Diverticulosis (Diverticular Disease) and Diverticulitis (Colonic Diverticulitis) — Symptoms and Treatment

Diverticulosis (diverticular disease) is an extremely common disease of the colon. The colonic wall is exposed to high luminal pressure which forces the wall outwards to form outpouchings called diverticula. This is a painless condition, but patients can become very worried as it can cause rectal bleeding. This condition is very prevalent in Western society because of the low fiber diet. Diverticulitis is a much more serious condition and occurs when a diverticula becomes inflamed. It is related to diverticulosis as the diverticula in this disease can become obstructed and/or inflamed due to an infection. The outpouching becomes very painful due to the inflammatory response and can continue to grow in size. If the outpouching is not treated rapidly, it can progress to rupture and lead to peritonitis, sepsis and death.
Diverticulitis

Diverticulosis and diverticulitis explained

**Diverticulosis (diverticular disease)** is the condition of having *diverticula* in the colon. These are outpouchings of the *mucosa* and *submucosa* due to the weakness of the muscular layers of the *colonic wall*.

![Image: "Large bowel (sigmoid colon) showing multiple diverticula. Note how the diverticula appear on either side of the longitudinal muscle bundle (taenium)," by Haymanj. License: Public domain.]

**Diverticulitis** is a very serious condition which involves *inflammation of the diverticula*. It can occur in the small and large intestine or the colon. It can occur at any age when diverticula are present, e.g., *Meckel’s diverticulum* in infants, or in the elderly, with diverticular disease.

These diseases are very important to notice early on to ensure the patient gets the relevant diagnosis and treatment as soon as possible. Diverticulitis has very serious complications that can arise if rapid action is not taken, therefore these conditions are considered essential knowledge and are commonly examined.

Epidemiology of Diverticulosis and Diverticulitis

Occurrence of diverticulosis and diverticulitis

**Diverticulosis** has a huge correlation with the low fiber Western diet; hence, diverticulosis is very common in the US, UK, Canada, Australia and relatively uncommon in Africa and Asia.

In the U.S., 10% of 40-year-olds and more than 50% of over-60-year-olds have the disease. Certain conditions increase the chance of developing diverticulosis, such as *Marfan’s syndrome, Ehlers Danlos syndrome* and *scleroderma*. 
**Diverticulitis** most commonly affects adults who are middle-aged to elderly, although it does affect the young too. 95% of the patients suffer from diverticulitis of diverticula found in the *sigmoid colon*. Some of the epidemiology of diverticular disease carries over to diverticulitis, as approximately 15–25% of the patients with diverticulosis develop diverticulitis at some point in their lives. 10–20% of the patients with Meckel’s diverticulum (embryological condition) develop diverticulitis as a complication.

**Etiology and Risk Factors of Diverticulosis and Diverticulitis**

**Causes of diverticulosis**

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**Diverticulosis** is thought to be caused by a number of factors. It commonly occurs in older demographics because increasing age causes a decrease in the strength of the connective tissue that makes up the walls of the colon. The connective tissue, which is mostly made up of collagen types 1 and 2, decreases in tensile strength with age and the *elastic mucosa* pushes outwards. The weaker connective tissue fails to maintain the structure of the colon and creates diverticula outpouchings. This is why genetic conditions that result in dysfunctional connective tissue (e.g., Marfan syndrome and Ehlers Danlos syndrome) increase the chance of developing diverticulosis.

If a patient has a **family history** of diverticulosis, then it is more likely that they will develop it, due to their inherited genetic predisposition. Family members may also share environmental factors (e.g., low fiber diet) which are thought to have a role in diverticulosis.
Constipation causes the colon walls to be exposed to higher pressures than normal. If this occurs in the elderly, or those with weaker connective tissue, it is likely to result in the formation of diverticula. Younger patients who suffer from chronic constipation may also get diverticular disease despite having connective tissue of normal strength.

Some studies have shown that a low fiber diet has a role in the causation of diverticular disease. A low fiber diet causes the muscles of the colon to contract strongly. This results in increased pressure that leads to herniations (diverticula) in weaker parts of the wall, where blood vessels enter. Recent studies have provided evidence that questions this theory and claims that a high-fiber diet may even increase the chance of diverticular disease as it increases the frequency of bowel movements.

