Annals of Gastroenterology (2015) **28,** 25-30

Trends in the surgical management of diverticulitis

Nicole Wieghard, Cristina B. Geltzeiler, Vassiliki L. Tsikitis

Oregon Health and Science University, Portland, OR, USA

Abstract

Sigmoid diverticulitis is an increasingly common Western disease associated with a high morbidity and cost of treatment. Improvement in the understanding of the disease process, along with advances in the diagnosis and medical management has led to recent changes in treatment recommendations. The natural history of diverticulitis is more benign than previously thought, and current trends favor more conservative, less invasive management. Despite current recommendations of more restrictive indications for surgery, practice trends indicate an increase in elective operations being performed for the treatment of diverticulitis. Due to diversity in disease presentation, in many cases, optimal surgical treatment of acute diverticulitis remains unclear with regard to patient selection, timing, and technical approach in both elective and urgent settings. As a result, data is limited to mostly retrospective and non-randomized studies. This review addresses the current treatment recommendations for surgical management of diverticulitis, highlighting technical aspects and patterns of care.

Keywords Elective surgery for uncomplicated diverticulitis, primary anastomosis versus Hartmann procedure, Hinchey I-II, Hinchey III-IV, laparoscopic versus open

Ann Gastroenterol 2015; 28 (1): 25-30

Introduction

Colonic diverticulosis is extremely common in Western countries. Prevalence increases with age, and is estimated to affect approximately 70% of individuals by age 80 [1]. Manifestations of diverticular disease, which include diverticulitis, bleeding, abscess, free perforation, fistula, and stricture formation account for significant disease burden and are frequently associated with poor outcomes, including mortality [2]. Furthermore, hospitalizations for acute diverticulitis are increasing, leading to escalating costs in the US, now estimated to exceed 2.4 billion dollars annually [3-5].

Our evolving understanding of the pathophysiology and natural history of the disease, as well as improvements in diagnostic imaging and nonsurgical management of the disease have led to significant changes in treatment recommendations [6,7]. Less aggressive medical and surgical treatments have been proposed. In cases of acute uncomplicated diverticulitis, outpatient management has been advocated for, and the use of antibiotics challenged [8-10]. Similarly, in cases of complicated diverticulitis, nonsurgical management is preferred initially, including percutaneous drainage of abscesses, given the high morbidity and mortality of urgent operations [11,12]. Maintenance of intestinal continuity via primary anastomosis and the use of minimally invasive approaches are advocated for in elective and urgent settings.

Current practice guidelines are tailored to the individual patient, taking into account risk factors, disease severity on initial presentation, persistent symptoms, and patient preferences [6,13]. Technical aspects of the various surgical treatments are left to the discretion of the individual surgeon. This review will highlight both current surgical recommendations and practice trends.

Uncomplicated diverticulitis

Patients with uncomplicated diverticulitis usually have an indolent course with a low incidence of subsequent complications [9,14,15]. The majority of patients successfully respond to outpatient management [8,16]. Inpatient treatment with bowel rest and IV antibiotics is recommended for those with persistent abdominal pain that does not improve with outpatient antibiotic therapy. Recently, the use of antibiotics in mild episodes of the disease has been questioned. A randomized controlled trial from Europe found no difference in recurrence or development of complications after one year in those treated with antibiotics, versus those who did not receive them [10]. Clinical judgment

Department of Surgery, Oregon Health and Science University, Portland, OR, USA

Conflict of Interest: None

Correspondence to: Nicole Wieghard, Oregon Health and Science University, Department of Surgery, Division of Colorectal Surgery, 3181 S.W. Sam Jackson Park Rd., Mail Code L223A, Portland, 97239 Oregon, USA, Tel.:+1 503 494 1424; Fax: +1 503 494 8884, e-mail: wieghard@ohsu.edu

Received 21 May 2014; accepted 19 June 2014

remains an important aspect of managing acute diverticulitis and determining resolution of acute inflammation.

Recurrence of acute diverticulitis is lower than previously thought. It is frequently reported that about one third of all patients with acute diverticulitis will have a recurrent attack, often within one year [6,17]. Recurrence after an uncomplicated episode of diverticulitis, however, has recently been shown to be much lower, with one prospective study reporting a recurrence of only 1.7% over five years of follow up [15]. Notably, a complicated recurrence after recovery from an uncomplicated episode is very rare, a finding demonstrated in multiple studies [2,7,17].

