

# EMERGENCY MEDICINE REPORTS

Practical, Evidence-Based Reviews in Emergency Care

APRIL 19, 2015

VOL. 36, NO. 9

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**AHC Media**

## Diverticulitis: Evaluation and Management

*Before the advent of CT scans, making the diagnosis of abdominal pain, particularly in obese or elderly patients, was very difficult. Either you played the odds (young people get appendicitis, old patients get diverticulitis), or you operated to get a definitive diagnosis. Today, patients with abdominal pain are more likely to be diagnosed by CT. And those with recurrent abdominal pain may receive many CTs over the course of their life.*

*Diverticulitis is seen mainly in the older population, although with CT scanning, we do see it in younger patients as well. As the population ages, this disease will increase.*

— Sandra Schneider, MD, Editor

## Introduction

Acute diverticulitis is placing an increasing burden on health care resources as the incidence, prevalence, and hospital admission rate is rapidly increasing.<sup>1-4</sup> Diverticulitis is a result of acute inflammation of colonic diverticulum. Of those patients with diverticula, only 10-25% develop symptomatic diverticular disease, while the majority remain asymptomatic.<sup>5</sup> Left-sided diverticulosis is commonly found in Western society, with the prevalence increasing with advancing age. Up to 25% of patients with diverticulosis will develop an episode of acute diverticulitis, making the necessity for accurate diagnosis and treatment essential.<sup>6</sup> Management and therapies are clear for those who have very mild presentation or very severe and potentially life-threatening attacks of diverticulitis.<sup>7-8</sup> However, the management of intermediate severity patients with diverticulitis lacks evidence-based research or a standardized guideline to support a specific management protocol.<sup>7,9</sup>

## Relevancy of the Problem to the Adult Population

Among developed countries, diverticulitis has become an increasingly common and costly condition.<sup>5</sup> Its timely diagnosis and treatment are essential to help improve outcomes for patients. The breadth of diverticulitis spans from uncomplicated diverticulitis as a result of local inflammation requiring oral antibiotics and close follow up to complicated diverticulitis including abscess, fistula, or stricture formation and life-threatening perforation with peritonitis requiring admission with aggressive resuscitation, early intravenous antibiotics, and surgical consultation. The ability to recognize complicated versus uncomplicated diverticulitis can aid in expedited care and resource allocation to prevent repeat radiation exposure through radiological imaging of these patients who present with uncomplicated diverticulitis. From 1998 to 2005, there was a 26% increase in cost for hospital admission for diverticulitis, with

## EXECUTIVE SUMMARY

- While diverticulitis is a disease of the elderly, younger patients can develop the disease, particularly if they are obese. It was once thought that younger patients had more severe disease, more recent studies have questioned that.
- Patients with uncomplicated disease, even those with leukocytosis, who can tolerate oral medications, can be sent home with antibiotics. Such patients should improve in 2-3 days.
- Patients who present with acute peritonitis, fever, and shock require immediate fluid resuscitation and IV antibiotics. A plain film of the abdomen may show free air. Many of them will require surgery. Less aggressive surgical approaches such as peri-cutaneous drainage of an abscess, are more common.
- The primary diagnostic test is a CT scan of the abdomen, though ultrasound is a reasonable first test. The CT scan typically shows diverticular disease, bowel wall thickening and pericolic fat stranding. It will also show the presence of an abscess or fistula.

a 29% increase in elective surgeries in the United States.<sup>5</sup> With this increase comes a significant burden on the healthcare system.

### Epidemiology

Of the patients with known diverticulosis, 10-25% of patients will proceed to develop diverticulitis. The prevalence increases with advancing age.<sup>10</sup> The majority of the cases of diverticulitis occur in people older than age 65, although it is thought that patients who are younger tend to develop the more virulent form of the disease requiring surgical intervention.<sup>11</sup> There is an increasing prevalence of acute diverticulitis in Western countries such as the United States, representing an increasing incidence and significant cost burden on the national health system.<sup>5</sup>

### Etiology and Pathophysiology

The exact etiology of diverticular disease is not known. Possible causes include colonic motility disorder, colonic muscular disorder resulting in increased luminal pressure, and a disordered colonic microenvironment.<sup>8</sup> The favored etiologies are low residue diet and relationship to intraluminal pressure which can explain the development of sigmoid or colonic diverticula.

Colonic diverticulae are false out-pouchings of the mucosa and submucosa caused by increased intraluminal pressure over time.<sup>5,11</sup> They most often occur at the weakest site where the colon's muscular propria is pierced by the vasa recta and nerves, resulting in an interruption of the muscular support.<sup>8,12</sup> Increased intraluminal pressure is caused by excessive peristaltic

contractions of the large bowel. In Western populations, diverticula most often occur in the sigmoid colon, whereas in Asian populations they are most commonly seen in the ascending colon, such as the cecum.<sup>13</sup> In contrast to sigmoid or colonic diverticulum, cecal diverticuli are true diverticuli involving all three layers of the bowel wall.

