Colon Diverticula and Diverticulosis

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Revised edition 2016
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Acknowledgement

I extend my thanks to the Institute for Diagnostic and Interventional Radiology (Medical Director: PD Dr. W. Kersjes, Klinikum Ludwigsburg) for providing the radiographic images and CT scans.

The specimen of a colonic diverticulum (figure 1) was provided by Prof. Dr. M. Stolte, former Director of the Institute of Pathology, Klinikum Bayreuth.

I wish to express my special gratitude to my former co-author, Prof. Dr. P. Frühmorgen, former Medical Director of the Medical Clinic 1, Klinikum Ludwigsburg.
I. Introduction

Diverticula can occur at any point in the gastrointestinal tract (esophagus, stomach, small bowel and colon). We distinguish between congenital or inborn diverticula and diverticula that have been acquired at some point in life. Diverticula of the colon are particularly frequent in nations with a high standard of living and constitute one of the so-called diseases of civilization.

Diverticula of the large bowel do not constitute outpouchings of the entire bowel wall but rather acquired herniations of the intestinal mucosa through gaps in the bowel wall musculature (figures 1 and 2).

Figure 1: Surgical specimen of the colon including a diverticulum.
**Diverticulosis** refers to the condition in which a person with no symptoms exhibits multiple diverticula of the colon.

The term **diverticular disease** is applied to that condition in which diverticula are symptomatic, inflamed (diverticulitis) or where there are complications (e.g. bleeding among others).

**Diverticulitis** is defined as the inflammation of one or more diverticula. The inflammation may be limited to the immediate vicinity of the diverticula or may extend to surrounding structures and organs.

**Figure 2:** Schematic representation showing the development of a diverticulum. The left side shows normal conditions, while, on the right, one sees a diverticulum, which is an outpouching through a vascular gap in the musculature.
II. Frequency and localization of diverticula

The importance of diverticular disease has been recognized since the 1930’s. Since then, diverticulosis with its potential complications is considered the most common bowel disease in the Western world.

With advancing age, there is a significant increase in the frequency of diverticula (figure 3). While less than 10% of persons aged 30–40 years suffer from diverticula, this proportion rises to 20–35% in persons aged 50–60 years, increasing to over 40% in persons over 70 years of age. With advancing age, there is an increase in both the number and size of diverticula. Men and women are about equally affected.

![Figure 3: Frequency of colonic diverticula in relation to patients’ age.](image-url)
The colon (figure 4) consists of the cecum with appendix, the ascending, transverse and descending colon, the S-shaped sigmoid colon and the rectum. About 80–95% of diverticula develop within the sigmoid colon, making it the bowel segment most commonly affected by diverticula. The second most commonly affected segment of the colon is the descending colon, followed in frequency by the other segments. Asians and younger patients more commonly develop diverticula in the ascending colon. Although a large percentage of the population develops diverticula at some point in their lives, over 80% of these people remain without symptoms.

Figure 4: Segments of the colon.
III. Causes and development of diverticula

Although the exact causes remain unknown, it is today considered very probable that diverticulosis results primarily from segmental motility disturbances in the colon that result in localized areas of high intra-luminal pressure within the bowel. Further factors include acquired weakness of the bowel wall in the area of vascular and muscular gaps (figure 2) and possibly changes in lifestyle and nutritional habits. Current studies suggest that changes of the intestinal nervous system may represent an additional cause for the development of diverticula.

Table 1 explains the risk factors for the development of asymptomatic diverticulosis, diverticular disease and diverticular bleeding.

