

# Diverticular disease of the colon and acute diverticulitis: what the clinician should know

## *Doença diverticular dos cólons e diverticulite aguda: o que o clínico deve saber*

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### ABSTRACT

Diverticular disease is one of the most frequent benign diseases, with high patient morbidity. Several complications can arise from it and in certain cases they can be very severe. However, this condition is most often asymptomatic and few individuals are aware of its existence. In the presence of diverticular inflammation patients seek emergency services with symptoms of acute diverticulitis. It is up to the clinician to proceed with a detailed clinical assessment, efficient workup and start adequate therapy. Additionally, it is essential to discern the need for a surgical approach. This article aims to contribute with an update on the diagnosis and treatment of acute diverticulitis and diverticular disease.

**Key words:** Diverticulosis, Colonic; Diverticulitis, Colonic; Colonic Diseases.

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### RESUMO

*A doença diverticular constitui uma das afecções benignas mais frequentes e ocasiona elevada morbidade para o paciente. Várias complicações são advindas dessa doença, e em determinadas situações elas apresentam significativa gravidade. Contudo, essa afecção é, na maioria das vezes, assintomática e poucos indivíduos estão cientes de sua existência. Na vigência de inflamação dos divertículos, os pacientes procuram atendimentos de urgência com sintomatologia de diverticulite aguda. Cabe ao clínico proceder com avaliação clínica detalhada, propedêutica eficiente e instituição de terapêutica adequada. Ainda, torna-se essencial discernir sobre a necessidade da abordagem cirúrgica. Esse artigo objetiva contribuir para a atualização do conhecimento sobre o diagnóstico e o tratamento da doença diverticular e diverticulite aguda.*

**Palavras-chave:** Diverticulose Cólica; Diverticulite Cólica; Doenças do Colo.

## INTRODUCTION

### Importance and epidemiology

Although diverticulitis of the colon is very common and affects up to 10% of middle-aged adults and 50 to 80% of adults above 80, few people are aware that they have it. The majority of colonic diverticula are acquired, affect men and women similarly, and incidence increases with advancing age. Less than 2% of the patients below 30 have diverticulitis, while more than 40 and 60% of 60 and 80-year old patients acquire diverticula, respectively. In the United States, diverticular disease results in

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approximately 130,000 hospitalizations per year, with a high cost to the health system.<sup>1,2</sup>

Diverticular disease of the colon is usually asymptomatic. It generally occurs in populations in industrialized or western regions, where it is associated with a low-fiber diet. In western countries, 95% of the diverticula are located in the sigmoid and descending colon and their incidence in proximal regions of the colon increases with advancing age.<sup>1</sup> In Asian countries, especially in Korea, diverticulitis most commonly affects the right colon, in up to 70% of cases.<sup>3</sup>

## Definition and pathophysiology

Colonic diverticula refer to uncomplicated herniations of the mucous and submucous colonic membranes through the muscle layer of the colon. These lesions are acquired and are called false diverticula, or pseudodiverticula, while the diverticula that involve all the layers of the colonic wall are regarded as true diverticula.

Diverticulosis is the existence of asymptomatic diverticula in the colon. The manifestations associated with diverticula constitute diverticular disease of the colon.

The precise etiology of diverticulosis remains unknown.<sup>1</sup> The Industrial Revolution introduced new eating habits which included a reduction in fiber intake, which correlates with the emergence of symptomatic diverticular disease.<sup>1,2,4</sup> Low fiber intake leads to production of bulky stool with low water content, which can change the intestinal transit and contributes to increasing intracolonic pressure. The disposition of nutrient arteries (vasa recta) in the colon, along with the increase of intraluminal pressure, contributes to the occurrence of diverticula. Colonic diverticulosis emerges on the site where the vasa recta penetrate the muscle layer, on the mesenteric edge of the antimesenteric taenia.<sup>1</sup> At this point, there is inherent weakness in the bowel wall, which, in addition to the increase in intraluminal pressure, facilitates herniations.<sup>2</sup> A much higher deposition of elastin in the taeniae in the colon then occurs, causing muscle shortening, which can explain the changes on the intestinal wall in this disease and the increase in luminal pressure.<sup>5</sup> Collagen crosslinks also increase with advancing age,<sup>6</sup> leading to colon hardening and less complacency in the accommodation of increased pressures.<sup>1</sup> The segmental contractions of the colon, also called colon segmentations, can participate in the process of formation of diverticula by creating areas of extreme intraluminal

pressure. Segmentation happens when two adjacent haustra contract simultaneously, in a non-propulsive way, but increasing the luminal pressure.<sup>1,7</sup> Obesity and physical inactivity also are risk factors.<sup>2,8,9</sup>