Diverticulitis results from inflammation and micro perforations of these impacted colonic diverticuli. Although the exact mechanism of inflammation and perforation is unclear, one theory is that it is associated with an increased and altered colonic microenvironment.<sup>8</sup> The lack of muscular support in the diverticuli results in increased risk of perforation and abscess formation.

Other complications of diverticulitis include colitis, fistula formation, obstruction, stricture formation, and peritonitis. Fistulas often result as a complication of perforation resulting in colo-vesicular or colo-vaginal fistulas that requires surgical intervention.<sup>14</sup> Perforation causing peritonitis is an uncommon, but potentially catastrophic complication of diverticulitis, with a mortality rate approaching 30%.<sup>14</sup>

**Low Fiber Diet.** Historically, a low fiber diet has been thought to be the culprit in the development of diverticulosis, but its relationship to the development of acute diverticulitis is unclear.<sup>1,5,15</sup> A low fiber diet is hypothesized to cause a smaller size of the colonic lumen and decreased intestinal content resulting in transmission of the muscular contraction pressure to the lumen of the wall rather than the content in the colon. This transfer of high pressure to the lumen wall results in the production of diverticuli.<sup>16-17</sup>

### Table 1. Risk Factors

- Age
- Alcohol use
- Low fiber diet
- NSAIDs, opioids, steroids
- Obesity (BMI > 30 kg/m<sup>2</sup>)
- Sedentary lifestyle
- Smoking

Diverticulosis is more common in developed nations where the fiber intake tends to be much lower. Studies across populations with varying fiber intake show changes in stool transit time, and some evidence of decreased diverticulosis incidence is seen in populations with high fiber diets, such as in vegetarian patients.<sup>1,8,12-14</sup> Several studies have failed to show this long held belief to be true.<sup>8</sup>

**Dietary Factors.** The development of diverticula increases the risk of complications. Diverticula are at risk of obstruction by fecal material moving through the digestive tract. Traditionally, patients with diverticulosis were counseled to avoid food that may leave coarse particulate matter in stool (such as nuts, corn, and seeds) due to concern that this could obstruct the narrow neck of the diverticulum resulting in inflammation or cause abrasion of the diverticulum resulting in bleeding. However, this association has been unfounded.<sup>1,8,17</sup>

**Age.** Age is considered an important risk factor in the development of diverticulosis, with prevalence increasing with older age.<sup>18</sup> More than half of patients older than the age of 60 have

evidence of colonic diverticuli. It is unusual for patients younger than the age of 40 to develop diverticulitis; this accounts for only 5–11% of cases, while well over two thirds of the cases occur in those older than 65 years old.<sup>5,18</sup> Age is important to consider as 21% of patients younger than 50 years of age with diverticulitis have complicated diverticulitis, compared with 38.5% of older people.<sup>18</sup>

There is conflicting consensus about the severity of disease in this younger population, with some studies suggesting patients younger than 40 have a higher operative rate, implying a more virulent disease with an aggressive course and significant recurrence rate, while other studies suggest no difference.<sup>6,18–19</sup> However, the high surgical rate has been called into question since in many cases the preoperative diagnosis may be appendicitis. Because of their young age, surgery may be involved earlier. When the diagnosis is in question and the patient is ill, an operative approach may seem reasonable.<sup>18</sup> Newer research suggests that younger age is neither associated with a more severe presentation nor with a higher incidence of recurrence, although this is still debated.<sup>19</sup> It is important to note that among those who were younger than 40 years old and developed acute diverticulitis, the majority of these patients were obese (BMI > 30 kg/m<sup>2</sup>).<sup>18</sup>

## Other Risk Factors

**Heredity.** Genetic susceptibility is thought to play a role in the development of both diverticulum and diverticulitis.<sup>13</sup> Diseases that interfere with collagen or elastin formation are associated with complicated diverticular disease at an early age.<sup>1,20–22</sup>

**Smoking, Medication, Obesity.** There are also several other modifiable risk factors that were found to have an increased risk of diverticular disease. Smoking and obesity (defined as BMI > 30 kg/m<sup>2</sup>) were found to have an increased relative risk of an episode of acute diverticulitis.<sup>1,5,8,23–27</sup> Smoking is also thought to be linked to complicated diverticulitis with an increased rate of perforation.<sup>28</sup> Acute diverticulitis was found in increased frequency in those who use aspirin, non-steroidal

anti-inflammatory drugs (NSAIDs), steroids, and opiates, and was associated with increased risk of perforated diverticulitis.<sup>1,8,13,23</sup> Current data show correlation only and a causative association between many of these risk factors has yet to be elucidated.