Elective surgery for uncomplicated diverticulitis

The guidelines for elective sigmoid colectomy for uncomplicated diverticulitis have changed [6]. The decision to proceed with elective resection should no longer be based on the number of episodes or age at onset [7], and routine "prophylactic" elective colectomy is no longer recommended after an acute episode [13,18]. Studies have shown that an increasing number of episodes of acute uncomplicated diverticulitis do not increase the risk of recurrence, complications, or the need for urgent operative management [18,19]. Further, the greatest risk of free perforation is during the first episode of disease [19]. Younger patients (age of onset <50 years) do not have a more aggressive course, as previously thought [20-22]. On the contrary, a lower threshold for both elective and urgent resection has been recommended in immunocompromised patients, given the associated increased risk for failure of medical management and increased risk of recurrent disease with significant morbidity [6,23].

Despite the restricted indications for elective surgery for acute diverticulitis, multiple population-based studies have shown a large increase in the number of elective colectomies performed in the United States [3,24]. This increase is most dramatic in younger patients, aged 18-44 years [3]. This data may suggest a delay in adoption of the practice guidelines and/or may reflect the increasing incidence of acute diverticulitis.

Complicated diverticulitis

Complicated diverticulitis encompasses a broad spectrum of disease presentation, ranging from small pericolic abscesses to perforation with generalized peritonitis and sepsis, as well as late complications, including fistula and stricture formation. Treatment of complicated diverticulitis in the acute setting depends on the patient's overall clinical condition and degree of peritoneal contamination and infection. The most commonly used grading system to describe the severity of complicated diverticulitis is the Hinchey classification (Table 1) [25].

It has been estimated that about 15-20% of all patients admitted with acute diverticulitis, both complicated and uncomplicated, will require surgical intervention during their initial admission [6,26,27]. Those with complicated diverticulitis are even more likely to require an operation during their initial hospitalization, upwards of 50% of the time [4]. Given the substantial morbidity associated with urgent colectomy for complicated diverticulitis, however, there is a trend to favor non-operative management initially. The proportion of patients undergoing urgent colectomies has decreased in recent years, from 71 to 55% [4].

Table 1 Hinchey classification [25]

Hinchey classification	Description
I	Colonic inflammation+pericolic abscess or phlegmon (confined)
II	Colonic inflammation+retroperitoneal or pelvic abscess (distant)
III	Colonic inflammation+purulent peritonitis
IV	Colonic inflammation+fecal peritonitis

Hinchey I-II

The most common presentation of complicated diverticulitis is an abscess, estimated to occur in approximately 15% of patients [6]. For small abscesses <2 cm, medical management (bowel rest and IV antibiotics) is often sufficient. For larger abscesses >5 cm, image-guided percutaneous drainage is the preferred initial treatment [6,28,29]. According to recent studies, there has been a consistent increase in patients admitted with diverticular abscesses, as well as an increase in those undergoing percutaneous drain placement [4,26].

Hinchey III-IV

The incidence of free perforation (purulent and feculent peritonitis) appears to have remained stable in recent years at around 1.5% [4]. Patients who present with sepsis and diffuse peritonitis require urgent operative intervention [6]. Two single institution studies, however, have recently suggested nonoperative management for select patients in the absence of severe sepsis [30,31].

When treated nonoperatively, complicated diverticulitis is associated with high recurrence rates, reported up to 50%. When compared to those with uncomplicated diverticulitis higher incidences of late complications including persistent symptoms, abscess, fistula and stricture have been reported [32,33]. In several studies, the severity of the initial disease presentation, based on CT findings, is directly correlated to an increased risk of recurrence and subsequent complications [28,29,32]. To further evaluate this relationship, Ambrosetti *et al* developed a CT-based severity grade and correlated this retrospectively with patient outcomes,

elucidating the value of imaging as a prognostic indicator to guide management [29]. A "severe grade" on CT, which included evidence of abscess, extraluminal air, or extraluminal contrast was statistically predictive of medical treatment failure in the acute phase, and for increased risk of recurrence or additional complications after successful nonoperative management [29].

Location and size of the abscess on presentation also contributed to the risk of recurrence and failure of nonoperative treatment [17,28]. In a prospective study of 73 patients with diverticular abscesses, pelvic abscesses were associated with worse outcomes when compared to mesocolic abscesses [34]. In a retrospective study of 218 patients undergoing percutaneous drainage, a larger abscess, defined as size greater than 5 cm, was also significantly associated with higher recurrence rates [35].

