

Diverticulitis: A Review of Diagnosis, Treatment, and Prevention

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Abstract: Diverticulitis is a common occurrence in the hospital setting. Occurring in up to 25% of patients with diverticulosis, it presents with fever, pain, and a palpable mass in the left lower quadrant. In the early 20th century, intervention focused on surgery. Currently, a conservative medical route utilizing antibiotics selectively is recommended in cases of uncomplicated diverticulitis. Several studies question the need for antibiotics. Recurrence is a relative indication for surgical intervention, and percutaneous drainage is offered for cases with an abscess greater than 3 cm.

Keywords: Diverticulitis, colon, diverticular disease

Diverticulitis is a frequently encountered burden on patients and society. The increasing rate of diverticulosis correlates with an increase in the rate of diverticulitis. Healthy lifestyles and pursuing a diet high in fiber and low in red meat has shown to decrease the incidence of diverticulitis. Once diverticulitis has been diagnosed, judicious use of antibiotics is recommended in uncomplicated episodes. Complicated and recurrent episodes can be treated surgically, with the greatest benefit after the third episode. Diverticulitis with abscesses greater than 3 cm are drained via computed tomography (CT) assisted percutaneous drainage prior to

surgical intervention. Colonoscopy is recommended 4 to 6 weeks after the episode to exclude underlying neoplasia.

Background

Diverticulitis is from Latin, meaning inflammation of a blind tube.¹ It was first described in 1793 by Matthew Baillie, MD, who termed diverticulitis as a *schirrus*, or slow-growing malignant tumor, of the large intestine.^{2,3}

In the early 20th century, classification of diverticula leading to diverticulitis was established, distinguishing true and false diverticula, based on the mucosal layers that herniated. True diverticula are composed of the entire wall of the intestine, while false diverticula herniate the mucosa and submucosa.⁴ Diverticulitis has since been described clinically as fever, pain, and palpable mass in the left lower quadrant. Mild cases were treated with rest, morphine, and oral and intravenous fluids. More severe cases of diverticulitis were treated surgically, excising the diseased bowel.

Pathophysiology

Diverticulitis is inflammation that occurs in the diverticula. Diverticula form between 2 longitudinal bands of muscle in the colon due to intraluminal pressure. Current theory suggests that the pressure is secondary to low-fiber stool, which transmits the force of contraction on the wall rather than on stool content.^{5,6} The outpouching can become inflamed due to microperforation.⁵ Microperforation in turn, leads to muscle thickening and muscle spasm.⁷ Disease can progress to intra-abdominal abscess, pyelonephritis, perforation, or fistulization to the bladder, a loop of bowel, the skin, or the uterus or vagina.^{5,8}

Epidemiology

Diverticular disease is approximately 70% prevalent in patients aged 80 years or older.⁹ Acute diverticulitis occurs in an estimated 10% to 25% of patients with diverticulosis.^{10,11} In 2010, the US prevalence is estimated to have been 92 per 100,000.⁹ The disease costs approximately \$2.4 billion annually in the United States.¹² Obesity increases the risk of diverticulitis.¹³

Dietary factors such as consumption of red meat, particularly unprocessed red meat, increases risk of diverticulitis,¹⁴ while a high-fiber diet and physical activity prevents diverticulitis.^{15,16} The Western diet high in red meat, grains, and high-fat dairy has a hazard ratio of 1.55 to 1.58 compared with a diet high in fruits and vegetables.^{13,14} In the acute phase of diverticulitis, an unrestricted diet has no consequences.¹⁷ Previously, expert opinion had suggested that nuts, popcorn, and seeds should be restricted due to possible irritation inciting diverticulitis, but in a large prospective trial, consuming these foods was found not to increase the incidence of diverticulitis. While increased frequency of consuming popcorn has shown to decrease

incidence.¹⁸ Smoking also has been found to be an independent risk factor for diverticulitis.^{9,19} Vitamin D levels have shown a correlation, with low levels found in complicated diverticulitis cases and high levels in uncomplicated diverticulitis cases.²⁰ Exposure to drugs, including nonsteroidal anti-inflammatory drugs, steroids, and opiates, is associated with diverticulitis, while exposure to statin drugs may decrease the incidence.²¹

Genetics has been found to play a significant role in the pathogenesis of diverticulitis. Asian countries and people of Asian ancestry have reported right-sided diverticulosis, while those with Western ancestry have found diverticulosis on the left side of the colon.²⁰ Interestingly, the Japanese population living in Hawaii following a Western diet still predominantly report right-sided diverticular disease.²² Furthermore, only left-sided colonic diverticula was inversely associated with constipation.²³

Microbiota may also play a role. Enterobacteriaceae was found in significantly high levels in patients with diverticular disease.²⁴ Depletion of *Clostridium* cluster IV, *Clostridium* cluster IX, *Fusobacterium*, and Lactobacillaceae was found in patients with symptomatic disease.²⁵

Diagnosis

Diverticulitis is diagnosed clinically and radiologically. In the mid-20th century, diagnosis relied on barium enema, clinical presentation, or combination of the two.²⁶ Radiographic findings include a paracolic mass, calcified fecalith, and distended loop near the bowel. Utilizing barium makes these findings all the more apparent.²⁷ By the 1980s, computed tomography (CT) began being employed as the initial study for detecting diverticulitis.²⁸ CT is more expensive but has a lower risk of perforation and can help diagnose extracolonic pathology.²⁹ CT is 97% sensitive,³⁰ making it the standard of care in the diagnosis of diverticulitis.³¹

A classification system was developed by Hinchey and colleagues in 1978 (**Table 1**),³² which later was modified by Wasvary and colleagues (**Table 2**)³³ to include new modalities such as ultrasonography and CT, in order to drive treatment decisions.