## Clinical Manifestations

**History of Presenting Illness.** The classic presentation of acute diverticulitis is abdominal pain. The pain is classically acute onset and constant, with patients often reporting changes in bowel habits such as constipation or diarrhea.<sup>13,29</sup> A fever below 39°C is typical.<sup>13</sup> The location and characteristic of this pain differs depending on the involved portion of the colon. The majority of cases in Western populations are in the sigmoid colon, with only 15% arising from the right side of the colon.<sup>5</sup> In Western populations, where the diverticuli are most commonly found in the sigmoid colon, the pain is typically located in the left lower quadrant. However, in Asian populations, where cecal diverticulitis is more common, complaints of right lower quadrant abdominal pain are seen.<sup>28</sup> This is an important consideration with the increase in immigration. This may be indistinguishable from acute appendicitis, confounding the differential diagnosis. Helpful historical information includes the duration, which is typically longer than that of appendicitis, with the pain felt higher than McBurney's point and often milder when compared to appendicitis.<sup>28</sup>

**Review of Systems.** Complications of diverticulitis can be evident on a thorough history from the patient. The patient may complain of urinary frequency, pyuria, or dysuria if the inflamed diverticulum irritates the bladder or ureter.<sup>11</sup> The formation of a fistula may lead to recurrent urinary tract infections or pneumaturia or urine coming from the vaginal canal. Patients who develop a paralytic ileus, obstruction, or stricture may complain of nausea or vomiting with abdominal distension.<sup>30</sup>

**Physical Examination.** The physical examination, as always, aids in determining the etiology of the abdominal pain. The presence of rebound tenderness, voluntary guarding, or rigidity

suggests peritonitis and raises concern for free perforation.<sup>1</sup> Occult blood may be present in the stool on rectal exam, and the finding of tenderness on the left side may be present if there is an abscess.<sup>11</sup> Redundant sigmoid colon can reach toward the right lower quadrant and mimic appendicitis.<sup>30</sup> In female patients, clinicians should consider gynecological sources of the abdominal pain, and a pelvic exam may offer additional information to help distinguish between abdominal and pelvic pain. Clinical evaluation for suspected acute diverticulitis has a sensitivity of 64% and specificity of 98% based on a study by Toorenvliet.<sup>5</sup> The findings of isolated left abdominal tenderness, signs of constipation, and elevated C-reactive protein were found in patients with diverticulitis, whereas vomiting and right sided abdominal pain were more frequently seen in patients with nonspecific abdominal pain in which the etiology could not be obtained.<sup>5</sup> A decision rule was created in one study to improve the diagnostic reliability. Suggested factors associated with a high risk of diverticulitis included pain only in the left lower quadrant, the absence of vomiting, and a C-reactive protein greater than 50 mg/L. Presence of these factors improved diagnostic reliability to 97%.<sup>6</sup>

## Diagnostic Studies

**Laboratory Investigation.** The triad of left lower abdominal pain, fever, and leukocytosis is the classically taught criteria in the presentation for diverticulitis. In the outpatient setting, practice guidelines from primary care, gastroenterology, and general surgery societies support the use of antibiotic therapy in stable patients with these symptoms and recommend abdominal imaging only in those in whom the diagnosis is uncertain.<sup>10</sup> However, this triad lacks sensitivity and is found in only 47% of those patients with severe CT scan findings of abscess and perforation.<sup>1</sup>

Routine laboratory studies should be sent to investigate the source of the abdominal pain and prepare for anticipating imaging. For instance, hypercalcemia can mimic abdominal pain and cause constipation. Evaluation of kidney function is important, as elevation of creatinine can limit the radiological

**Table 2. Summary of Imaging Modality<sup>36</sup>**

Imaging Modality	Findings	Sensitivity	Specificity
Plain Radiography: Upright X-Ray	Free air under the diaphragm, air fluid level	75%	50%
Ultrasonography: Graded Compression	Thickened bowel loop with a target-like appearance	92%	90%
Computed Tomography: Abdomen/Pelvis	Thickness of colonic wall, pericolic fat stranding, inflamed diverticula, abscess formation, free air, fistula formation	Near 100%	Near 100%
Magnetic Resonance Imaging: Abdomen/Pelvis	As above	94-96%	88-100%
Colonoscopy	Not recommended in acute phase of diverticulitis <sup>17</sup>	—	—

imaging that is available for the patient.

**Leukocytosis.** Leukocytosis is often seen in the setting of abdominal pain, raising the suspicion for inflammation and infection, but it lacks sensitivity or specificity.<sup>1</sup> Leukocytosis has no value in patients with acute diverticulosis to distinguish between complicated and uncomplicated diverticulitis.<sup>31</sup>

Leukocytosis may also be a normal variant in certain processes such as in pregnancy and does not always indicate infection.<sup>32</sup> In such populations, a neutrophil count greater than 80% can offer value in differentiating illness from normal variants.

