



## Original Research

# Management of Acute Uncomplicated Diverticulitis: Inpatient or Outpatient

Emre Teke,<sup>1</sup> Huseyin Ciyiltepe,<sup>2</sup> Nuriye Esen Bulut,<sup>1</sup> Yasin Gunes,<sup>1</sup> Mehmet Mahir Fersahoglu,<sup>1</sup>  
 Anil Ergin,<sup>1</sup> Bora Karip,<sup>3</sup> Kemal Memisoglu<sup>1</sup>

<sup>1</sup>Department of General Surgery, University of Health Sciences Türkiye, Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Türkiye

<sup>2</sup>Department of Gastroenterology Surgery, Antalya Training and Research Hospital, Antalya, Türkiye

<sup>3</sup>Department of General Surgery, Istanbul Oncology Hospital, Istanbul, Türkiye

### Abstract

**Objectives:** Diverticular disease is a highly frequent condition and affects 50% of the population in the 9th decade in Western society. Acute diverticulitis is the most prevalent complication. The patients who are clinically stable and tolerate fluid should be hospitalized if fluid intake tolerance worsens, fever occurs, or pain increases. Bowel rest, intravenous fluid therapy, and empiric antibiotic therapy are the traditional treatments for patients admitted to the hospital. This retrospective study aimed to determine the parameters that will affect the outpatient or inpatient treatment of patients diagnosed with uncomplicated acute diverticulitis.

**Methods:** Patients who presented to the emergency department with abdominal pain between January 2018 and December 2020 and were diagnosed with uncomplicated diverticulitis (modified Hinchey 1a) on computed tomography (CT) taken after intravenous contrast material shoot up were included in the study. Patient records were recorded retrospectively in the Excel file. After being seen in the emergency department, a comparison was performed between the inpatient group (Group 1) and the outpatient follow-up group (Group 2).

**Results:** The study comprised 172 patients with acute uncomplicated diverticulitis (modified Hinchey 1a). While 110 (64.0%) patients were followed up and treated as inpatients (Group 1), 62 (36.0%) patients were followed up as outpatients (Group 2). There was no statistically significant difference between the two groups in terms of patients readmitted to the hospital in the first 30 days after discharge (both for outpatient follow-up in the emergency department and after treatment in the inpatient group).

**Conclusion:** In this retrospective study, in which we evaluated the hospitalization criteria in uncomplicated Modified Hinchey 1a patients, it was found that patients can be safely treated as an outpatient if they have poor physical examination findings. Although there was no difference between the two groups in terms of hospital readmission after discharge and it was thought that follow-up of patients with Modified Hinchey 1a diverticulitis with outpatient oral antibiotic therapy might be reliable, prospective studies with larger numbers of patients are needed.

**Keywords:** Diverticular disease, Diverticulitis, Hinchey 1a, Outpatient management, Uncomplicated diverticulitis

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Colonic diverticulum is an outwardly protruding saccular protrusion of the colon wall. Diverticulitis is defined as the presence of peridiverticular inflammation and infection.

<sup>[1]</sup> Diverticulitis is a common disease that brings a huge financial burden on health-care systems worldwide. The annual cost in the United States is estimated to be \$2.1 billion.<sup>[2]</sup>

**Address for correspondence:** Emre Teke, MD. Sağlık Bilimleri Üniversitesi Fatih Sultan Mehmet Eğitim ve Araştırma Hastanesi, Genel Cerrahi Kliniği, İstanbul, Türkiye

**Phone:** +90 554 627 93 09 **E-mail:** dr.emreteke@gmail.com

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The incidence of diverticular disease is 33–66% and is increasing in Western and Asian countries.<sup>[3,4]</sup> However, 10–25% of these patients develop acute attacks of diverticulitis.<sup>[5]</sup> The majority of patients (80%) have uncomplicated diverticulitis, which is a self-limiting condition.<sup>[6,7]</sup> The prevalence of diverticular disease increases with age. While it is <10% in people under the age of 40, it increases up to 50–66% in patients over the age of 80, and the most common location is the sigmoid colon.<sup>[8,9]</sup>

The clinical symptoms of acute diverticulitis vary widely, ranging from mild phlegmonous changes to free perforation. The diagnosis is suspected when the triad of the lower abdominal pain, fever, and leukocytosis with localized or generalized peritonitis is present. There are many classifications for colonic diverticulitis such as Hansen-Stock classification,<sup>[10]</sup> Neff classification,<sup>[11]</sup> Ambrosetti classification,<sup>[12]</sup> and Hinchey classification.<sup>[13]</sup> However, the Hinchey classification is the most commonly used diverticulitis classification. The Hinchey classification was first published in 1978 to traditionally distinguish the four acute diverticulitis stages (Table 1). However, with the widespread use of computerized tomography (CT), which is preferred as the most sensitive tool in diagnosis, the modified Hinchey classification, which includes radiologic findings, is more commonly used (Table 1).<sup>[14-16]</sup>