Several complications may arise from diverticular disease. Among them are diverticulitis (inflammation and infection of colonic diverticula) which occurs in 10 to 25% of the people affected by diverticular disease of the colon,<sup>1</sup> as well as gastrointestinal bleeding. Diverticulitis can evolve with formation of abscess, fistula, perforation with peritonitis, and stenosis with colonic obstruction. The cause of this process is still not fully understood. Nonetheless, accumulation of particulate waste in the diverticular sac favors the obstruction of the narrow neck of pseudodiverticulum and causes bacterial overgrowth, local tissue ischemia, inflammation and microperforations.<sup>2</sup> Inflammation is the main cause for perforation of diverticular walls. Symptoms of diverticulitis arise when there are microperforations or free perforations into the peritoneal cavity. Generalized peritonitis is caused by the rupture of a simple or complicated diverticulum through formation of a peridiverticular abscess. Colonic obstruction is the result of abscess formation, edema of the colonic wall or stenosis in the regions of inflammatory process after recurrent episodes of diverticulitis.<sup>2</sup>

## Clinical manifestations

The majority of patients with colonic diverticula are asymptomatic. Elimination of bright red blood through the rectum, however, is considered a sign of diverticular disease of the colon, massive in approximately 5% of patients. Diverticular bleeding, however, is unusual in acute diverticulitis.

Acute diverticulitis involves different clinical manifestations depending on the extent of the diverticular process. It commonly involves pain in the lower left quadrant of the abdomen, low fever, changes in bowel movements, anorexia, and moderate leukocytosis. The pain in diverticulitis can radiate to the flank, dorsum or suprapubic region. In cases in which the sigmoid colon is redundant, it can be shifted to the right in the topography of the right iliac fossa, thus causing confusion with the diagnosis of acute appendicitis – which can also happen with the inflammation of diverticula located in right colon.<sup>3</sup> Diverticular disease of the colon can evolve with constipation, diarrhea, and increased

secretion of mucus, nausea and vomiting; urinary complaints can also arise when the diverticulitis is adjacent to the urinary bladder. Palpation of the lower left abdominal quadrant reveals sensitivity, and signs of peritoneal irritation can be detected and, occasionally, tumoration sensitive and painful to palpation.

Pericolonic abscess secondary to perforated diverticulitis causes localized peritonitis, which can be identified by peritoneal signs, such as pain relief. We must, therefore, suspect diverticular perforation in case of peritoneal irritation, which can also involve a sudden onset of involuntary rigidity of the abdominal wall. In case of diffuse peritonitis, urgent surgical exploration becomes imperative.<sup>2</sup>

There can be specific symptoms in cases involving fistulous complications, as in colovesical, enterocolonic and colovaginal fistulas, in which we find pneumaturia, fecaluria or recurrent urinary tract infections; severe diarrhea, especially when the involvement of the small intestine is proximal; and output of fecal matter through the vagina, respectively.<sup>1</sup> In cases of complicated diverticulitis with stenosis, obstructive symptoms such as abdominal pain in colic, abdominal distension and vomiting may be the most prominent.<sup>8</sup>

## METHODS

The bibliography has been obtained on the Scopus database by using the term diverticulitis for search in the article title search field. The search was limited to review articles in English and Portuguese published from the year 2000. Of the 75 articles found, seven were selected based on predefined parameters of the article, such as: title, practical application, interest and availability of full text via the Coordination for Higher Education Personnel Improvement (CAPES). Other articles were selected from the initial articles.