Age, heredity and excessive alcohol consumption, as well as overweight in some cases, can increase the likelihood of developing diverticula and/or diverticular disease.
Fiber (as well as nuts and grains), physical activity (at a sufficient level), and avoidance of overweight and nicotine can reduce the risk of diverticular disease.
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Diverticulitis (no symptoms)</th>
<th>Diverticular disease (with symptoms, e.g. pain)</th>
<th>Complications of diverticular disease (e.g. bleeding)</th>
<th>Co-morbidity</th>
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<td>Increased risk</td>
<td>Increased risk</td>
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<td>n/a</td>
<td>Increased risk</td>
<td>Age</td>
</tr>
</tbody>
</table>

Table 1: Some diseases may increase the likelihood of developing diverticulitis or diverticular disease and/or associated complications. Certain patients and anti-inflammatory medication may increase the likelihood of developing diverticulitis and/or associated complications.
IV. Symptomatic diverticulosis

Non-inflamed diverticula typically cause no symptoms by themselves; for this reason, the majority of persons affected by diverticula remain complaint free throughout their lives. Instances in which persons do experience lower abdominal pain are generally due, not to the diverticula, but to simultaneous bowel spasticity.

Patients complain of tearing or colicky abdominal pain, usually involving the left lower part of the belly. This pain, secondary to a cramp-like motility disturbance of the bowel, may resolve within a few hours, but may go on for several days. Food intake, which triggers increased motility of the bowel, may be followed by worsening of symptoms, while defecation and passage of wind may bring improvement or even resolution of complaints.

Associated symptoms, such as bloating, stomach cramps, increased passage of gas and stool irregularities may potentially indicate the presence of irritable bowel syndrome.

Examination of the patient by a physician during such a pain episode may prove completely normal. Frequently, however, a pressure sensitive colon, an abdomen distended by gas or a “palpable and pressure sensitive roll” may be noted in the left lower part of the belly. Blood tests are within normal limits (table 2).
<table>
<thead>
<tr>
<th><strong>Symptoms</strong></th>
<th><strong>Findings</strong></th>
</tr>
</thead>
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<tr>
<td>• Stomach cramps</td>
<td>• Gas-distended abdomen</td>
</tr>
<tr>
<td>• Bloating</td>
<td>• Palpable “roll” in the lower abdomen</td>
</tr>
<tr>
<td>• Stool irregularities</td>
<td>• Pressure-sensitive colon</td>
</tr>
<tr>
<td>• Feeling of fullness</td>
<td>• Unremarkable laboratory parameters</td>
</tr>
<tr>
<td>• Changing localization and intensity of complaints with symptom-free intervals</td>
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</tr>
</tbody>
</table>

**Table 2:** Symptoms and findings of irritable bowel syndrome with and without diverticulosis.
V. Diverticular disease

1. Diverticulitis

The most common disorder occurring in the context of diverticulosis is inflammation of the diverticula (diverticulitis). It was previously said to occur in 20% of individuals with diverticula. However, more recent studies have shown that just 5% of patients appear to develop diverticulitis. Triggers of inflammation include stool particles (fecoliths) that become trapped in the diverticula (figure 5a) and because of the constant pressure on the mucosa lead to tiny ulcerations in the vicinity of the diverticula (figure 5b).

A lack of physical activity, being overweight and regularly taking certain medication (e.g. painkillers, anti-inflammatory medication) are additional risk factors that may increase the likelihood of developing diverticulitis or even diverticular bleeding.

If the inflammatory process extends to the entire bowel wall and even into adjacent organs, patients may experience serious complications such as abscess formation (accumulation of pus), peritonitis and the development of fistulae (tracts,
connections) to adjacent organs, including other bowel segments and even the urinary bladder and vagina. Repeated bouts of inflammation in the diverticula can lead to formation of scar tissue with increased narrowing of the bowel (stenosis). Ultimately, obstruction of the bowel may develop and require surgery.

The inflammation of one or more diverticula manifests itself in the form of acute, usually colicky pain centered in the left lower part of the belly. In addition, patients may experience fever, irregular stools (constipation, less often diarrhea), as well as nausea, vomiting and reduced general health.

If the bladder region is affected by the inflammatory process, patients may experience difficulty in urinating or have urinary urgency. In some cases, there may actually be visible blood in the urine (table 3).