Controversy exists as to whether or not elective colon resection after successful nonoperative management of complicated diverticulitis is necessary. This notion is supported by the fact that observation after percutaneous drainage appears to be safe in selected patients [35].

According to the American Society of Colon and Rectal Surgeons (ASCRS) practice parameters, elective colon resection should typically be advised after a complicated episode is initially treated nonoperatively, due to the high incidence of medical treatment failure, recurrence, and late complications [6]. In addition, patients with fistula formation or stricturing disease are recommended for resection. A summary of recommendations from the ASCRS Practice Parameters for Sigmoid Diverticulitis and the Association of Coloproctology of Great Britain and Ireland (ACPGBI) Position Statement on Elective Resection for Diverticulitis are presented in Table 2 [6,13].

Technical aspects of surgical management

Primary anastomosis versus Hartmann procedure (HP)

Options for definitive surgery involve resection of the affected colon with or without anastomosis. The two-stage approach, commonly called HP, refers to sigmoid colectomy with end colostomy and later colostomy reversal. HP became the standard procedure for perforated diverticulitis in the 1980s [36]. It is associated with a high morbidity and mortality, as well as a high rate of non-reversed colostomies, reported up to 55% [11,12]. Surgical management, therefore, has evolved away from HP to establishing intestinal continuity, via sigmoid colectomy and primary anastomosis (PA), with or without protective diverting loop ileostomy (DLI). This is often constructed in the presence of abscess or free perforation.

The surgical resection margin should extend proximally to compliant bowel (does not need to be free of diverticula) and distally to the upper rectum (where the taeniae coli coalesce). An adequate distal margin is the most important factor in determining recurrence after resection [6]. Recurrence risk with colocolonic anastomosis is up to four times higher than that of colorectal anastomosis [37]. Some have advocated for routine splenic flexure mobilization to facilitate tension-free anastomosis [13]. We believe, however, the need for this is determined intra-operatively, based on the patient body-habitus and length of colon resected.

The vast majority of elective resections, approximately 95%, are performed with PA [24]. Although historically, HP has been the procedure of choice in the urgent setting, retrospective studies comparing HP to PA with or without DLI have shown similar short-term outcomes (including mortality and postoperative infections) [38-42]. A systematic review concluded that the overall morbidity and mortality were higher for HP than for PA, suggesting that PA with or without proximal DLI is safe in patients with diverticular peritonitis [11]. Patient selection remains an important component. In most of these studies, the patients selected for PA were younger, with lower Hinchey scores [38]. In a trial by Oberkofler *et al*, which randomized 62 patients to PA with DLI versus HP found similar mortality and complication rates, only 58% of the patients who underwent HP, however, had future reversal of their stoma [43]. Furthermore, colostomy use has been associated with higher comorbidities [3]. Concordant with recommendations from the literature, recent data has shown that the use of primary anastomosis in the acute setting is increasing [24].

The current body of evidence suggests that primary anastomosis can and should be performed in patients with acute complicated diverticulitis, conditions permitting. Ultimately, this decision is left to the judgment of the surgeon, taking into account the clinical status of the patient including comorbidities, health of the remaining intestine, and extent of peritoneal contamination.

Approach to colon resection: laparoscopic versus open

Elective setting: The laparoscopic approach has been shown to have several advantages over open surgery, including lower mortality and postoperative complication rates, shorter hospital stays, and lower overall cost [44-48]. In the Sigma trial, which randomized 100 patients to laparoscopic vs open colectomy in the elective setting, the laparoscopic group had fewer major complications, though in long-term follow up, there were no differences between the two groups [49,50]. Two additional small-randomized trials failed to show a significant difference in outcomes, but these studies were underpowered and had difficulty with enrollment due to patients' preference for laparoscopic surgery [51,52].

Overall, the number of laparoscopic colectomies performed for diverticular disease has been increasing, but remains lower than anticipated, with less than half of colectomies for diverticulitis being attempted laparoscopically [47,48].