## RESULTS

### Diagnosis

Evaluation of the patient with suspected diverticular disease or acute diverticulitis should be based on medical history and detailed physical examination. It is important to characterize the pain, define asso-

ciated symptoms and to be attentive to evidence of possible complications of the disease.<sup>1</sup> Another important point is to establish possible differential diagnoses, which include gastroenteritis, acute appendicitis, inflammatory bowel disease (especially Crohn's disease), inflammatory pelvic disease, cancer perforating the colon, nephrolithiasis, cystitis, ischemic or infectious colitis, and ectopic pregnancy.

Supplementary assessment should include complete blood panel and urinalysis. Imaging methods, in addition to reinforcing the diagnosis, help define the location and extent of the disease, evaluate the involvement of adjacent organs and identify whether there are any complications. A CT scan of the abdomen and pelvis is, for many authors,<sup>2,10,11,12</sup> the imaging exam of choice since it has high sensitivity (93 to 97%) and specificity (close to 100%) for diagnosing diverticular disease of the colon and respective complications.<sup>1,2</sup> This radiological method also allows therapeutic interventions, such as percutaneous abscess drainage. Its downside is that it emits ionizing radiation. Identification of acute diverticulitis by ultrasonography reaches sensitivity and specificity figures between 77 and 98% and between 80 and 99%, respectively.<sup>13,14</sup> Pelvic and abdominal ultrasound does not use ionizing radiation, neither does it require using oral, rectal or venous contrast. Besides, it can be repeated whenever necessary. Conversely, it is an operator-dependent test and its image is impaired by excessive abdominal fat or distended intestinal loops.<sup>13</sup> Complementary assessment of patients with suspected diverticulitis should begin with the ultrasound;<sup>13,15</sup> computed tomography should be saved for cases of diagnostic doubt when there is generalized peritonitis or a large abscess requiring percutaneous drainage. The decision to start the ultrasound or computed imaging propaedeutic must also take into account the availability of these methods and the levels of training and medical practice using them.<sup>16</sup> Thickening of the intestinal wall, pericolic inflammation and visible diverticulum are common findings to ultrasonography of diverticulitis. Direct view of an inflamed diverticulum is the main criterion for diagnosing diverticulitis in the ascending colon. Nuclear magnetic resonance does not emit ionizing radiation and is considered accurate in assessing acute diverticulitis and identifying complications, such as fistulas and abscesses.<sup>17</sup> However, it cannot be used as an initial means of imaging propaedeutic due to its scarce availability and high cost.

Barium x-ray is the most sensitive method for diagnosing colonic diverticula,<sup>1</sup> as it best shows the distribution and severity of diverticular disease (Figure 1). Barium enema, which shows the morphology of the colon, yields optimized results with full preparation of the colon and double contrast technique.<sup>18</sup> Barium enema, which shows colon morphology, yields optimized results with full preparation of the colon and double contrast technique.<sup>18</sup> However, this method fails to offer good visibility of the disease's extraluminal changes and is no longer widely accessible in radiology services. Moreover, it should not be used in the event of acute inflammation due to risk of perforation and/or contrast extravasation during the radiological study. Barium peritonitis is considered severe and is associated with high mortality. Colonoscopy and flexible sigmoidoscopy should be avoided in the acute phase of the disease due to risk of perforation and worsening of inflammation. Thus, ultrasound and computed tomography are the diagnostic methods of choice in this phase, also because of their greater accuracy in identifying other diseases included in the differential diagnosis. If colovesical fistula is suspected, cystography can be useful. Even if the fistula is not shown in the x-ray, existence of air in the bladder before acute diverticulitis is usually a diagnostic sign of colovesical fistula.<sup>1</sup>



**Figure 1** - Picture of a barium enema showing sacculations typical of diverticulosis in the sigmoid colon.

Colonoscopy must be performed after the resolution of the acute phase (Figure 2), usually after six weeks, with the aim to rule out other diagnoses, especially colonic cancer and inflammatory bowel disease. Some patients, however, even after waiting for a period of six to eight weeks, have diverticula with output of pus. In this case, the procedure must be stopped and the patient treated adequately. Approximately 3 to 5%

of the cases of diverticulitis are adenocarcinomas mimicking diverticular disease.<sup>1</sup> In patients with extensive diverticular disease, colonography by computed tomography (virtual colonoscopy), despite its high cost, becomes a suitable alternative.