The findings of the physical examination by the physician during the phase of acute inflammation (diverticulitis) reveal a distended and pressure-sensitive abdomen. The most commonly affected bowel segment is the sigmoid colon, locating in the left lower abdomen, which can be felt as a painful “roll”. Depending on the extent of the inflammatory process, there may also be a limited inflammation of the peritoneum (the inner lining of the abdomen) with associated muscular guarding. Blood tests reveal a moderate to pronounced increase in the number of white blood cells (leukocytes) and of the erythrocyte sedimentation rate (ESR) and/or CRP concentration (CRP = C-reactive protein, an inflammation marker).
2. Bleeding

Rectal bleeding may also be due to diverticula. Heavier bleeding tends to be associated with non-inflamed diverticula; milder bleeding, however, is observed with inflamed diverticula. The duration and intensity of the bleeding can be variable. Bleeding stops spontaneously without therapeutic measures in over 80% of cases. About one-quarter of these patients, however, experience recurrent bleeding.
3. Fistulae

Another complication of diverticulitis is fistulation, or the formation of fistulae, which are incomplete or complete ductal structures linking the bowel segment affected by diverticula with other bowel segments (figure 8). Fistulae may also form between the bowel and adjacent organs, such as the urinary bladder and vagina. In these cases, patients may experience the escape of wind or stool through the urethra or vagina.

4. Perforation

Sometimes, diverticulitis is associated with perforation of a diverticulum. In most cases, this is not associated with acute peritonitis (inflammation of the peritoneum) because superimposed adjacent bowel loops act to seal the defect. Perforation may begin with discrete areas of abdominal pain or patients may be initially symptom-free. The escape of intestinal contents through a perforated diverticulum is a rare event, but, when it does occur, it is associated with an acute and dramatic clinical picture. In these cases, patients may experience the severe complications of generalized peritonitis.

5. Stenosis

The inflammation of diverticula can result in narrowing of that section of the bowel. If inflammation is extensive or recurs, scar tissue may form, resulting in increased thickness of the bowel wall and narrowing of the bowel (figure 11c). These cases are characterized by the presence of a
stenosis. Because this narrowing does not return to normal and the passage of stool through this bowel segment is hampered, stenoses may result in pain that is either of limited duration or continuous. This may lead ultimately to a complete blockage of the bowel, which requires immediate surgical treatment.
VI. Diagnosis

In most cases, diverticula represent a coincidental finding during radiographic examinations or at colonoscopy. Pain, especially in the left lower part of the belly, accompanied by fever, should raise suspicion for acute inflammation of a diverticulum (diverticulitis) among other differential diagnoses. In such cases, patients should seek immediate medical attention. The type and extent of the examinations and tests required to establish the diagnosis will be determined by the physician based on the patient’s symptoms. The purpose is not only to confirm the suspicion of diverticulitis but also to consider and rule out other possible differential diagnoses.

1. Radiological examinations

With very few exceptions, double-contrast radiography of the large bowel is no longer used to confirm or rule out diverticulosis. Diverticula appear as circumscribed, contrast-enhanced outpouchings of the intestinal wall (figure 6). Changes in the mucosal surface, narrowing of the bowel and absent motility in an area of the bowel known to be affected by diverticula can all be signs of acute or chronic diverticulitis (figure 7).
Figure 6: Radiograph showing extensive diverticulosis.

Figure 7: Radiological evidence of acute diverticulitis (arrows) using water-soluble contrast medium.
The formation of fistulae (figure 8) as a complication of diverticulitis is easily confirmed by means of diagnostic imaging methods. Radiographic imaging of the colon is not helpful in cases of diverticular bleeding. In such cases, however, patients can undergo angiography, a radiological method by which the blood vessels of the bowel are examined following application of a contrast medium through an artery. If the bleeding is sufficiently severe, the source is visible as a site of contrast medium escape into the bowel lumen (figure 9).