Causes of diverticulitis

The etiology of diverticulitis is not well known. It is thought to be a balance between genetics and environmental factors. The evidence to support the low fiber diet theory is unclear, although it is commonly accepted as a reasonable theory. Diverticulitis is known to be more prevalent in obese patients. It is more likely to occur in patients with Meckel's diverticulum as a complication of this embryological outpouching.

Pathophysiology of Diverticulosis and Diverticulitis

Pathophysiology of diverticulosis

The most common place for diverticula to form is the **sigmoid colon**. This is because it is the place where the most pressure builds up. If the patient is constipated, or has particularly hard stools, then over time, the walls of the colon are put under constant strain, and eventually, the mucosa and submucosa punch through the weakened
muscular layer and form outpouchings. The outpouchings usually occur at the weakest spots in the wall of the colon, such as where blood vessels enter. These are most common in the elderly as it requires less strain to herniate through their weakened structural tissue.

Most people who have the structural change found in diverticulosis are not aware of it as they are commonly asymptomatic. These outpouchings can sometimes bleed and lead to an anemia from continuous GI blood loss. This can be a very serious complication, if the blood loss is significant, and may need to be treated surgically. All rectal bleeds should be thoroughly investigated as there are other causes such as colon cancer, inflammatory bowel disease and polyps that need to be ruled out.

Patients usually visit the toilet more times than they usually would, and a common complaint is that they pass rabbit-pellet stools in the morning time; this is caused by feces that have been stored and shaped by the spherical diverticula of the sigmoid colon. Diverticulosis can cause cramping, bloating, flatulence and a change in bowel habit; these symptoms mimic conditions such as irritable bowel syndrome and the distinction has to be made through investigations so that the right treatment can be provided. Diverticulosis is usually painless, and this is one of the main distinctions from diverticulitis. However, there can sometimes be start-stop pain in the left lower quadrant.

Pathophysiology of diverticulitis

It occurs when a diverticula becomes inflamed. It most commonly occurs in the diverticula found in age-related diverticulosis. The diverticula can sometimes become obstructed with a faecolith or foreign body. This can pass naturally or can start to irritate the colonic wall and cause an inflammatory reaction.

Bacteria found in the stool become trapped in the diverticula and begin to thrive, causing a neutrophilic response. Common bacterial agents include anaerobes (such as E.coli) and bacteroides – these bacteria are commonly found in the gut as part of the normal commensal flora.

The size of the diverticula increases due to distension caused by the edema and inflammation, and this causes severe lower left quadrant pain. The patient will present with a fever due to the infective aspect of the diverticulitis and will also feel nauseated and may even vomit. The bowel movements of the patient will change and become more frequent and may even turn to diarrhea. The patient may also be bloated and the passage of stools and flatulence may provide some pain relief.

The pain begins over approximately one or two days and usually starts in the central umbilical region before spreading to the lower left-quadrant, in western populations, or the lower right-quadrant, in East Asians (genetic predisposition to right-sided diverticula and diverticulitis). Diverticulitis can progress and be life-threatening if not treated rapidly. Complications include abscesses, build-up of gas, rupture, peritonitis and sepsis.

If the patient presents in the late stages of diverticulitis or progresses rapidly, they may experience a rupture of their infected diverticula, and this can lead to peritonitis. Their abdomen with become rigid due to guarding; this is a surgical emergency and they need to be referred immediately for the Hartmann’s procedure.
Signs and Symptoms of Diverticulosis and Diverticulitis

Signs of diverticulosis

It is uncommon for patients to suffer any symptoms from this condition. If patients have never experienced abdominal pain or diarrhea, they are likely to never develop any symptoms in the future. Diverticulosis is mostly a painless condition, unlike diverticulitis.

Diverticulosis can sometimes mimic IBS and other GI conditions – bloating, flatulence, cramps, change in bowel habit (diarrhea or constipation). Patients can pass rabbit-pellet stools and can more rarely pass dark blood from the rectum; blood loss from the rectum usually occurs after a bad episode of cramping pain and patients usually require a visit to the hospital. This occurs when a blood vessel ruptures and bleeds out.