Hospitalization, bowel rest, intravenous fluid and electrolyte therapy, and intravenous broad-spectrum antibiotics to cover anaerobes and Gram-negative organisms are conventional treatments for patients with uncomplicated diverticulitis. Recent studies, however, suggest that patients with uncomplicated diverticulitis who are clinically stable and can tolerate fluids should receive outpatient treatment with oral antibiotics.<sup>[17]</sup>

Another study examined the pathophysiology of diverticulitis and emphasized that diverticulitis is an inflammatory process caused by microperforation.<sup>[18-21]</sup> Before these studies questioning the utility of antibiotics in uncomplicated diverticulitis, antibiotic therapy was one of the main

treatment components used to treat all stages of this disease. However, it was reported that the use of antibiotics in treating patients with early-stage diverticulitis (Hinchey 1 or 1a) had no effect on patient survival and complications.<sup>[22]</sup> However, it has a place in the treatment of high-risk patients with significant comorbidities, symptoms of systemic infection, or immunosuppression.<sup>[18,19]</sup>

This study aimed to determine the demographic characteristics and clinical parameters that would influence the outpatient or inpatient management of patients diagnosed with uncomplicated acute diverticulitis in the emergency department.

## Methods

For our study, research permission was obtained from the Local Ethics Committee on November 18, 2021, numbered E-17073117–50.06.99. This study was conducted in accordance with the Declaration of Helsinki.

The retrospective study included patients who presented to the emergency department with abdominal pain between January 2018 and December 2020 and were diagnosed with uncomplicated diverticulitis (modified Hinchey 1a) on abdominal examination CT with IV contrast (Fig. 1). Patients diagnosed with complicated diverticulitis, those whose data could not be obtained at screening, those under 18, and those who refused treatment were excluded from the study.

Radiologists with at least 5 years of experience evaluated the CTs. The modified Hinchey classification (Wasvary<sup>[16]</sup>) was used for the Hinchey classification in CT.

Of the patients evaluated in the emergency department, those whose pain persisted after IV hydration and analgesics or rebound findings on abdominal examination were hospitalized. Patients were divided into two groups: Inpatient Group 1 and outpatient Group 2. Treatment with oral ciprofloxacin (1500 mg/day, 2 doses) and oral metronidazole (1500 mg/day, 3 doses) was given to outpatients for 7 days. At the 48<sup>th</sup> h after being discharged from the emer-

**Table 1.** Hinchey classification

Hinchey classification (13)	Modified Hinchey classification by wasvary (16)
	0 Mild clinical peritonitis
I Pericolic abscess or phlegmon	Ia Confined pericolic inflammation or phlegmon
II Pelvic, intraabdominal or retroperitoneal abscess	Ib Pericolic or mesocolic abscess
III Generalized purulent peritonitis	II Pelvic, distant intraabdominal, or retroperitoneal abscess
IV Generalized fecal peritonitis	III Generalized purulent peritonitis
	IV Generalized fecal peritonitis



**Figure 1.** Modified Hinchey 1a diverticulitis in axial tomographic section.

gency department, outpatients were called for outpatient control. Here, a physical examination was performed, and leukocyte CRP levels were noted.

Inpatients were treated with IV fluid administration, IV ciprofloxacin (1500 mg/day), and IV metronidazole (1500 mg/day). Oral intake continued as regimen 1. Patients whose pain complaints regressed and whose leukocyte and CRP levels regressed were discharged with oral ciprofloxacin and oral metronidazole, completing antibiotic treatment for 7 days. On the 7th day after discharge, they were invited to the outpatient clinic. Physical examination findings and leukocyte and CRP levels were recorded here. If no progression or clinical worsening of laboratory values was observed in the controls, no additional imaging examination was performed. None of the patients underwent emergency colonoscopy, but elective colonoscopy was scheduled for all patients at week 6 after the diverticulitis attack.

Patient records were retrospectively reviewed, and age, gender, presence of additional medical conditions, physical examination findings at the time of admission to the emergency department (sensitivity, guarding, and rebound), pulse rate, presence of  $>38^{\circ}$  fever, leukocyte and neutrophil percentage, CRP level, location of diverticulitis on CT, time of onset of symptoms, whether the patient was hospitalized, length of hospital stay and readmission in the first 30 days after discharge were recorded in the Excel file.