Similarly, in immunocompromised and elderly patients, patients may have a normal white count, without a left shift, and still have a severe infection. A higher level of suspicion should be used in these populations, rather than solely relying on leukocytosis to guide evaluation.<sup>33</sup>

Using the presence or absence of leukocytosis to support or refute a diagnosis can lead to a false sense of reassurance in the presence of significant pathology as elderly and immunocompromised patients may not be able to mount a leukocytosis. The lack of a normal inflammatory response due to steroids can reduce the patient's peritoneal signs and limit the value of a physical examination. Steroids have also been found to make a patient susceptible to infection while also causing demargination of the leukocytes, making it difficult to interpret the cause of the leukocytosis.<sup>34</sup>

**C-Reactive Protein.** The elevation

of C-reactive protein greater than 50 mg/L in conjunction with left lower quadrant pain on physical examination and the absence of vomiting has a high predictive value in the diagnosis of acute diverticulitis.<sup>6</sup> Patients with complicated diverticulitis in general have a higher CRP when compared to those with uncomplicated diverticulitis. However, a low or normal CRP should not suggest that complicated disease can safely be excluded, as radiological examination is a more accurate way to exclude this.<sup>31</sup>

**Radiological Investigation.** Some expert panels suggest a “step-up approach” to imaging for diverticulitis to decrease the exposure to ionizing radiation. They suggest that ultrasound for diverticulitis should be done first, with abdominal CT being ordered only in cases of negative or inconclusive ultrasound results.<sup>35</sup> This can also lower cost and potential exposure and resulting contrast-induced nephropathy.

**Plain Film Radiography.** For patients who have concerning abdominal examinations suggestive of peritonitis, an upright X-ray may offer some value to rule out free air under the diaphragm.<sup>30</sup> If this is seen, early surgical consultation and intravenous antibiotics can be initiated.<sup>30</sup> Also, ileus and obstruction may be seen on an X-ray, although X-ray imaging lacks the sensitivity that is seen with CT imaging.

**Ultrasonography.** Ultrasonography is another modality that should be considered in specific populations such as pregnant patients or younger patients

**Table 3. Differential Diagnosis for Acute Diverticulitis**

- Appendicitis
- Cholecystitis
- Constipation
- Ectopic pregnancy
- Epiploic appendagitis
- Hernia
- Inflammatory bowel disease
- Infective colitis
- Malignancy
- Mesenteric ischemia
- Omental infarction
- Pancreatitis
- Perforated viscus
- Prostatitis
- Psoas abscess
- Renal colic
- Torsion (testicular, ovarian)
- Tubo-ovarian abscess (PID)
- Urinary tract infection

with suspected diverticulitis. Ultrasound is used to decrease exposure to ionizing radiation, as well as to evaluate other structures in the pelvis that could contribute to the patient's presentation.<sup>13,36</sup> The use of “compression graded” ultrasonography was 90% sensitive in detecting acute diverticulitis in one report.<sup>5</sup> However, ultrasonography is not the best initial test in obese patients in whom the images are likely to be suboptimal.

**Table 4. Modified Hinchey Classification, CT Findings, and Treatment**

Hinchey Classification	Classification Definition	CT Finding <sup>49</sup>	Treatment <sup>5,30</sup>
0	Clinically mild diverticulitis	Diverticula with or without wall thickening	Oral antibiotics, fluid therapy, bowel rest
Ia	Confined to pericolic inflammation or phlegmon	Colonic wall thickening with inflammatory reaction in the pericolic soft tissue	As above
Ib	Pericolic or mesocolic abscess < 5 cm in proximity to the primary inflammatory process	Stage Ia changes with pericolic or mesocolic abscess formation	Initial conservative treatment as for class 0/Ia. If fails, US or CT guided percutaneous drainage. If abscess > 5 cm, percutaneous drainage.
II	Intra-abdominal, pelvic, or retroperitoneal abscess, or abscess distant from primary inflammatory process	Stage Ia changes with distant abscess (deep in the pelvic or interloop regions)	If abscess > 5 cm, percutaneous drainage with IV antibiotics. <sup>30</sup>
III	Generalized purulent peritonitis	Free gas associated with localized or generalized free fluid, findings of peritoneal wall thickening	Resuscitation with IV fluid, early antibiotics, surgical consultation
IV	Generalized fecal peritonitis	Stage III findings	As above

**Computed Tomography.** The gold standard to evaluate diverticular disease is abdominal/pelvis CT, with a reported sensitivity and specificity approaching 100%.<sup>36</sup> The abdominal/pelvic CT with contrast typically reveals bowel wall thickening and pericolic fat stranding consistent with inflammation.<sup>13,36</sup> The imaging can also reveal complications of diverticulitis such as abscess, fistula formation, or free air, as well as evaluate the severity of the disease in order to guide treatment. CT may not be necessary in suspected uncomplicated diverticulitis, as 90% of patients with this follow a projected indolent course and the images obtained from CT only modify the therapy in 7% of cases.<sup>5</sup> This is particularly true when the patient has a “classic” presentation or has recurrent disease.