If these episodes continue and/or are neglected, the patient can develop an anemia over time and experience symptoms including:

- shortness of breath
- headaches
- worsened angina
- dizziness
- syncope.

Patients are usually very anxious to find the cause of the bleeding and are usually worried about diseases such as colon cancer (which need to be ruled out). Unlike colon cancer, diverticulosis does not cause weight loss.

**Note:** 10 – 25 % of those with diverticulosis go on to having an episode of diverticulitis.

Signs of diverticulitis

The presentation of diverticulitis is very different and noticeable when patients present with the following symptoms:

- severe left lower-quadrant pain
- fever
- malaise
- tiredness
- nausea and vomiting.

The pain comes on over one or two days and can begin in the umbilical region before localizing to the lower left quadrant in most West countries (lower right in most East Asians).

On physical examination, the abdomen will be tender in the affected lower-quadrant. The patient’s face should be observed as the abdomen is gently palpated. If the patient has a rigid abdomen with guarding, peritonitis should be suspected. Signs of peritonitis include:

- Reduced movement
- Reduced breathing volume
- Guarding
- Rebound and percussion tenderness
- Absent bowel sounds
- Tympanitic (resonance)
- Distended abdomen.

Additionally, signs of **sepsis** must not be neglected:

- High-flow Oxygen
- Blood cultures
- IV **antibiotics**
- Fluid challenge
- Measure lactate
- Measure urine output

**Note**: If suspected, the **sepsis pathway** should be followed immediately.

### Complications of Diverticulitis

Diverticulitis has the following common complications:

- Rupture and consequent **peritonitis**
- **Sepsis**
- **Abscess**
- **Fistula** between adjacent structures (e.g., the **bladder**)
- **Bleeding** — blood vessel rupture
- **Strictures** (consequence of surgery)
- Risk of surgical procedures that may be required.

**Note**: The main complications one should worry about are rupture, peritonitis and sepsis; these conditions are the most serious as they are potentially fatal.

### Diagnosis of Diverticulosis and Diverticulitis

#### Detecting diverticulosis

The diagnosis of this condition involves good history-taking skills and some investigations. As this condition has serious differential diagnoses, it is important to rule these out (e.g., colon cancer). Asymptomatic diverticulosis is mostly found incidentally on radiological images.

#### Detecting diverticulitis

The diagnosis of diverticulitis needs to be rapid to avoid further progression and complications. A full **gastrointestinal physical examination** needs to take place. Signs of peritonitis and sepsis should be looked out for. Once the patient is stable, a detailed history should be taken to assess risk factors, symptom duration, onset and any family history or genetic conditions.

### Differential Diagnosis

#### Symptomatic Diverticulosis

- **Irritable bowel syndrome**
- **Food poisoning**
GI infection

Differential diagnosis for diverticulitis

- Colorectal cancer
- Ischemic colitis
- Irritable bowel syndrome
- Acute appendicitis
  - Inflammatory bowel disease (especially Crohn’s disease)
  - Female gynecological disorders: ovarian torsion, ectopic pregnancy, pelvic inflammatory disease, ruptured cysts
- Pseudomembranous colitis
- Amoebic colitis.

Investigations

Method of investigating diverticulosis

**Abdominal x-ray**

- Thickened walls;
- Constipation;
- Not sufficient to diagnose diverticulosis (may be an incidental finding).

**CT scan with contrast**

- Gold standard to accurately diagnose diverticulosis and any complications.

**Colonoscopy**

![Endoscopic image of diverticulosis](image)

- It is important to rule out any other diseases that may mimic symptomatic diverticulosis - cancer, inflammatory bowel disease, etc.
- If the patient had an acute flare up, the patient should recover for up to 6
weeks before having this investigation (reduces the risk of iatrogenic perforation).
- Enables visualization of diverticula.

**Barium enema**
- Can reveal any strictures or diverticula present;
- Useful where colonoscopy is contraindicated.

**MRI scan**
- Not as useful as contrast CT scan.
- Clearer picture of soft tissue but most costly vs. CT and colonoscopy.

**Full blood test**
- If the patient experienced/experiences any rectal bleeding, they may have an anemia that needs treatment.