When the blood vessels are imaged with this method, the physician is able not only to identify the site of the bleeding but at the same time to stop the bleeding by sealing the vessel that feeds it.
2. Colonoscopy

Diverticula are easily recognized by endoscopic methods (figure 10). As a rule, colonoscopy is not performed during the acute stage of diverticulitis: The risk of injuring the bowel during the examination is too great. Colonoscopy, however, should be performed about six to eight weeks after the diverticulitis has subsided in order to rule out other possible disorders of the colon, especially colon cancer. Colonoscopy is not absolutely necessary in patients who underwent a complete colonoscopy with normal findings within the past two years. Sometimes, inflamed diverticula cannot be seen on endoscopy. In such cases, however, one usually finds swelling and redness of the mucosal membrane at the neck of the diverticulum as a
sign of inflammation (figure 11a). Diverticulitis complicated by abscess formation may result in the spontaneous emptying of pus from the inflamed diverticulum into the bowel (figure 11b). Both during the stage of acute inflammation and in recurrent disease the mucous membrane in the inflamed region may become so severely swollen (stenosis) that passage with the endoscope is impossible (figure 11c).

Polyps are also reliably detected by endoscopy in segments of the bowel affected by diverticula. Endoscopic removal of polyps can be safely performed if there is sufficient distance between the polyp and the mouth of the diverticulum (figure 12).

A further advantage of endoscopy is the detection and localization of diverticular bleeding (figure 13a), whether this is a slight ooze from an inflamed diverticulum or massive bleeding from non-inflamed diverticula. In addition to identifying the source of the bleeding, in individual cases it is also possible to stop the bleeding, e.g. by means of an injection (figure 13b), or to seal the site of the bleeding using one or more metal clips (figures 14a and 14b).

In some cases, it may not be possible, based on the findings of ultrasound or computed tomography, to determine whether narrowing of the colon in a patient with known diverticula is caused by inflammatory stenosis or is due to stenosis secondary to the growth of a tumor. In such cases, endoscopy with removal of tissue samples from this area (biopsy) will help to clarify the underlying cause.
Figure 10: Endoscopic findings of extensive diverticulosis.

Figure 11a: Endoscopic findings in acute diverticulitis.

Figure 11b: Endoscopic findings in acute diverticulitis with drainage of pus.

Figure 11c: Endoscopic findings in acute diverticulitis with impassable narrowing (stenosis).
Figure 12: Endoscopic evidence of diverticula and a polyp in the same bowel segment (sigmoid colon).

Figure 13a: Endoscopic evidence of diverticular bleeding.

Figure 13b: Endoscopic procedure to stop diverticular bleeding by injection of diluted epinephrine solution.

Figure 14a: Visible vascular stump with blood clot within a diverticulum as the cause of diverticular bleeding.

Figure 14b: The diverticulum is sealed by means of two metal clips. Above, a second, unremarkable diverticulum.
3. Ultrasound, computed tomography and magnetic resonance imaging

Ultrasound with high-resolution transducer heads and computed tomography represent the standard imaging methods in the work-up of patients with clinical suspicion of diverticular disease. Both methods provide data on the thickness of the bowel wall, the presence of diverticula, evidence of inflammation and possible complications associated with diverticulitis (e.g. abscesses, fistulae etc.; figures 15a and 15b, 16a and 16b). In addition to physical examination and laboratory studies, ultrasound examination of the abdomen is included in the initial work-up in suspected cases of diverticulitis. Unlike computed tomog-
Computed tomography (CT), diagnostic ultrasound is dependent on examination conditions; hence, the ability to adequately visualize the bowel may be limited. In the case of very overweight patients, significant amounts of intestinal gas (meteorism) or the position of the inflamed bowel segment within the pelvis, adequate sonographic assessment of the bowel may be impossible. Computed tomography (CT) imaging is ordinarily obtained in cases in which the diagnostic ultrasound examination either fails to clarify the patient’s clinical picture adequately or in cases in which a complicated clinical course is expected. In many hospitals, patients with suspected diverticulitis undergo computed tomography of the abdomen as the initial imaging method in place of ultrasound.