The use of soluble contrast enemas is determined to be obsolete in the diagnosis of diverticulitis with the inability to determine the extent and complications of the disease and is no longer a part of the diagnostic process.<sup>6</sup>

**Magnetic Resonance Imaging.** MRI is an alternative in those who are not candidates for ultrasonography or CT scan, with a sensitivity of 94–96% and

a specificity of 88%.<sup>5</sup> Disadvantages regarding MRI include limited availability, longer scan times with greater susceptibility to motion artifact, and higher cost.<sup>36</sup>

**Colonoscopy.** In the acute phase of inflammation associated with acute diverticulitis, colonoscopy is not recommended. There are several reasons it is recommended to wait at least 4–6 weeks prior to doing a colonoscopy. These include hypothetical risk of perforation with insufflation of air in colonoscopy, as well as the quality of colonoscopy being limited due to abdominal pain, inadequate preparation, and potential bowel stenosis. Many recommend the use of colonoscopy 6 weeks post acute inflammation to exclude the presence of malignancy, although some new research argues against the need for surveillance colonoscopy at all.<sup>5,17</sup>

### Differential Diagnosis

The differential diagnosis for acute onset abdominal pain presenting to an emergency department remains very broad, with diverticulitis being just one of many potential diagnoses. A thorough history and physical

examination can help to narrow the differential and draw the clinician closer to the actual etiology. There are a multitude of other gastrointestinal disorders, such as appendicitis, gastroenteritis, pancreatitis, obstruction, irritable bowel syndrome, inflammatory bowel disease, and ischemic colitis, that should also be considered. In women of childbearing age, ectopic pregnancy, ovarian torsion, and tubo-ovarian abscess must be sufficiently ruled out using a pregnancy test, pelvic examination, and ultrasound imaging if appropriate. Also, in younger males, testicular torsion should be placed in the differential. In both sexes, urinary tract infections and sexually transmitted diseases can cause similar presenting symptoms.<sup>11-12</sup>

**Management.** Diverticulitis can be managed either medically or surgically. The goal of medical management is to decrease the acute inflammation, prevent recurrence, and manage chronic symptoms, although the majority of evidence regarding treatment is Level B or C.<sup>8</sup>

**Initial Management.** Management for diverticulitis depends on the extent of the disease and the overall

**Figure 1. CT of Diverticulitis**



James Heilman, MD/ <http://creativecommons.org/licenses/by-sa/3.0/>

clinical picture of the patient. One consideration is if the patient is stable or unstable. The unstable patient in whom there is concern for frank perforation and/or peritonitis requires emergent resuscitation and early intravenous antibiotics. Such patients should be prepared for surgery with pre-surgical labs ordered. A stat plain film of the chest and abdomen can be helpful in determining the presence of free air under the diaphragm.<sup>13</sup> Rapid consultation with a surgeon is imperative and should be done without imaging.

**Classification.** In 1978, the original Hinchey classification was published, requiring several modifications as new advances in imaging modalities and treatments have become available.<sup>5</sup> In 1999, Wasvary modified the classification to include both mild disease and the most severe involving perforation, with Kaiser incorporating corresponding CT imaging findings.<sup>5</sup> It is important to understand the modified Hinchey classification and the correlating CT findings as well as treatment

modalities seen in Table 4.<sup>5-6</sup>

### **Approach to Uncomplicated Diverticulitis**

**Initial Management.** Uncomplicated diverticulitis accounts for the majority (averaging 75%) of presentations.<sup>13</sup> In the stable patient, management includes basic laboratory studies and imaging prior to any consultation, if indicated. The triad of left lower quadrant pain, fever, and leukocytosis may aid in the clinical diagnosis of diverticulitis; however, using these criteria can lack accuracy in the diagnosis of diverticulitis.<sup>7</sup> The majority of patients with uncomplicated diverticulitis respond successfully to outpatient management.<sup>37-38</sup> Vital sign abnormalities such as tachycardia or hypotension and signs of peritonitis including rigidity and rebound tenderness should increase concern for potential complicated disease.<sup>13</sup>

Recurrence rates in this population vary. In one study, this may be as high as 40% over the following decade.<sup>39</sup> In the

subset of patients with milder disease, this may be much lower.<sup>37</sup>

In the outpatient setting, those who presented with this triad (although research review has noted many times were lacking the laboratory support), more than 80% were treated with antibiotics, raising questions regarding what additional criteria created the clinicians' diagnostic certainty for diverticulitis.<sup>10</sup> It is thought that likely outpatient encounters for suspected diverticulitis are either much milder or less commonly encountered. Further research is necessary to determine the accuracy of the accepted triad of symptoms that is needed to meet the clinical diagnosis of acute diverticulitis in the outpatient setting, as imaging often is not used to confirm the diagnosis.<sup>10</sup>

**Imaging.** Clinical evaluation can help aid in the diagnosis of acute diverticulitis. One study found that in two-thirds of the patients, the diagnosis of acute diverticulitis was made based on clinical evaluation alone, while in one-third of the patients, additional imaging was necessary to establish the diagnosis.<sup>35</sup> An abdominal/pelvis CT scan is the test of choice in patients with suspected diverticular disease. As noted previously, imaging should be based on the status of the patient as well as age and sex. In patients with classic symptoms and a mild presentation of suspected diverticulitis, imaging may not be necessary. In the outpatient setting, practice guidelines from primary care, gastroenterology, and general surgery societies support the use of antibiotic therapy in stable patients with these symptoms and recommend abdominal imaging only in those in whom there is diagnostic uncertainty.<sup>10</sup>

