



Special Section on Contemporary Practice in Colon and Rectal Surgery by Dr. Matthew Wilson

Contemporary management of diverticulitis

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ABSTRACT

The treatment of diverticulitis is experiencing a shift in management due to a number of large scale clinical trials. For instance, clinicians are beginning to recognize that avoidance of antibiotics in uncomplicated diverticulitis is not associated with worse outcomes. Additionally, while the decision to proceed with elective surgical resection for recurrent uncomplicated disease is less conclusive and favors a patient-centric approach, complicated disease with a large abscess denotes more aggressive disease and would likely benefit from elective surgical resection. Lastly, in patient with acutely perforated diverticulitis who require urgent surgical intervention, laparoscopic lavage is generally not recommended due to high re-intervention rates and the preferred surgical procedure is primary anastomosis with or without diversion due to high morbidity and low rates of Hartmann reversal.

Epidemiology

Colonic diverticulosis are false diverticula, outpouchings composed of only the mucosa and submucosa through the muscularis [1]. These outpouchings occur at sites of inherent defects where the vasa recta penetrate the muscularis [2]. In Western societies, due to low dietary fiber, diverticulosis most frequently develops in the sigmoid colon [3]. Diverticulosis in itself is asymptomatic, and is present in approximately 50 % of individuals in the United States over the age of 60, with the incidence increasing with age [4].

Progression from diverticulosis to diverticulitis is less common than previously believed, with more contemporary studies indicating around 5 % of patients with diverticulosis develop diverticulitis [5–7]. Although many patients will never develop diverticulitis, the incidence of diverticulosis is so pervasive the absolute number of patients who develop diverticulitis is significant. Diverticulitis leads to over 500,000 provider visits a year with over 300,000 admissions annually, with healthcare costs near 9 billion dollars [8]. The vast majority of patients with diverticulitis are managed non-operatively, but a small subset of patients will have surgery for recurrent disease and/or complicating factors [9].

Uncomplicated diverticulitis

Historically, the mainstay of acute diverticulitis therapy whether uncomplicated or complicated has been antimicrobials [10]. A Cochrane review over a decade ago found antibiotic therapy had no significant effect in uncomplicated diverticulitis with regard to complications, emergency surgery, recurrence, duration of hospital stay, or recovery [11]. More recent randomized controlled trials have provided further evidence evaluating the use of antibiotics in uncomplicated diverticulitis. The AVOD trial randomly assigned 623 inpatients with uncomplicated diverticulitis to receive either antibiotics or fluids alone. There was no difference in recovery time, recurrence, or complications when patients with uncomplicated diverticulitis did not receive antibiotics [12,13]. In long-term follow-up there was also no significant difference in recurrence of diverticulitis, complications, rate of surgical management, or quality of life between the two cohorts in the AVOD trial [12,13]. A second randomized controlled trial was the DIABOLO study in which 528 patients were assigned to receive either a 10 day course of antibiotics or outpatient observation. In the DIABOLO study there was no difference in recovery time, complications, or recurrence when patients with acute left-sided diverticulitis, including patients with abscesses <4 cm, were managed with antibiotics versus observation [14]. An update to the 2012 Cochrane study indicates there may be no difference in short-term complications when comparing antibiotics to no

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antibiotics and the rate of emergency surgery within 30 days may be lower in patients that do not receive antibiotic therapy, but evidence remains low-quality [15]. These findings have transformed practice guidelines from the American Society of Colon and Rectal Surgeons (ASCRS), American Gastroenterological Association, and American College of Physicians with antibiotics no longer required for otherwise healthy, immunocompetent patients with mild acute diverticulitis [16–18]. Antibiotics are still recommended in high-risk patients with multiple comorbidities, evidence of systemic infection, immunosuppression, or Hinchey classification II through IV [18].

