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SUMMARY

Acute diverticulitis is a common disease that may require surgical management. Traditional management of acute diverticulitis focused heavily on immediate surgical resection, but a preponderance of evidence currently strongly advocates for a more conservative approach to managing even complicated diverticulitis. Less invasive surgical treatment leads to decreased morbidity, mortality, and hospital length of stay.

RECOMMENDATIONS

- **Level 1**
 - **None**
- **Level 2**
 - **Uncomplicated (Hinchey Class I) acute diverticulitis in hemodynamically stable, immunocompetent patients can be treated in the outpatient setting without antibiotics.**
 - **Antibiotics alone are generally sufficient to treat colonic abscesses < 4 cm.**
 - **Percutaneous drainage is appropriate for abscesses > 4 cm.**
 - **Hinchey Class II diverticulitis in hemodynamically stable patients can be treated with percutaneous drainage and intravenous antibiotics.**
 - **Primary anastomosis is preferable to Hartmann's procedure in select patients with Hinchey Class III and IV diverticulitis.**
- **Level 3**
 - **ICU / step-down unit admission should be considered in patients with Hinchey Class III or IV diverticulitis due to increased mortality rates.**
 - **Laparoscopic lavage is associated with increased short-term morbidity compared to surgical intervention.**
 - **Prophylactic sigmoidectomy is not necessary after uncomplicated acute diverticulitis and should be considered on a case-by-case basis.**

INTRODUCTION

Acute diverticulitis can result in significant morbidity and mortality. The incidence of acute diverticulitis has increased over the last decade (especially in patients under 40 years of age), accounting for nearly 300,000 U.S. hospital admissions and \$1.8 billion of annual direct medical costs (1,2). Acute diverticulitis is more common in men under the age of 50 years of age while it is more common in women above 50 years of age (1). The peak incidence of acute diverticulitis is during the summer months (1). Risk factors for acute diverticulitis include increased body mass index (BMI), tobacco use, decreased physical activity, HIV, Ehler-Danlos, Marfan's, and Williams-Beuren syndromes, and those undergoing chemotherapy (1). Acute diverticulitis typically presents with left lower quadrant abdominal pain, absence of vomiting, and a C-reactive protein level of > 50 mg/L (1,2). Abdominal/pelvic computed tomography is considered the diagnostic imaging modality of choice (2). The Hinchey classification system is generally used to define the severity of disease (Figure 1).

LEVEL OF RECOMMENDATION DEFINITIONS

- **Level 1:** Supported by multiple, prospective randomized clinical trials or strong prospective, non-randomized evidence if randomized testing is inappropriate.
- **Level 2:** Supported by prospective data or a preponderance of strong retrospective evidence.
- **Level 3:** Supported by retrospective data or expert opinion.

DISCLAIMER: These guidelines were prepared by the Department of Surgical Education, Orlando Regional Medical Center. They are intended to serve as a general statement regarding appropriate patient care practices based on the medical literature and clinical expertise at the time of development. They should not be considered to be accepted protocol or policy, nor are intended to replace clinical judgment or dictate care of individual patients.

Figure 1: Hinchey Classification of Acute Diverticulitis

Class	Definition
1a	Pericolonic phlegmon and inflammation, no fluid collection
1b	Pericolonic abscess < 4 cm
2	Pelvic or inter-loop abscess OR abscess > 4 cm
3	Purulent peritonitis
4	Feculent peritonitis

The management of both uncomplicated and complicated acute diverticulitis has changed significantly over the past two decades. Uncomplicated acute diverticulitis can generally be managed in the outpatient setting without antibiotics (1). Complicated acute diverticulitis (Hinchey Class III/IV), traditionally treated with a Hartmann's procedure, is currently managed with a more conservative approach with improved outcomes (3-6).

LITERATURE REVIEW

Management of Hinchey Class I and II diverticulitis

Hinchey Class I diverticulitis accounts for 75% of symptomatic diverticular disease. Often these patients are admitted to the hospital for intravenous antibiotics and non-operative management. A randomized controlled trial by Biondo et al. in 2012 compared the treatment failure rates of an outpatient protocol vs. hospital admission for uncomplicated diverticulitis (7). They defined treatment failure as persistence, increase, or recurrence of abdominal pain and/or fever, inflammatory bowel obstruction, need for radiological abscess drainage or immediate surgery due to complicated diverticulitis, need for hospital admission, and mortality during the first 60 days after discharge. There was no statistically significant difference in the two groups ($p=0.62$). They concluded that it is safe and cost-effective to treat patients with uncomplicated diverticulitis as an outpatient.

The incidence of abscesses complicating diverticulitis ranges from 17-19%. In 2008, Singh et al. published a retrospective study evaluating the use of percutaneous drainage of diverticular abscesses over an 8-year period (8). They found in 16 patients that drainage can be safely performed avoiding the need for operative intervention. Abscesses less than 4 cm in size can generally be treated with antibiotics alone with a high rate of success (1,2). Drainage may be considered in patients who fail to respond to antibiotics alone or for clinical deterioration. Abscesses greater than 4 cm should be considered for percutaneous drainage which is successful in >80% of patients with a low rate of complications and recurrence (1,2).

The presence of free intraperitoneal air is a common finding in acute diverticulitis. In stable patients without an acute abdomen consistent with peritonitis, initial non-operative management for patients with acute diverticulitis and pericolonic air localized to less than 5 cm from the colon is appropriate (2). Patients with more extensive pneumoperitoneum, but no diffuse intraperitoneal free fluid, may still be managed non-operatively, but require close monitoring and follow-up. Surgical intervention should be reserved for those patients who fail to respond to initial non-operative management, demonstrate progression of disease, or become hemodynamically unstable. Immunocompromised patients are more likely to fail non-operative management (2).