**Figure 2** - Picture of a colonoscopy with no signs of inflammatory process in a patient with diverticula in the sigmoid colon.

## Staging

The Hinchey classification is generally used to graduate the clinical severity of diverticulitis associated with abscesses (Table 1). The risk of death is below five, approximately 13 and 43% for patients in Hinchey stages 1 and 2, 3 and 4, respectively.

**Table 1** - Hinchey classification (1978)

Stage 1	Small paracolic abscess, confined to colon mesentery
Stage 2	Large, distant abscess located in pelvis or retroperitoneum
Stage 3	Purulent peritonitis caused by abscess rupture
Stage 4	Fecal peritonitis caused by free perforation of a non-inflamed diverticulum

## Treatment of uncomplicated diverticulitis

The treatment of uncomplicated, or simple, diverticulitis is essentially based on prescription of antibiotics, which should cover Gram-negative and anaerobic bacteria for seven to 10 days, in addition to medications for controlling general symptoms and hydration. A liquid diet should be prescribed, which can be changed in terms of consistency as the symptoms disappear. Oral antibiotic administration and home treatment with frequent reassessments may be the appropriate option when the patient has mild

symptoms, when there is tolerance to liquid intake and when severe comorbidities cannot be identified. Also, in these cases, the intestinal function should be normal and the complications ruled out.<sup>1,2,8,12,19</sup> Hospitalization is suggested when patients face complications such as marked pain requiring analgesia with narcotics; uncontrollable vomiting; and intolerance to oral ingestion, for elderly patients (especially above 80 years of age), immunosuppressed, transplanted or presents relevant comorbidities such as diabetes mellitus, chronic kidney failure, malignant hematologic diseases and acquired immunodeficiency syndrome<sup>12</sup> and if broad spectrum intravenous antibiotic therapy (Table 2) is being administered without oral ingestion of food. If there is evidence of gastrointestinal obstruction, a nasogastric catheter should be inserted to decompress the stomach and prevent stasis.<sup>2</sup>

**Table 2 - Antibiotic options for acute diverticulitis**

Drugs	Posology
<b>Oral route for home treatment</b>	
Metronidazole and quinolone	Metronidazole – 500mg every 6 to 8 hours Ciprofloxacin – 500 to 700 mg every 12 hours
Metronidazole and Trimethoprim/sulfamethoxazole	Metronidazole – 500mg every 6 to 8 hours Trimethoprim-sulfamethoxazole – 160mg Trimethoprim and 800 mg sulfamethoxazole every 12 hours
Amoxicillin-clavulanate	Amoxicillin-clavulanate – 875mg every 12 hours
<b>Intravenous route for hospital treatment</b>	
Metronidazole and quinolone	Metronidazole – 500mg every 6 to 8 hours Ciprofloxacin – 400mg every 12 hours
Metronidazole and third-generation cephalosporin	Metronidazole – 500mg every 6 to 8 hours Ceftriaxone – 1 to 2g every 24 hours
Beta-lactam and beta-lactamase inhibitor	Ampicilina-sulbactam – 3g every 6 hours

Duration of treatment: 7 to 10 days. All doses are for adult patients. Dose adjustments might be necessary depending on presence and degree of kidney failure. Adapted from Jacobs DO. Diverticulitis. N Engl J Med. 2007;357(20):2057-66.