**Note:** Barium enemas and colonoscopies should **never** be performed in an acute episode of diverticulitis or symptomatic diverticulosis as there is increased risk of complications such as rupture and perforation. Barium fluid may leak into the abdominal cavity in colonic rupture. A significant time must be allowed to pass before these investigations can be performed.

**Method of investigating diverticulitis**

**CT Scan with contrast**

![Image: “Diverticulitis in the left lower quadrant,” by James Heilman, MD. License: CC BY-SA 3.0](image)
- Gold standard test for diagnosing diverticulitis;
- 98 % accurate;
- Should not be delayed in any suspected case;
- Can identify extent of the disease and any complications, such as abscesses.

**Blood test**
A blood test will reveal any signs of infection, e.g., **leukocytosis**, an increase in the number of white cells due to the infection. If there is any GI blood loss, full blood count will reveal any anemia.
Temperature: The patient's temperature should be checked regularly to monitor for any change (e.g., temperature spike if there is progression to peritonitis and sepsis).

**Note:** Barium enema and colonoscopy should never be performed in an episode of diverticulitis.

### Treatment of Diverticulosis and Diverticulitis

#### Therapy for diverticulosis

As most patients are usually asymptomatic, no treatment is required. It is recommended that they increase the amount of fiber in their diet and ensure that their diet is well-balanced. Weight loss through an improved diet and increased exercise is recommended to increase general health. Certain foods are thought to worsen this condition and patients are sometimes referred to a dietician for diet plans. If possible, patients should also avoid aspirin or NSAIDs as this increases the risk of complications.

#### Therapy for diverticulitis

The following treatments are possible:

**Nil by mouth**

Patients experiencing an acute episode should stop eating/drinking immediately to prevent further irritation of the colon. Once the patient is fully recovered, they should follow the treatment pathway for those diagnosed with diverticulosis in terms of increasing the amount of fiber in their diets.

**Nasogastric tube**

This removes food from the stomach and tries to prevent further strain on the inflamed colon that may be caused by food passing. Gas is also allowed to escape from the stomach which prevents a dangerous build up.

**Antibiotics**

If bacterial infection is suspected, antibiotics are usually given as treatment. Common antibiotics, which work against the causative bacteria, include Metronidazole and fluoroquinolones (e.g., cefotaxime).

**Surgery**

If treatment is started early enough, hopefully the patient would not require surgery. If CT scans reveal complications such as bleeding, rupture, peritonitis, abscesses or fistulas, the surgery may be necessary. Depending on the complication, some cases are suitable for elective surgery.

Complications requiring emergency surgery include rupture. Upon rupture, the patient’s life is in danger and immediate referral for emergency surgery is essential. This is because intestinal rupture always leads to infective peritonitis and potentially, sepsis.

Emergency procedures include: primary bowel resection or bowel resection with colostomy (Hartmann's procedure). They can be done laparoscopically (preferred) or by open surgery. Laparoscopic offers fast post-operative recovery rate amongst other advantages.
In Hartmann’s procedure, the end of the resected bowel is attached to the abdomen and exits at the skin surface where the feces pass into a colostomy bag. This is usually temporary until the surgeon can reverse the colostomy once the inflammation and infection has settled. The time for the reversal depends on the severity of the case and can be months later.

**Review Questions**

The correct answers are below the references.

1. **What is the gold standard of radiological investigation for those with suspected diverticulitis?**
   - A. Abdomen X-ray
   - B. MRI scan
   - C. CT scan
   - D. CT scan with contrast
   - E. Ultrasound

2. **Which of the following need to be avoided in acute diverticulitis?**
   - A. Colonoscopy
   - B. Blood test
   - C. Nasogastric tube
   - D. Antibiotics
   - E. CT scan with contrast

3. **Where is a diverticula most likely to be found in age-related diverticulosis?**
   - A. Ileum
   - B. Jejunum
   - C. Ascending colon
   - D. Appendix
   - E. Sigmoid colon

**References**

Robbins Pathology 8E
Oxford Handbook of Clinical Medicine 9E

_Diverticulitis treatments and drugs_ Mayo Clinic. 2010-02-23


**Correct answers:** 1D, 2A, 3E

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