Elective resection for uncomplicated disease

It is important to recognize a complicated presentation with perforation or abscess is not the natural history of recurrent uncomplicated diverticulitis. For most patients with uncomplicated diverticulitis, their first diverticulitis event is the most severe episode [19]. The risk of recurrent episodes of diverticulitis does increase with each additional episode of uncomplicated diverticulitis [20]. At 1 year, 8 % of patients will have a recurrence after their first episode, 19 % of patients will have a recurrence after their second episode, and 24 % of patients will have a recurrence after their third episode [20]. Previous recommendations that patients should undergo elective resection after multiple episodes of diverticulitis or onset of diverticulitis at a young age have become more nuanced. ASCRS recommends having an informed discussion on the risks and benefits of elective resection and individualizing the decision to offer resection following recovery from uncomplicated diverticulitis [18]. The COSMID trial (Comparison of Surgery and Medicine on the Impact of Diverticulitis) is currently enrolling patients to determine the impact of elective colectomy versus continued medical management in patients with recurrent diverticulitis or persistent diverticulitis symptoms [21]. At this time long-term nonoperative management recommendations are not definitively associated with a reduction in diverticulitis but consist of eating a healthy diet high in fiber, physical activity, maintaining a normal body mass index, and smoking cessation [16].

Complicated diverticulitis

Non-operative management

The rate of emergent operative intervention for diverticulitis has been declining, likely due to increased success with nonoperative management of diverticulitis [22]. Patients who present with complicated diverticulitis with an abscess >3 cm are preferentially managed with percutaneous drainage and antibiotics [18]. Non-operative management is successful in up to 80 % of presentations [23]. Patients who are successfully managed non-operatively for complicated diverticulitis, however, are at increased chance of future episodes of diverticulitis, with an up to 25 % recurrence rate at 5 years [24]. Risk factors for recurrent complicated diverticulitis include an abscess managed with percutaneous drainage or an abscess >5 cm at index presentation [25,26]. Some studies have found successful non-operative management of patients with complicated diverticulitis may eliminate the need for future surgical resection with low recurrence rates and readmission rates [25,27,28]. The LASER trial randomized 128 patients with complicated diverticulitis to either surgery or nonoperative management and those who underwent elective colectomy reported higher quality of life at 6 months compared to those who received nonoperative management [29]. Surgical resection for complicated diverticulitis reduced the risk of future diverticulitis episodes to 5 % compared to the 31 % of patients who had nonoperative management [29]. At 2-year follow-up there was no significant difference in quality of life, however, only 11 % of those in the surgical cohort had a recurrent episode of diverticulitis compared to 61 % of patients in the nonoperative cohort [27].

ASCRS currently recommends considering elective resection

following successful non-operative management of diverticulitis complicated by an abscess, acknowledging the high risk of future episodes in those that do not undergo interval resection [18]. Endoscopic evaluation is still recommended following an episode of complicated diverticulitis if a colonoscopy had not been performed recently [18]. The risk of occult malignancy in complicated diverticulitis is believed to be as high as 10 % and a recent meta-analysis has confirmed the value of colonoscopy in detecting occult malignancy in patients with complicated diverticulitis [30,31].

Operative management

Urgent operative interventions are generally reserved for patients who fail non-operative management or those who present with diffuse peritonitis [18]. The classic operative procedure for acutely perforated diverticulitis was the Hartmann procedure in which patients received an end colostomy [32]. The belief is that patients could then undergo colostomy reversal under elective conditions, but under 50 % of patients who undergo a Hartmann procedure for diverticulitis undergo stoma reversal within 2 years [33]. Hartmann reversal is associated with significant operative morbidity with almost 24 % of patients experiencing a complication [34]. Clinicians have been searching for alternatives to a Hartmann procedure management of perforated diverticulitis.