Urgent setting: The role of laparoscopy in the urgent setting is incompletely evaluated [13]. In a small retrospective study, emergent laparoscopic surgery for patients with complicated diverticular disease was associated with decreased

Table 2 Comparison of published surgical treatment recommendations

Considerations	ASCRS practice parameters[a] Grade (Level)	ACPGBI position statement[b] Grade (Level)
Diagnostic imaging		
CT	CT is the most appropriate imaging modality in suspected diverticulitis A (III)	CT or ultrasound should be done during the acute presentation of diverticulitis C (IIb)
Colonoscopy	After resolution of an initial acute episode, the colon should be adequately evaluated to confirm the diagnosis D (V)	Investigation of the colon by endoscopy or barium enema after acute attack is mandatory (to rule out alternative diagnoses or second pathologies) C (NR)
Urgent surgery		
Indications	Urgent colectomy for those with diffuse peritonitis or those who fail nonoperative management of acute diverticulitis B (III)	Not addressed
Elective Surgery		
Indications (after recovery from acute episode)	Decision to recommend elective sigmoid colectomy after recovery from acute diverticulitis should be made on a case by case basis B (III)	Decision on elective resection should be made on an individual basis after assessment of the particular circumstances of the patient C (III)
After acute complicated episode	Elective colon resection should typically be advised if an episode of complicated diverticulitis is treated nonoperatively B (III)	Not addressed
Recurrent disease/ Chronic symptoms	Decision to recommend surgery should be influenced by whether there are persistent symptoms after acute episode NR	Not addressed
Patient Age	No clear consensus regarding whether younger patients treated for diverticulitis are at increased risk of complications or recurrent attacks They may have higher cumulative risk for recurrence NR	No clear evidence that younger patients exhibit a more aggressive form of the disease Little evidence to support a different management strategy in young patients C (III)
Comorbid disease	Lower threshold for immunosuppressed or immunocompromised patients for urgent or elective surgery NR	Not addressed
Technical Factors		
Hartmanns Procedure (HP) vs Primary Anastomosis (PA)	PA might be performed depending on status of patient and severity of intraabdominal contamination (Hinchey classification) Precise role & relative safety of PA especially without proximal diversion remains unsettled NR	Not addressed
Laparoscopic vs Open approach	When a colectomy for diverticular disease is performed, a laparoscopic approach is appropriate in selected patients A (III)	Laparoscopic resection of uncomplicated diverticulitis confers benefits to patients compared to open and should be offered A (I) Laparoscopic approach is appropriate for complicated diverticulitis in the elective setting D (III)
Laparoscopic Lavage	Not addressed	May be an alternative to resection in the acute setting for some patients, it is not certain whether it is an acute alternative to delayed resection C (IIb)
Resection Margins	Resection should be carried proximally to compliant bowel and extend distally to the upper rectum B (III)	Should involve resection to soft compliant bowel proximally with anastomosis onto the rectum The splenic flexure should be mobilized routinely for diverticular disease resections C (IIb)

Grade of Recommendation and Level of Evidence from the original articles , [a]The practice parameters from the ASCR are from the article by Rafferty *et al* [6], [b]The position statement from the ACPGBI are from the article by Fozard *et al* [13]

ASCRS, American Society of Colon and Rectal Surgeons; ACPGBI, Association of Coloproctology of Great Britain and Ireland; CT, computed tomography; NR, not reported (in original article); vs, versus

morbidity and a shorter length of stay, when compared to open procedures [53].

A laparoscopic HP has been proposed as a way to reduce the postoperative complications and expedite recovery. This has not been shown, however, to reduce postoperative morbidity and mortality after controlling for confounding variables and is therefore not currently recommended [54]. Overall, laparoscopic approach for one or two stage procedures is infrequently performed in the urgent setting and is reported in only 3.4-6% of all procedures [24,40].

Laparoscopic lavage

Current consensus holds that there is insufficient evidence to recommend laparoscopic lavage as an alternative to resection [6,7]. Laparoscopic lavage has been proposed as an alternative management strategy in patients with peritonitis in order to control contamination and bridge these patients to elective resection with primary anastomosis at a later date [55-58]. Small observational studies have shown fewer complications in patients with diverticulitis undergoing laparoscopic lavage versus primary resection. The patients selected for laparoscopic lavage were healthier with lower Hinchey grades. As a result, substantial selection bias confounds the generalizability of these results [55-58]. Anticipated future randomized trials may help clarify the role for laparoscopic lavage [59-62].

Concluding remarks

Overall, the surgical management of diverticular disease has evolved with current goals of maintaining intestinal continuity, using a laparoscopic approach, and controlling infection acutely to bridge patients to later one-stage procedures. Patient selection remains paramount to the surgical decision-making process and treatment plans should be individualized according to the needs of the patient.

Acknowledgment

The authors would like to thank Mary Kwatkosky-Lawlor for her assistance with the review process and the preparation of the bibliography.

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