### Statistical Analysis

To evaluate the findings obtained in the study, IBM SPSS Statistics 22 (IBM SPSS, Turkey) was used for statistical analysis. The conformity of the parameters with normal distribution was evaluated using the Shapiro–Wilks test and it was found that the parameters displayed a normal distribution. In the analysis of the study data, one-way ANOVA test was used to compare quantitative data, as well as descriptive statistical

methods (mean, standard deviation, median, and frequency). To compare qualitative data, the Pearson Chi-square test was used. The level of significance was assessed at  $p < 0.05$ .

### Results

The study comprised 172 patients who presented to emergency department between January 2018 and December 2020 and diagnosed with acute uncomplicated diverticulitis (modified Hinchey 1a). While 110 (64.0%) patients were admitted and treated as inpatients (Group 1), 62 (36.0%) patients received treatment as outpatients (Group 2). The median age of the patients was 56.09 years, and the two groups were similar. About 55.2% of the patients were female, and there was no statistical difference in regard to gender between the groups. Diverticulitis was localized to the sigmoid colon in 61% of patients on CT. Transverse colon localization or localization in the right colon was observed in 11 patients (6.4%). In terms of diverticulitis location, there was no difference between the groups. The average period of the commencement of complaints was 2.77 days, with no difference between the groups. There was no significant difference between the two groups in terms of readmission. Only 1 (0.6%) of all patients had a clinical condition requiring hospitalization within the first 30 days. Table 2 contains information on demographic characteristics. Patients in the hospitalized group had higher leukocyte counts and CRP levels at the time of admission (12.9 vs. 11.3,  $P: 0.01$  and 5.8 vs. 4.3, respectively;  $P: 0.04$ ). Sensitivity was determined in 87.2% of patients (94.5% in Group 1, 74.2% in Group 2), guarding in 12.2% (17.3% in Group 1, 3.2% in Group 2), and rebound in 21.5% (31.8% in Group 1, 3.2% in Group 2). In hospitalized patients, physical examination find-

**Table 2.** Demographic characteristics and localization of diverticulitis

	Group 1 n=110	Group 2 n=62	Total n=172	p
Age (mean)	56.09	56.10	56.09	0.99 <sup>a</sup>
Gender (n, %)				
Female	63 (57.3)	32 (51.6)	95 (55.2)	0.28 <sup>b</sup>
Male	47 (42.7)	30 (48.4)	77 (44.8)	
Localization of diverticulitis				
Descending colon	9 (8.2)	9 (14.5)	18 (10.5)	0.46 <sup>b</sup>
Sigmoid colon	71 (64.5)	34 (54.8)	105 (61.0)	
Both descending and sigmoid colon	24 (21.8)	14 (22.6)	38 (22.1)	
Other	6 (5.5)	5 (8.1)	11 (6.4)	
Complaint period (day)	2.75	2.81	2.77	0.92 <sup>a</sup>
Readmission rate	1 (0.9)	0 (0)	1 (0.6)	0.64 <sup>b</sup>

<sup>a</sup>One-way ANOVA; <sup>b</sup>Pearson Chi-square.

ings were significantly more pronounced. Table 3 shows the patients' physical examination and laboratory findings at the time of admission to the emergency department.

One hundred and ten patients in Group 1 were hospitalized and followed up or treated for a median of 2.89 days.

## Discussion

This study investigated the characteristics of patients with uncomplicated diverticulitis (Modified Hinchey 1a) treated as outpatients or inpatients; it was determined that physical examination findings were more pronounced in the inpatient group, as well as a higher leukocyte count and CRP. While there was no readmission among the patients discharged from the emergency department, one of the patients discharged after inpatient treatment had to be hospitalized.

The incidence of diverticular disease increases with age. <10% of cases occur under 40 years of age, while 50–66% of cases occur over 80 years of age. In this regard, the weakening of the intestinal wall caused by age-related changes in collagen structure is effective.<sup>[17]</sup> When evaluated by gender, although the first series found a preponderance of males, later studies showed that the distribution between the genders was equal.<sup>[2,4]</sup> Wheat et al. showed in their study that there was a marked preponderance of women in the prevalence of diverticulitis.<sup>[23]</sup> In our study, 55.2% of the patients were female, and there was no significant difference between the groups in terms of gender. The rate of patients under 40 years of age was 3.4%.