Figure 15b: Computed tomographic (CT) findings in acute diverticulitis (arrow) with accumulation of pus (abscess) around the bowel (x).
Both ultrasound and computed tomography offer the option of guided puncture for confirming the diagnosis of abscess as well as for aspirating the pus or placing a drainage as a further therapeutic measure. This can make a surgical procedure unnecessary or reduce the need for multiple operations.

Both examination methods are also used in monitoring the clinical course of diverticulitis. Ultrasound, because it does not involve radiation exposure to the patient, is especially suitable for regular monitoring of patients’ progress.
Similar to computed tomography, magnetic resonance imaging, another modern cross-sectional imaging method, can reliably detect diverticula and inflammatory changes associated with diverticulitis. However, it is only rarely used in the emergency diagnosis of acute diverticulitis.
VII. Therapy

While patients with asymptomatic diverticulosis do not require medical or surgical therapy, those with diverticular disease can be offered conservative or surgical treatment options that differ with the patient’s symptoms and the extent of the inflammation.

1. Conservative treatment of diverticulosis

Patients with diverticulosis and functional complaints (abdominal cramps, bloating, stool irregularity, feeling of fullness) without evidence of inflammation are advised to adopt a high-fiber diet (table 4).

Dietary fiber consists of substances that act as bulking agents because of their ability to bind water without being digested by the human body. Common types of fiber include cellulose, the hemicelluloses, pectins, lignin, indigestible polysaccharides and alginates. The physical properties of these substances are very diverse but all share the capacity to increase the stool volume, reducing pressure in the bowel and shortening the stool transit time in the bowel. Besides whole

- High-fiber food
- Wheat bran
- Other bulking agents (e.g. psyllium)
- Adequate fluids
- Moist-warm compresses
- Lactulose (for constipation)
- Medications that relieve cramps

Table 4: Treatment of diverticulosis with functional complaints.
grain products, important sources of dietary fiber include vegetables, potatoes, salads, fruit, and grains (Table 5).

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<thead>
<tr>
<th>Fruits</th>
<th>grams of fiber per 100 grams</th>
<th>Graham crackers</th>
<th>Pasta</th>
<th>Rolls</th>
<th>Rye bread</th>
<th>Wheat bread</th>
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Table 5: Fiber content of some foods (from: Wissenschaftliche Tabellen Geigy, 1985).
A comparison of fiber derived from different foods has shown that wheat bran causes the greatest increase in stool volume. The effect is most pronounced when wheat bran (10–25 grams daily) is coarse and not finely milled. Untreated brans also have a greater effect than do cooked brans.

Patients with a tendency to constipation require generalized measures (table 6). Good-tasting muesli preparations (table 7) are recommended. Also well tolerated are other vegetable bulking agents and sources of dietary fiber, such as psyllium (Plantago ovata seed shells) or karaya gum. The recommended daily quantity of psyllium is 5–15 grams. Your physician may also prescribe psyllium (e.g. Mucofalk®) for treatment of constipation associated with diverticulosis. Improvement in symptoms requires regular intake of a diet high in fiber or supplementation with bulking agents. Adequate intake of fluids – approx. 1.5–2.5 liters per day – is important. The activity of the colon is also affected by the type of beverage. While coffee, mineral water and fruit juice stimulate passage of stool, black tea, cocoa, and red wine may promote or worsen constipation.
• Before breakfast, take a glass of cool water containing a level teaspoon of magnesium sulfate (or sodium bicarbonate). Gradually reduce use as constipation improves.

• For breakfast, 4 heaped tablespoons of oatmeal and 4 heaped tablespoons of wheat bran, together with 1 tablespoon of lactulose and cold milk. Mix well.

