



## Review

## Changing paradigms in the management of diverticulitis



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## HIGHLIGHTS

- This review outlines the most significant changes that diverticular disease management in recent years.
- The review gives physicians an updated view on the most current studies in treatment for acute diverticulitis.
- The review focus on the surgical management and the indications for surgery in diverticulitis.

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## ABSTRACT

The management of diverticular disease has evolved in the last few decades from a structured therapeutic approach including operative management in almost all cases to a variety of medical and surgical approaches leading to a more individualized strategy. There is an ongoing debate among surgeons about the surgical management of diverticular disease, questioning not only the surgical procedure of choice, but also about who should be operated and the timing of surgery, both in complicated and uncomplicated diverticular disease. This article reviews the current treatment of diverticulitis, with a focus on the indications and methods of surgery in both the emergency and elective settings. Further investigation with good clinical data is needed for the establishment of clear guidelines.

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## 1. Introduction

Diverticular disease is relatively common in the western world. Already in 1975, the estimated prevalence in the United States was about 60% in the over-65-year age group [1]. This rate has been steadily increasing concomitant with the increasing life expectancy of the general population. Accordingly, hospitals have witnessed a growing number of admissions for acute diverticular disease. In 1988, diverticulitis and its complications accounted for 2.2 million hospitalizations in the United States, incurring cumulative health care costs of \$2.5 billion [2]. Between 1988 and 2005, this figure rose by 26% [3]. These findings were echoed in studies from Europe, where acute diverticulitis accounts for more than 200,000 annual hospital admissions and poses a health burden exceeding €300 million [4].

The reported trends have prompted an ongoing search for novel,

efficient and cost-effective therapeutic strategies, and in the last 20 years, advances and innovations in imaging and surgical techniques have yielded significant changes in the management of diverticular disease. The paradigm has shifted from widely accepted stringent guidelines outlining specific indications for antibiotic administration, hospital admission, emergency surgery (including the procedure of choice), and elective surgery to a wide range of available options at all stages of the disease. The current possibility of tailoring treatment to the individual patient has made sound surgical judgment and surgical experience of prime importance in this setting, and it is widely acceptable to choose the therapeutic intervention based on the specific patient, in order to lower the risks of morbidities and complications and improving patient quality of life.

The aim of the present study was to review the important changes in the management of diverticulitis, with an emphasis on the indications for surgery in the emergency and elective settings.

## 2. Diagnosis

Clinical manifestations in acute diverticular disease vary, and

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depend mainly on the severity of the inflammatory process of the disease and the presence or absence of complications. The most common symptom is left lower quadrant pain, occurring in 70% of cases, lasting for more than 24 h in most cases [5]. Other manifestations include vomiting and nausea, changes in bowel movement and urinary symptoms may also be part of the clinical presentation. Physical findings comprise of left lower abdominal tenderness in most cases, abdominal distension and a palpable mass are also common, mainly in acute diverticulitis complicated by an abscess formation [6]. Low grade fever with mild leukocytosis is common [7], but studies have showed that almost half of all patients with acute diverticulitis have normal WBC levels [8].

Although the main clinical manifestation of diverticulitis is lower left abdominal pain, it has a wide differential diagnosis. This is often a misleading symptom that can result in misdiagnosis in 34%–68% of patients [9–11]. Also, caregivers today must acknowledge that though left sided diverticulitis is much more common in western populations, in many Asian countries and eastern populations the predominant presentation of acute diverticulitis is seen on the right side of the colon [12–14]. Therefore, in suspected cases, clinicians usually base the diagnosis on imaging studies, particularly computed tomography (CT) which has been found to have high sensitivity and specificity for acute diverticulitis [15,16]. The role of colonoscopy in diagnosis is mainly to confirm the presence of diverticuli as seen on computed tomography, mainly to exclude malignant findings, a task often difficult for the radiological studies. However, the need for endoscopic evaluation following an attack of acute diverticulitis is controversial, as some studies [17,18], including one performed in our institute demonstrated no clear advantage for colonoscopy following an episode of acute diverticulitis [19].

