or may even obviate the need for surgery altogether. Much of the treatment of uncomplicated diverticulitis now falls to the gastroenterologist, the emergency medicine physician, and the family physician. Most LGIB are currently managed with only surgical standby for hemodynamic instability and possible future elective resections. When surgery is necessary or recommended, the initial nonoperative management of complications allows time for bowel prepping, thus facilitating one-stage operative procedures and potentially saving the patient from needing an ostomy. While some diverticular complications are amenable to cure only by surgery, there is an increasing trend toward medical and minimally invasive management. With increasing evidence to support the efficacy of nonoperative management in select cases, surgical management of complicated diverticular disease may ultimately become reserved for use in only the most complicated or unstable of patients.

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