**Antibiotics.** The traditional approach of antibiotic use for 10-14 days has been modified recently to reduce the duration of therapy in the setting of uncomplicated diverticulitis. Several trials brought into question the route as well as duration of antibiotics in these cases. A significant advantage of intravenous over oral antibiotics has not been found, and data suggest equivalent efficacy of a four-day compared to a seven-day course of broad-spectrum antibiotics, thus recommending outpatient management. Recent data call into

question the routine use of antibiotics in uncomplicated diverticulitis.<sup>8</sup> A Cochrane review of antibiotic use in uncomplicated diverticulitis suggests no support for antibiotics in this setting, while other studies have found the use of antibiotics has no effect on complications, recurrence rate, or the need for surgery.<sup>8,40-42</sup> Specifically, there was no evidence of an increased rate of bowel perforation or abscess formation in the patients who received supportive care only.<sup>40</sup> Expert opinion from the Society for the Surgery of the Alimentary Tract suggests that antibiotics should be continued only until the leukocytosis is resolved, fever defervescence, and the patient is able to tolerate oral feedings. They suggest that a restrictive approach in the use of antibiotics may be more beneficial than the historical 14-day course.<sup>43</sup>

The current standard of care for uncomplicated diverticulitis is antibiotics, bowel rest or clear liquid diet, and pain control, although new research is bringing questions to the traditional approach.<sup>8,13-14,29,42</sup> At this point the evidence is not strong enough to recommend supportive care only, and patients with uncomplicated diverticulitis should continue to receive antibiotics.<sup>5,44</sup> However, further studies could significantly alter current treatment recommendations in patients with uncomplicated diverticulitis, and clinicians should stay up to date with the evolving research.

Antibiotic therapy should be broad spectrum, covering gram-positive, gram-negative, and aerobic-anaerobic bacteria. Commonly used options with this coverage include ciprofloxacin combined with metronidazole, ampicillin-sulbactam, or amoxicillin/clavulanate.<sup>14,29,42</sup> Inpatient antibiotics are most often administered intravenously. Common choices include piperacillin/tazobactam, combined ceftriaxone and metronidazole, or meropenem.<sup>13</sup>

**Elective Surgery.** Management of diverticulitis has changed drastically through research and expert panel discussion regarding the treatment of these patients. Uncomplicated diverticulitis is most often managed medically, while trends in complicated diverticulitis have evolved through the years. Historically,

patients who failed medical management would be offered elective sigmoid colectomy to prevent recurrence of disease and the future potential need for emergent colectomy.<sup>8</sup> In contrast, patients with complicated diverticulitis were often managed with surgery right away. However, current clinical practice is trending away from invasive surgical management even in some patients with complicated disease.<sup>8</sup> A newer approach suggests proceeding with elective colectomy following two episodes of diverticulitis, while newer systematic reviews indicate the decision for surgery should be based on risk of recurrent disease, morbidity of surgery, ongoing symptoms, operative risk, and the complexity of the disease. Age at onset and number of episodes should no longer dictate when the decision to proceed for elective surgery should be made, and there is a movement away from “prophylactic” elective colectomy after an acute episode. Studies have also found that an increasing number of episodes of acute uncomplicated diverticulitis do not increase the need for urgent operative management, risk of recurrence, or complication risk.<sup>37</sup>

If surgery is chosen, laparoscopic surgery is preferable to open approach.<sup>45</sup>

## Approach to Complicated Diverticulitis

**Initial Management and Imaging.** Diverticulitis is considered complicated when the disease includes perforation, abscess formation, or fistulae formation.<sup>13,29,42,45</sup> Many of these complications are reliably identified on CT imaging, aiding in the distinction between complicated and uncomplicated disease.<sup>5,8,36</sup> Because of the potential catastrophic consequences of complicated disease, the emergency clinician should have a high index of suspicion for complicated disease in the unwell-appearing patient and pursue CT imaging to further investigate. Prior to imaging, early resuscitation and surgical consultation should be started on those patients with vital sign abnormalities or signs of peritonitis on physical examination.

**Abscess Management.** There are increasing options for non-operative management of complicated

diverticulitis, such as percutaneous abscess drainage and intraperitoneal lavage, and other minimally invasive procedures.<sup>13-14,45</sup> Abscesses that are small (< 4-5 cm) can be treated medically with antibiotics alone, while those that are larger (> 5 cm) typically require percutaneous drainage in combination with antibiotics.<sup>5-6,14,30</sup> The evidence regarding the need for elective surgical resection in those who were successfully medically managed is lacking. However, there is some suggestion that complicated diverticulitis with abscess formation is associated with a high probability of requiring surgery, whereas conservative management may result in chronic or recurrent diverticular symptoms.<sup>7</sup> Further studies are needed to elucidate this. Recurrent symptoms typically occurred within 3 to 6 months of the initial presentation, implying that the original episode and abscess were never completely normalized and the recurrence may actually have been a flare up of a smoldering chronic diverticulitis.<sup>7</sup>