Table 1. Hinchey Classification of Diverticulitis-Related Colonic Perforation

Class	Description
I	Pericolic abscess or phlegmon
II	Pelvic, intraabdominal, or retroperitoneal abscess
III	Generalized purulent peritonitis

Table 2. Wasvary Classification of Diverticulitis-Related Colonic Perforation

Class	Description
0	Mild clinical diverticulitis
Ia	Confined pericolic inflammation or phlegmon
Ib	Pericolic or mesocolic abscess
II	Pelvic, distant intra-abdominal, or retroperitoneal abscess
III	Generalized purulent peritonitis
IV	Generalized fecal peritonitis

Endoscopic examination is recommended 4 to 6 weeks after a course of diverticulitis to evaluate the colon, given that underlying neoplasia has been reported in 1% to 9.2% of cases.^{10,31,34,35} Newer evidence suggests that colonoscopy during hospitalization is safe so long as no pericolic air is present. Early colonoscopy during hospitalization yields better adherence but shows no clear benefit.³⁶

Further literature yields colonoscopic evidence of neoplasm of 0.7% and 10.8% in uncomplicated and complicated diverticulitis, respectively, questioning the need for colonoscopy after uncomplicated diverticulitis.³⁷⁻³⁹ Endoscopic examination is still recommended 4 to 6 weeks after the resolution of diverticulitis.³¹

Diet

A high-fiber diet has long been associated with the prevention of complications of diverticulitis.⁴⁰ Red meat has been noted to be associated with an increased risk of diverticulitis. Higher levels of C-reactive protein and ferritin have been associated with consumption of red meat, which might indicate a pathomechanism of diverticulitis predisposition.^{12,14} Earlier recommendations had focused on avoidance of seeds and nuts in the hope of avoiding inflammation of the diverticulum, but the results of a large cohort study showed that eliminating nuts, popcorn, and seeds did not decrease the incidence of diverticulitis.¹⁸ Vegetarians are at decreased risk

compared with the population eating red meat.⁹ Current guidelines recommend a high-fiber diet, but no other dietary limitations have been recommended.³¹

Treatment

Treatment of diverticulitis is based on bowel rest, antibiotics, and pain control as needed. Antibiotics are aimed at the gastrointestinal flora, including anaerobic gram-negative coverage. Antibiotic choices include ciprofloxacin with metronidazole, amoxicillin-clavulanate, piperacillin-tazobactam, and meropenem for a duration of 7 to 10 days.⁴¹

Recent attention has been focused on a more judicious use of antibiotics. In recent studies, antibiotic treatment was found to be of no benefit in cases of uncomplicated diverticulitis,^{42,43} while current recommendations call for antibiotics to be used selectively, without clear indications identified.³¹ Studies are under way to determine the need for antibiotics by treating uncomplicated cases without antibiotics.⁴⁴ In complicated diverticulitis, control of the source of infection and adequate initial empirical antibiotic therapy are important to improve clinical outcomes.⁴⁵

No significant difference has been found between oral and intravenous antibiotics, nor between anaerobic coverage and no anaerobic coverage.⁴² Similarly, no statistically significant differences have been found between inpatient and outpatient antibiotic treatment in uncomplicated and mildly complicated diverticulitis.⁴⁶ A failure rate of 6.2% for oral antibiotics warrants outpatient treatment of uncomplicated diverticulitis whenever possible.⁴⁷

Since 1907, surgery was applied for diverticulitis. Mortality with these early surgical approaches surpassed 17%.⁴⁸ By the mid-20th century, the development of new surgical techniques such as the Mikulicz technique, in which a double-barreled colostomy is created, and 3-stage procedures reduced the mortality rate to 12% and 6%, respectively.^{49,50} Surgeons began advocating for early surgical intervention due to the recurrence of disease.⁵¹ The Hartmann procedure, modified by Boyden and Nelsen for diverticulitis, was employed in the 1950s utilizing a 2-stage sigmoid resection.⁵² Recent advances in surgical intervention include minimally invasive techniques with primary anastomosis, which have shown to decrease length of stay, pain, and infection rates.⁵³

By the 1980s, CT-guided percutaneous drainage of diverticular abscess had proven to be a safe procedure to decrease inflammation prior to surgery.^{50,54} The recurrence rate of diverticulitis after percutaneous drainage alone is 35.4%; as such, the procedure usually is reserved for patients who are poor operative candidates. Surgery following percutaneous drainage has an associated mortality rate of 7%.⁵⁵ Thus, from single- or double-stage surgery after antibiotics, CT-guided percutaneous drainage before surgery has become the standard in

cases of abscesses larger than 3 cm. Those smaller measuring less than 3 cm are treated medically.⁵⁶

Surgical treatment has been found not superior to medical treatment, with nonrecurrence rates of 79% and 75% for surgery and medical treatment, respectively. The lengthy postoperative hospitalization and morbidity indicates that surgical treatment should be reserved for complicated presentations.⁵⁷ Thus, first noncomplicated episodes should be treated medically. Surgery is recommended after the second or third episode of uncomplicated diverticulitis, with cost savings noted to be most after the third episode of uncomplicated diverticulitis.⁵⁸ On the other hand, patients with recurrent uncomplicated episodes of diverticulitis do not have an increased risk of poor outcomes.⁵⁹

In addition to dietary modifications, preventive measures were explored. Mesalamine has shown promise as a preventive measure, given that the inflammation seen in diverticulitis is similar to that of inflammatory bowel disease. Mesalamine reduced the symptoms of diverticulitis in one study,⁶⁰ but on the other hand, recent meta-analyses have not found mesalamine to be beneficial in preventing diverticulitis.^{61,62}

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