Laparoscopic lavage

Recognizing the morbidity and low rate of stoma reversal associated with a Hartmann procedure for Hinchey III/IV diverticulitis, multiple studies have evaluated the effectiveness of laparoscopic abdominal lavage. This procedure consists of extensive lavage of all four quadrants of the abdomen without surgical resection of the diseased bowel [35]. In the DILALA trial, 39 patients with Hinchey III diverticulitis were randomized to laparoscopic lavage and 36 patients were randomized to Hartmann procedure. They found there was no difference in rate of reoperation at 30 days between the two cohorts [35]. Although not statistically significant there was increased 30-day mortality in the laparoscopic lavage cohort [35]. In the SCANDIV trial, 199 patients with perforated diverticulitis with pneumoperitoneum and Hinchey < IV were randomized to receive either laparoscopic lavage or resection. There was no difference between the cohorts with respect to severe complications or mortality. Patients who received laparoscopic lavage were more likely to have recurrent diverticulitis, but less likely to have a stoma at the median follow up of 59 months [36]. In the LOLA trial 90 patients with Hinchey III diverticulitis were randomized to either receive laparoscopic lavage or segmental resection [37]. Those that received laparoscopic lavage had an increased event rate that lead to early termination of the study, but 3 year follow-up revealed there was no difference in cumulative morbidity or mortality between the two cohorts [37,38]. Fewer patients in the lavage group had stomas, but 47 % of patients in the lavage cohort underwent sigmoid resection [37,38]. The use of laparoscopic lavage in the surgical management of complicated diverticulitis is associated with increased post-operative abscess and/or sepsis, unplanned reoperations, complications, and mortality compared to patients who underwent surgical resection. Therefore, laparoscopic lavage is not recommended over colectomy [18].

Primary anastomosis

A second alternative to a Hartmann procedure is a primary anastomosis with or without proximal diversion. The safety and efficacy of re-establishing gastrointestinal continuity at the time of acute diverticular resection has been evaluated in multiple randomized trials, retrospective analyses, and systematic reviews [39,40]. The DIVERTI trial randomized 102 patients with purulent or feculent peritonitis to either a Hartmann procedure or primary anastomosis with diverting ileostomy and found no difference in morbidity or overall mortality between the

two cohorts at 18 months. However, 96 % of patients with a diverting ileostomy were reversed at 18 months compared to 65 % of patients who underwent a Hartmann procedure with an end colostomy [39]. Long-term data of this cohort indicates primary anastomosis has fewer long-term complications and patients have better quality of life than those who underwent a Hartmann procedure [41]. The LADIES trial was a superiority trial in which 133 patients were randomized to either primary anastomosis, with or without ileostomy, or Hartmann procedure [40]. At its conclusion, 12-month stoma free survival was higher in those who underwent primary anastomosis as compared to those who underwent Hartmann procedure (94.6 % vs. 71.7 %), and there were no differences in short-term morbidity or mortality [40]. The safety of primary anastomosis with selective diversion has been supported in multiple retrospective studies and systematic reviews [42,43]. Unfortunately, despite these results the rate of Hartmann procedure for perforated diverticulitis has increased in the United States over the past 25 years [44]. A retrospective review conducted from 2000 to 2014 revealed the overwhelming majority (94.0 %) of urgent/emergent colectomies for diverticulitis are performed by noncolorectal surgeons which conferred a higher risk of mortality [45]. As such, ASCRS guidelines currently recommend the decision to perform primary anastomosis should incorporate surgeon preferences, but primary anastomosis with diversion is safe in most patients [18]. Studies currently in progress may further segment the field as some are considering whether diverting stoma is required at all. The DIVERTI 2 trial is currently recruiting patients undergoing primary anastomosis for Hinchey grade III/IV diverticulitis for randomization into either a protective or no protective stoma cohort [46].

Key points

- Antibiotics are no longer mandatory for otherwise healthy, immunocompetent patients with mild acute diverticulitis as it is not associated with faster recovery or decreased recurrence of disease.
- Elective resection for uncomplicated disease is an individualized decision with clinical trials underway to help stratify decision-making.
- Primary anastomosis with diversion is safe and generally preferred over Hartmann procedure and laparoscopic lavage in patients with complicated diverticulitis requiring urgent operative intervention.

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CRedit authorship contribution statement

Austin C. Portolese: Conceptualization, Writing – original draft, Writing – review & editing. **Nimalan A. Jeganathan:** Conceptualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

ACP and NAJ have no conflicts of interest.

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