**Operative Management.** Surgical resection is an option for patients with complicated or recurring disease. Diverticulitis, although the span of disease is expansive, is associated with a low mortality of 1% following timely medical management, and rises to 4% in-hospital mortality for those who require surgery.<sup>1</sup> Urgent colectomy is traditionally indicated in patients with sepsis and peritonitis, and in those who do not improve with nonoperative management.<sup>8,45</sup> These are typically patients with a Hinchey classification of III or IV.<sup>6</sup> However, due to the significant morbidity associated with these operations such as the need for colostomy, current practice leans toward medical management if at all possible.<sup>45</sup>

The presence of free air is not an absolute indication for surgery in the absence of diffuse peritonitis and hemodynamic instability. The entire clinical picture is necessary for an informed decision regarding the indication for emergent surgery. In the interim, aggressive resuscitation with intravenous fluids, intravenous antibiotics, and bowel rest are warranted in these cases.<sup>46</sup>

Current parameters suggest that the

decision for surgery should be made based on identification of good candidates for surgery and on a case-by-case basis, although the identification of a good candidate is not clearly defined.<sup>47</sup> Only 5.5% of the patients with recurrent hospitalization for diverticulitis are subjected to emergency surgery.<sup>6</sup> The majority of the patients requiring emergent intervention do so during their first presentation. The greatest risk of perforation also occurs during the first episode of disease.<sup>37</sup> The patients with complicated diverticulitis at the first admission were found to have a high risk of recurrence and poor outcomes, suggesting that in this population, elective surgery should be offered.<sup>46</sup>

Previously, it was thought that patients with diverticulitis who were younger than 40 years old had a more aggressive, virulent course, although newer research does not suggest this.<sup>8,37</sup> There is conflicting information regarding recurrence, but because of their long lifespan, younger patients may have an increased risk of recurrent diverticulitis and, thus, elective resection may be offered on a case-by-case basis.

Elective surgery now has been recommended only after two episodes of acute diverticulitis, per the American Society of Colon and Rectal Surgeons.<sup>5</sup> As such, the guidelines for surgery are more nuanced, and take into account patient age, comorbidities, and frequency of acute episodes.<sup>5-6,14</sup> It is important to take into account patient-related factors rather than number of previous episodes, to determine who would benefit from elective sigmoidectomy.<sup>6</sup>

Although resection will bring relief of symptoms for many patients, a significant amount will continue to experience symptoms following surgery. About 25% of patients who undergo sigmoid resection will have a persistence of symptoms.<sup>29</sup> The literature does not demonstrate that surgical resection prevents recurrence or treats chronic disease.<sup>5,29</sup>

## Disposition

**Uncomplicated Diverticulitis.** For patients with uncomplicated diverticulitis, outpatient antibiotic treatment with regimens discussed above and a liquid diet are often effective and negate

the need for inpatient admission.<sup>37-38</sup> Patients considered for discharge should have the ability and the reliability to return if their condition worsens or fails to improve. Clinical examination should not demonstrate alarming findings on physical or radiographic exams. In patients with uncomplicated diverticulitis, the majority of patients report improvement in symptoms within 2-3 days, at which point their diet should be advanced as tolerated. Fewer than 10% of these patients will present to the ED again for symptoms in the next 60 days.<sup>14,29,42</sup>

**Complicated Diverticulitis.** Patients with complicated disease on CT scan, those who are unable to tolerate oral intake, those who have other concerning comorbidities, or those with a concerning clinical picture on physical examination, including high fever or concerning abdominal exam, should be admitted for IV antibiotics, bowel rest, and close monitoring.<sup>14,30</sup> Patients who are immunosuppressed, including those on chronic steroids or elderly patients, should almost always be admitted, as their clinical and laboratory presentation is often more subtle, and they are at greater risk for outpatient treatment failure.<sup>14</sup> Following treatment with IV antibiotics and complete bowel rest, most are discharged with another 7-10 days of oral antibiotics.<sup>29,42</sup> Most perforations do not occur on recurrences but typically happen after the first attack of diverticulitis.<sup>6</sup>

## Prevention

**Lifestyle Modification.** Prevention centers around lifestyle modification, including smoking cessation, weight loss, and the introduction of fiber into diet, although randomized controlled trials on fiber-enriched diets showed inconsistent results.<sup>6</sup> Similarly, modifications in lifestyle have not been studied to understand the effects on disease course.<sup>8</sup> Despite the lack of evidence, a high-fiber diet is still recommended.<sup>16</sup>

**Probiotics.** The use of probiotics (poly-bacterial lysate suspension of *Escherichia coli* and *Proteus vulgaris* administered orally twice daily for two weeks every month within the first 3 months after an acute attack) was found to be more effective in preventing

a recurrence than no treatment in the post-attack period.<sup>5</sup> Multiple recurrences of diverticulitis were not associated with a higher chance of complicated disease or a higher chance of mortality.<sup>6</sup> The use of non-absorbable antibiotics such as rifaximin may reduce the risk of recurrent episodes of diverticulitis by 73% and the readmission rate by 50%. The combination of rifaximin with 5-aminosalicylic acid (mesalamine) was shown to be more effective than rifaximin alone in the prevention of recurrent diverticulitis.<sup>5-6</sup> When comparing mesalamine to rifaximin, mesalamine was found to significantly reduce symptoms 6-12 months after the initial episode of acute diverticulitis.<sup>8</sup>