The majority of patients with uncomplicated colonic diverticulitis responds to treatment and show improvement of symptoms and reduction in leukocyte counts within 48 hours from the start of antibiotic therapy. Lack of improvement or worsening in two to three days after these measures are effected requires that the possibility of resolution by surgery be considered.<sup>1,2,8,19</sup> The surgical assessment must also be made before recurrence of diverticulitis, complications of the disease – acute episode affecting immunocompromised patients – or if the diagnosis is uncertain.<sup>1,2</sup>

Prescription of antibiotic therapy in uncomplicated diverticulitis, however, has also been questioned.<sup>20</sup>

### Treatment of complicated diverticulitis

A small intra-abdominal abscesses (less 4 cm in diameter) with no peritonitis (stage 1 of Hinchey) requires administration of antibiotics and bowel rest. If, however, it is larger than 4 cm in diameter (stage 2 of Hinchey), CT-guided percutaneous drainage should be considered<sup>1,2,19</sup> in association with antibiotic therapy, particularly if interventional radiology is available (Figure 3). This procedure replaces urgent surgery with an elective procedure, which can be scheduled in a period of six to eight weeks after the CT-guided drainage. This period coincides with the quiescence of the inflammatory process, normalization of the physical examination and reduction of leukocytosis.<sup>1</sup> An early surgical approach can be performed within seven to 30 days after the resolution of the infectious process, which can reduce the hospitalization time and lead to lower morbidity and less need for ostomy.<sup>8</sup>



**Figure 3 - CT-guided drainage of pelvic abscess secondary to acute diverticulitis in the sigmoid colon. Patient in ventral decubitus.**

Abscesses with coarse fecal matter tend to respond poorly to drainage and require urgent surgical approach. The urgent surgical procedure must be performed in case of generalized peritonitis (stage 3 of Hinchey), uncontained visceral perforation (stage 4 of Hinchey) and uncontrolled sepsis. The mortality rate in this case is high. The surgical approach should be scheduled for diverticulitis in case of failure of the clinical treatment of uncomplicated diverticulitis and in cases of abscess not accessible to percutaneous drainage, as well as immunocompromised patients.<sup>1,2,19,21</sup>

Self-expanding metal stents can be deployed to decompress the colonic obstruction due to diverticulitis and to enable a subsequent elective surgical approach, which must be carried out in a timely manner to avoid late complications associated with this implant.<sup>22</sup>

If surgery is indicated, a sigmoidectomy must be performed. A complete resection of the sigmoid is necessary since its partial removal is associated with high rates of recurrence of the disease.<sup>8</sup> It is important to emphasize that it is not necessary to remove the entire length of the colon affected by diverticulitis, but only the portion affected by the inflammatory, infectious process, with thickened, friable walls.

Intestinal transit can be reconstructed by primary anastomosis or Hartmann's procedure, by suturing of the end of the rectum and colostomizing the sectioned end of the colon. We can notice a reduction of morbidity, cost, length of hospital stay and complication rates with the primary anastomosis performed after the complicated diverticulitis.<sup>23</sup> Nonetheless, performing it depends on the technical qualification of the attendings and the ability of the surgeon who proposes it, which requires analysis on a case-by-case basis. The laparoscopic surgery, performed in both complicated and uncomplicated diverticular disease situations, entails low post-operative morbidity rates, reduces hospital stay and speeds postoperative recovery.<sup>8,24</sup> The laparoscopic approach has been increasingly adopted for surgical treatment of diverticular disease of the colon.

### Treatment of recurrent diverticulitis

Approaches to recurrent uncomplicated diverticulitis<sup>10</sup> must be assessed on a case-by-case basis and should not be based only on the number of episodes, but mainly on the patient's age, comorbidities, frequency and severity of episodes and how persistent the symptoms are after the acute phase.<sup>8,21</sup> The impossibility of ruling out colon carcinoma is a suitable indication for colectomy.<sup>10</sup> Patients under the age of 50 must be operated on as they have long life expectancy, which entails high accumulated risk for recurrent episodes.

### Prevention of recurrences

A fiber-rich diet is recommended after recovery, with or without long-term antibiotic therapy (rifaximin, 400 mg twice a day for seven days each month),

to reduce the intracolonic pressure and the risk of recurrence. There is no consensus regarding the benefits of avoiding nuts and seeds.

### CONCLUSION

Diverticulitis and diverticulosis of the colons affect adults and the elderly with high frequency, manifesting with a wide range of clinical events within a spectrum of severity. Knowledge about this disease is required for the clinician to conduct cases appropriately and create conditions to overcome the acute episode and to control the disease.

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