Antibiotics have traditionally been used for all patients presenting with acute diverticulitis regardless of Hinchey class, however various studies have demonstrated equivalent outcomes in patients treated without antibiotics for uncomplicated diverticulitis. The DINAMO trial, a prospective multi-center randomized controlled trial included a total of 480 patients with uncomplicated diverticulitis treated outpatient with or without amoxicillin-clavulanic acid (9). The trial demonstrated similarly low rates of unscheduled return visits (6.7% vs. 7%) or hospitalization (6% vs. 3%), with additional studies also demonstrating similar outcomes between groups (10,11). A systematic review and meta-analysis evaluating the treatment of uncomplicated acute diverticulitis in 2019 also demonstrated no significant difference in the percentage of patients requiring additional treatment or intervention, rate of readmission, need for surgical or radiological intervention, recurrence, or complications between those treated with and without antibiotics (12). When indicated, antimicrobial therapy should cover both Gram-negative and anaerobic organisms. For uncomplicated acute diverticulitis, it is reasonable to begin with oral antibiotics as this decreases the hospital length of stay associated with the conversion from intravenous to oral antibiotics (2).

Management of Hinchey Class III and IV diverticulitis

Non-operative management of Hinchey Class III/IV disease has a low rate of success. Patients with evidence of colonic perforation and diffuse peritonitis should undergo urgent/emergent open or laparoscopic surgical

intervention based upon the patient's clinical factors and the surgeon's expertise and skillset. Hartmann's procedure is the preferred operation for hemodynamically unstable patients with perforated diverticulitis.

It is well established that morbidity and mortality of both the initial Hartmann's procedure and subsequent colostomy take-down are high. This led to investigation into the primary management of perforated diverticulitis with laparoscopic lavage. Laparoscopic lavage has been used for Hinchey III diverticulitis since the early 1990's with initially reportedly equivalent outcomes when compared to those treated with surgical intervention and colostomy. However, randomized controlled trials have since demonstrated that although long-term morbidity and mortality may be equivalent between the treatment methods, laparoscopic lavage have been associated with statistically significant increased short-term morbidity (13,14). A large systematic review and meta-analysis including 6 trials and 626 patients evaluating outcomes between treatments demonstrated statistically significant increased major complications (Clavien–Dindo >IIIa) in patients who underwent laparoscopic lavage compared to sigmoidectomy, primary resection and anastomosis, and Hartmann procedure (15). Additional meta-analyses have demonstrated increased short-term morbidity in those who underwent laparoscopic lavage (16).

In recent years, prospective randomized controlled trials have demonstrated that colonic resection with primary anastomosis, rather than Hartmann's procedure, is the preferred operation in patients with Hinchey Class III & IV diverticulitis (1). The LADIES trial, a randomized paralleled superiority trial performed between 2010-2016, included 133 patients with Hinchey Class III and IV diverticulitis. The study was conducted across 8 academic hospitals and patients were randomized 1:1 to receive either a Hartmann's procedure or resection with primary anastomosis. The results of the trial demonstrated no significant difference in short-term morbidity or mortality between the two groups (17). An additional follow up study was performed evaluating patients after 36 months to assess long-term outcomes, with the primary end point being stoma-free rate 36 months after index operation, as well as number of readmissions and overall morbidity (including surgical reintervention) and mortality. The study found that the primary anastomosis group had a significantly increased 36-month stoma-free rate compared to the Hartmann's group, as well as significantly less in-hospital days (including readmissions) and parastomal hernia rates among the primary anastomosis group (18). The study concluded that not only were there no significant differences in short-term morbidity or mortality between groups, but there were significantly improved long-term outcomes among the primary anastomosis group (18). The LADIES trial concluded that in immunocompetent, hemodynamically stable patients <85 years old, primary anastomosis is preferable to Hartmann's for Hinchey Class III and IV diverticulitis (17). The DIVERTI trial is another large prospective multicenter randomized trial conducted between 2008-2012 comparing primary anastomosis vs. Hartmann's in Hinchey Class III and IV diverticulitis. This study demonstrated significantly increased stoma reversal rates within the primary anastomosis group at 18 months, and no significant difference in morbidity and mortality between groups (19).

Other studies have also demonstrated no significant difference in short-term morbidity and mortality between primary anastomosis vs. Hartmann's for perforated diverticulitis, and improved long-term outcomes in terms of stoma reversal, readmissions, and overall quality of life among those that underwent primary anastomosis (20,21). The addition of these prospective randomized trials over recent years have influenced the approach and management of Hinchey Class IV diverticulitis with the current literature demonstrating that primary anastomosis is the preferred treatment of choice in select patients with Hinchey Class IV diverticulitis.

Colonoscopy after diverticulitis

Follow up colonoscopy after an episode of acute diverticulitis has been common in the past. The aim has been to exclude underlying malignancy. Retrospective and prospective studies have demonstrated that malignancy rates discovered on routine colonoscopy after CT diagnosed left-sided diverticulitis are relatively low (2.2-3.5%). In a prospective study, Meyer et al. discovered a 2.2% rate of malignancy at the site of diverticulitis in those who underwent colonoscopy within 1 year of their initial attack (12). Recent consensus statements have recommended that colonoscopy is no longer recommended following an initial episode of uncomplicated acute diverticulitis (1,2). Patients with abscesses requiring percutaneous drainage, recurrent diverticulitis or other complicating factors should undergo colonoscopy to define the extent of their disease and guide appropriate intervention.

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Acute Diverticulitis Management Algorithm