**Colonoscopy.** In first-time episodes of diverticulitis, a colonoscopy should be performed 6-8 weeks following the resolution of symptoms to rule out malignancy or other diagnoses.<sup>14</sup> More recent systematic reviews suggest that there is no place for routine endoscopic examination after an episode of diverticulitis with Level 2 data, although this is still controversial.<sup>6,8</sup>

## Summary

The current standard for treatment and disposition of patients presenting to the emergency department with an acute episode of diverticulitis depends upon the evidence of possible complications and the patient's overall clinical picture. A majority of patients follow the natural history of diverticulitis, which involves a mild course treated by conservative means.<sup>6</sup> A move has been made to lower the use of antibiotics and move away from elective surgery. Non-surgical means are now utilized to treat patients with complicated diverticulitis. Timely recognition and management are essential to improve outcomes in patients with suspected diverticulitis.

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## CME Questions

1. The imaging modality of choice to evaluate for acute diverticulitis is:
  - A. abdominal X-ray upright
  - B. CT abdomen pelvis with IV and rectal contrast
  - C. CT abdomen pelvis with contrast
  - D. ultrasound with graded compression
  - E. MRI abdomen/pelvis
2. Initial management for complicated diverticulitis includes all the following *except*:
  - A. intravenous fluid resuscitation
  - B. intravenous antibiotics
  - C. surgical resection
  - D. surgical consultation
3. After a thorough history and physical examination, a patient with suspected uncomplicated diverticulitis who is able to eat and drink should undergo:
  - A. oral antibiotics and discharge
  - B. upright X-ray to rule out free air, IV antibiotics
  - C. abdomen/pelvis CT with contrast
  - D. intravenous antibiotics and admission
  - E. colonoscopy
4. The following are risk factors for diverticulitis *except*:
  - A. age
  - B. consumption of seeds and nuts

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Upon completion of this educational activity, participants should be able to:

- recognize specific conditions in patients presenting to the emergency department;
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- discuss the differential diagnosis of the particular medical problems discussed in the publication;
- explain both the likely and rare complications that may be associated with the particular medical problems discussed in the publication.

- C. NSAID use  
D. obesity  
E. smoking
5. The following triad helps to increase the likelihood of the diagnosis being diverticulitis:
- A. left lower quadrant pain, fever, elevated CRP  
B. left lower quadrant pain, fever, elevated ESR  
C. left lower quadrant pain, nausea/vomiting, elevated CRP  
D. left lower quadrant pain, fever, leukocytosis
6. Which of the following is true?
- A. Intravenous antibiotics are more effective than oral antibiotics in uncomplicated diverticulitis.  
B. A high fiber diet has been proven to reduce the rate of diverticulitis recurrence.  
C. Surgical resection should be offered to all patients younger than age 40 as they have more virulent and aggressive course than older patients.  
D. Rifaximin and mesalamine have shown benefit in reducing recurrence.
7. Which of the following is the most common complication of diverticulosis?
- A. significant bleeding  
B. perforation with free air  
C. obstruction  
D. fistula formation  
E. diverticulitis
8. A 70-year-old male presents with complaints of left lower quadrant pain, constipation, and subjective fever. Vitals reveal BP 100/60 mm Hg, HR 115 bpm, RR 24, T 39°C. He is diaphoretic, and in acute distress. Abdominal exam reveals voluntary guarding with rebound. What is the next best step?
- A. Consult general surgery.  
B. Order a CT abdomen/pelvis with contrast.  
C. Administer intravenous fluids and antibiotics.  
D. NPO with bowel rest and NGT placement  
E. Order a flat X-ray abdomen.
9. What is the next best step in treatment for a patient with suspected diverticulitis on clinical examination with abdominal CT confirming the presence of a 3 cm abscess?
- A. surgical resection  
B. percutaneous drainage alone  
C. percutaneous drainage and antibiotics  
D. laparoscopic washout
10. Which of the following is *not* an indication for CT imaging?
- A. age younger than 40 years old  
B. atypical symptoms  
C. elderly  
D. immunocompromised  
E. leukocytosis

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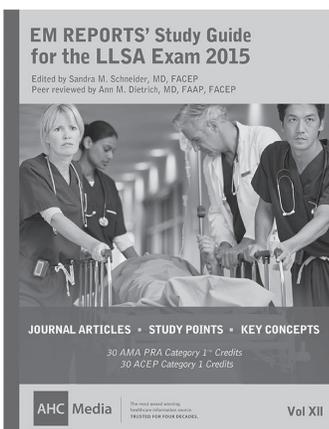
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