### 3. Staging

Staging is used in various diseases to score severity and aid clinicians in treatment decisions. Hinchey et al. [20] developed the first staging system for perforated diverticulitis in 1978. The classification relates to infectious and inflammatory spread following colonic perforation, escalating from a small pericolic abscess (Grade 1) up to fecal peritonitis (Grade 4). It is still commonly used by physicians and aids with therapeutic decisions. Almost 20 years after Hinchey first described his classification, Sher et al. [21] modified the Hinchey score to account for the increasing use of CT as a diagnostic modality, and it subsequently became the most common staging method applied by surgeons for acute diverticulitis worldwide. Several alternative systems have been introduced as well in the interim, such as the Köhler classification, which is based on symptom severity and presentation [22], and the classification of Ambrosetti et al. [23], which uses CT findings as the reference for selecting treatment.

### 4. Treatment

#### 4.1. Uncomplicated diverticulitis

Mild or moderate diverticulitis is usually treated conservatively. Traditionally, most patients are hospitalized to receive intravenous antibiotics against aerobic and anaerobic microbial agents and fluids along with mandatory bowel rest. However, several recent studies have shown that in the absence of significant comorbidities, outpatient management with oral antibiotics is equally safe and effective [24–30]. In a randomized trial of outpatient management of uncomplicated diverticulitis, Biondo et al. [31] reported excellent results and reduced health care-costs. These findings were supported by a systematic review wherein outpatient management led

to a decrease of more than 80% in health-care costs in some cases with no loss of effectiveness [32]. Nevertheless, the in-hospital administration of intravenous antibiotics, usually a combination of anti-aerobic and anaerobic bacteria such as Fluoroquinolone and Metronidazole [33] or Amoxicillin-clavulanate [34] is still warranted in patients with comorbidities or a more severe clinical and radiologic presentation [35]. The latter is also true for right sided diverticulitis, which according to several studies in recent years usually responds to a non-operative treatment, with a low recurrence rate after the first attack [36,37].

There is also evidence suggesting that uncomplicated diverticulitis may be treatable without antibiotics at all [38–40]. Chabok et al. [38] conducted a multicenter trial in which patients were randomized to receive hospital treatment with or without antibiotics. They found no between-group differences in complication rate, length of hospital stay, or recurrence.

#### 4.2. Complicated acute diverticulitis

##### 4.2.1. Emergency surgery

About 15%–25% of cases of acute diverticulitis are associated with complications that require surgery. Until recently, peridiverticular abscess was the main indication for surgery, but thanks to improvements in imaging and drainage techniques, it is now usually manageable by percutaneous drainage and intravenous antibiotics [41].

Today, the main indication for surgery is colonic perforation, which can lead to acute peritonitis and subsequent significant morbidity and occasional mortality. Up to the early 1980s colonic perforation was treated by a standard three-stage procedure that included a diverting proximal colostomy and drainage of the perforation site in the acute setting to alleviate sepsis, followed by resection of the involved colonic segment in an elective setting, and later, colostomy closure [42]. Despite the considerable intervals between the steps to allow for recovery, mortality rates were high [43]. Thereafter, perioperative care improved, leading to the introduction of the two-stage Hartmann procedure [44,45]: primary resection of the perforated segment and end-colostomy followed by colostomy closure [46,47]. The Hartmann procedure was associated with better outcome and fewer complications than other surgical techniques, although there was no decrease in mortality rates [48]. In 2000, the American Society of Colon and Rectal Surgeons recommended the Hartmann procedure as the gold standard for the treatment for acute perforated diverticular disease with peritonitis [49].

Another viable option is resection of the diseased segment with primary anastomosis and diverting loop ileostomy. This approach has been associated with a favorable outcome in selected low-risk, hemodynamically stable patients, but there are as yet no large-scale randomized controlled trials. Oberkofler et al. [50] compared patients with Hinchey class III-IV perforation who were randomized to undergo primary resection with anastomosis or the Hartmann procedure. They found that the primary anastomosis group was characterized by a lower rate of stoma reversal fewer serious complications, less operating time, shorter hospital stay, and lower health care costs, although the overall complication and mortality rates were similar to the Hartmann procedure group.

Several studies have suggested the incorporation of laparoscopic techniques during surgery for colonic perforation due to acute diverticulitis. Studies of the benefits of peritoneal laparoscopic lavage and drainage in these cases reported excellent outcomes with less risk compared with the Hartmann procedure [51–57], especially in stable patients with less severe peritonitis (Hinchey class III) [58,59]. However, reviews and meta-analyses

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