• For breakfast, whole grain bread, if desired with prune jam and herbal tea (peppermint, rose hips, mallow). If desired, bean coffee prepared as espresso.

• After breakfast, spend the next 5–10 minutes in the bathroom and attempt to pass stool. It is important to relax and not press excessively. Be patient if you are not successful the first few times.

• For your main meals, include much high-fiber food (salads, radishes, cucumbers, sauerkraut, oranges, apples, nuts or dried apricots and plums).

• Protein-containing foods that are recommended include sour milk, kefir and yogurt.

• Physical exercise and occasional massage of the back and abdomen.

• Adequate fluid intake, especially in older persons (1.5–2.0 liters per day)

• 1–2 dose of Macrogol per day.

• 1–6 tablespoons of lactulose.

• Constipation is promoted by low-fiber food (too little fruit and salads, white bread and sweets), chocolate, red wine, strong black tea and codeine-containing pharmaceuticals (analgesics, cough remedies).

Table 6: Basic treatment of chronic constipation (alternative options).
Patients with cramping abdominal pain often get relief from moist compresses on the abdomen (hot-water bottle with moist towel). Your physician may temporarily prescribe medication that will relieve the cramps. Analgesics (pain relievers) should only be used for short periods and only after consulting your doctor.

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**Table 7**: Example of a muesli recipe for treatment of constipation.

Muesli recipe

- One-half cup of all-purpose muesli
- One cup of yogurt
- One teaspoon of pine seeds
- One teaspoon of ground hazelnuts
- One teaspoon of sunflower seeds
- One half-teaspoon of sesame seeds
- One half-teaspoon of oatmeal
- One teaspoon of raisins
- Two teaspoons of grated apple
- One teaspoon of honey
- Juice from one half lemon

Mix ingredients and eat for breakfast.
2. Conservative treatment of diverticulitis

Diverticulitis treatment depends on the severity of the disease. A new staging system introduced in Germany in 2014 distinguishes between acute uncomplicated diverticulitis, acute complicated diverticulitis and a chronic form of diverticular disease.

In patients with **acute uncomplicated diverticulitis**, the inflammation is confined to either the colonic wall or the immediate vicinity. Doctors speak of **acute complicated diverticulitis** if these inflammatory changes are accompanied by small or larger abscesses (accumulation of pus) in the inflammation area or by perforation of a diverticulum with subsequent inflammation of the peritoneum.

2.1 Conservative treatment of acute uncomplicated diverticulitis/diverticular disease

The majority of patients with acute uncomplicated diverticulitis can be treated conservatively, i.e. without surgery. In each case, the doctor must decide whether the patient needs to be treated as an outpatient or inpatient.

If patients manifest with typical left-sided lower abdominal symptoms, no fever and no or only slightly raised inflammatory markers, they can be treated as outpatients. Adequate treatment usually consists of a light diet, adequate fluid intake and, if necessary, analgesics (pain relievers) and/or spasmylytics (medication to relax the bowel).
Provided that they are closely monitored by their doctor, patients with uncomplicated diverticulitis do not need to follow a course of antibiotics, which were regularly prescribed in the past. Exceptions include patients with significantly increased inflammatory markers and individuals with risk factors making a complicated progression likely, such as high blood pressure, chronic kidney disease and immunosuppression. In such cases, antibiotics should always be prescribed.

Patients who fail to respond to conservative outpatient treatment must be admitted as inpatients. Under conservative treatment, most patients with acute diverticulitis become symptom-free within a few days. Laboratory and ultrasound checks, as well as physical examinations, are necessary for identifying complications early on (bleeding, abscesses, perforation, fistulae etc.).

If the disease has an uncomplicated progression, patients can start to transition back to a normal diet at an early stage with tea and light meals or with liquids which are completely absorbed in the upper small intestine (known as astronaut food). If symptoms continue to improve, patients should switch to a high-fiber diet once the inflammation has subsided, if necessary including bulking agents.

### 2.2 Conservative treatment of acute complicated diverticulitis/diverticular disease

Patients with complicated diverticulitis usually need to be treated as inpatients. Depending on the clinical symptoms, treatment initially consists of bed rest and a temporarily restricted food
intake and, in cases of poor oral intake of fluids, of intravenous rehydration. It may also be necessary to administer spasmylytics or analgesics. In such cases of diverticulitis, a course of antibiotics lasting 7–10 days is usually prescribed to treat the inflammation (Table 8). Performing clinical check-ups, monitoring inflammatory markers and carrying out an additional ultrasound examination or CT scan can help to assess the healing process.

If an ultrasound examination or CT scan reveals a small abscess (smaller than 4 cm) caused by diverticulitis, this can usually be treated with antibiotics alone. Abscesses in the abdominal cavity larger than 4 cm can usually be treated through a combination of drainage using an ultrasound-assisted or CT-controlled puncture and a course of antibiotics. This avoids the risk of emergency surgery during acute phases of diverticulitis.

Light intestinal bleeding in patients with acute diverticulitis does not usually require special treatment, as it resolves itself in most cases.

Around a third of patients will become symptomatic or develop diverticulitis again at a later stage. As for the first flare-up, doctors will generally attempt to treat these patients conservatively – studies of recent years have shown that the risk

- Temporary fasting state
- Course of antibiotics
- Pain relievers
- Spasmolytics

Table 8: Treatment of acute complicated diverticulitis
of complications is no higher during the second or third flare-up of uncomplicated diverticulitis than during the first. With the exception of general dietary recommendations, there is currently no confirmed medication treatment for the prevention of further episodes of diverticulitis.

3. Surgical treatment of diverticulitis

Surgery is not usually necessary for patients with asymptomatic diverticulosis. It is only indicated in cases of uncontrollable, severe diverticular bleeding that cannot be stopped endoscopically. Complications of diverticulitis such as perforation, abscesses that persist despite treatment and intestinal obstruction represent further absolute indications for surgery, as do fistulae and the possibility of bowel tumors that cannot be completely ruled out.

During emergency surgery for acute diverticulitis, it is sometimes necessary to perform an artificial ostomy (stoma). In almost all cases, this can be reversed in a follow-up procedure a few weeks later.

Surgery may also be indicated in the event of acute inflammation that fails to respond to antibiotic treatment, recurrent episodes of diverticulitis with the development of complications and bleeding as well as problems with urination (table 9).

In the past, the rule of thumb was to surgically remove the inflamed part of the intestine after the second flare-up of diverticulitis. However, current studies and clinical practice guidelines
state that indication for surgery should no longer be based on the number of diverticulitis flare-ups, but depend on individual factors. These include the age of the patient, severe concomitant diseases, medication, current symptoms, previous progression and structural intestinal changes caused by inflammation (e.g. development of stenosis).

The decision of whether to operate should be made on an individual basis.

In many departments of surgery, the removal of the bowel segment affected by diverticula is no longer performed by conventional open surgery (abdominal incision) but by means of laparoscopic methods.

### Urgent indications for surgery

- Refractory diverticular bleeding
- Perforated diverticula with peritonitis and/or abscess formation
- Bowel obstruction
- Fistulae
- Suspected colon cancer

### Potential indications for surgery

- Persistent complaints despite drug treatment
- Recurrent inflammation with development of stenosis
- Repeated intestinal bleeding
- Persistent problems with urination

**Table 9**: Urgent and potential indications for surgical treatment of diverticulitis.
The informed patient

The success of a surgical procedure depends to a great extent on the selection of the optimum time for the operation. Thus, in order to keep the risk to the patient at a minimum, it is crucial to determine the best time to operate based on the results of clinical examination and the findings of diagnostic imaging and laboratory methods. Efforts are also being made to spare patients from unnecessary surgery.
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