There are also studies showing that the localization of the

diverticulum may be one of the factors that may play a role in the severity and recurrence of the disease.<sup>[24]</sup> In our study, 95% of the patients had diverticulitis located in the sigmoid colon. In 65% of the patients, the diverticula are found only in the sigmoid colon and in 24% in other parts of the colon together with the sigmoid colon. However, in 10% of patients, they are in a segment more proximal than the sigmoid colon.<sup>[8,9]</sup> Similarly, in our study, diverticulitis was localized only to the sigmoid colon in 61% of the patients. In 83.1% of the patients, the diverticulum was located in the left colon.

Looking at the literature, it is recommended that antibiotic treatment be completed for 14 days after patients have been treated with IV antibiotics in the hospital for an average of 3–5 days. Other similar studies found that the average length of hospital stay in patients with acute uncomplicated diverticulitis was 6 days.<sup>[23,25]</sup> In our study, the average length of stay for hospitalized patients in Group 1 was 2.89 days and appeared to be lower than the literature data. We think that this may be related to the clinical improvement observed in patients with an average of 3 days of IV antibiotic treatment followed by close outpatient follow-up.

Anamnesis and physical examination are critical parameters in the diagnosis of acute diverticulitis. Although diverticulitis is classically characterized by the left lower quadrant pain, left lower quadrant sensitivity, fever, and leukocytosis, often, not all symptoms are present in the same patient. In the study conducted by Toorenvliet et al., it was determined that 78.9% of diverticulitis patients experienced left lower quadrant sensitivity, 35.1% had right lower quadrant sensitivity, 22.8% had suprapubic sensitivity, 8.8% had guarding, and 40.4% had rebound.<sup>[26]</sup> In our study, sensitivity was identified in 87.2% of the patients, guarding in 12.2%, and rebound in 21.5% of the patients, with the inpatient group having a significantly higher rate of sensitivity.

CRP was identified as a marker for complicated diverticulitis in many case series. In the retrospective study carried out by Mäkelä et al. involving 350 patients, CRP level of 150 mg/L was crucial in distinguishing between uncomplicated diverticulitis and complicated diverticulitis. In addition, this study reported that a CRP level >150 mg/L and free fluid at CT significantly increased the risk of mortality.<sup>[27]</sup> The mean CRP level in our study was 53 mg/L (58 mg/L in Group 1 and 43 mg/L in Group 2).

Bolkenstein et al., in their study comparing the parameters in uncomplicated diverticulitis and complicated diverticulitis, found that the mean leukocyte count was  $11.9 \times 10^9$  in uncomplicated diverticulitis and  $14.6 \times 10^9$  in complicated diverticulitis, with a significant statistical difference

**Table 3.** Comparison of the characteristics of Groups 1 and 2

	Group 1 n=110	Group 2 n=62	Total n=172	p
Sensitivity				
(+)	104 (94.5)	46 (74.2)	150 (87.2)	0.00 <sup>a</sup>
(-)	6 (5.5)	16 (25.8)	22 (12.8)	
Guarding				
(+)	19 (17.3)	2 (3.2)	21 (12.2)	0.00 <sup>a</sup>
(-)	91 (82.7)	60 (96.8)	151 (87.8)	
Rebound				
(+)	35 (31.8)	2 (3.2)	37 (21.5)	0.00 <sup>a</sup>
(-)	75 (68.2)	60 (96.8)	135 (78.5)	
Fever >38.2°C	6 (5.5)	3 (4.8)	9 (5.2)	0.82 <sup>a</sup>
Heart rate (mean)/minute	96.2	92.2	94.8	0.10 <sup>b</sup>
White blood cell count (mean)	12.9	11.3	12.3	0.01 <sup>b</sup>
Neutrophil count (%) (mean)	71.4	69.7	70.8	0.32 <sup>b</sup>
CRP (mg/L)	58.2	43.6	53.3	0.04 <sup>b</sup>

<sup>a</sup>Pearson Chi-square, <sup>b</sup>One-way ANOVA.

between them.<sup>[28]</sup> In our study, the median leukocyte count was  $12.3 \times 10^9$ , which is in agreement with the literature, and a significant difference was found between the two groups (Group 1  $12.9 \times 10^9$  vs. group 2  $11.3 \times 10^9$ ;  $p=0.01$ ). In the study by P.F. Ridgway, the oral antibiotic and IV antibiotic treatments were compared in uncomplicated diverticulitis patients, when the mean hospital stay, readmission, and treatment success were compared, no significant difference was found.<sup>[29]</sup> Our study also showed no significant difference in treatment success and readmission rate between Group 1, who were admitted as inpatients and started on IV antibiotics, and Group 2, who were continued on oral antibiotics as outpatients. There are many studies in the literature comparing antibiotic treatment and non-antibiotic treatment in the patients with acute uncomplicated diverticulitis. In many analyses, no significant difference was found between the addition of antibiotics to treatment, treatment failure, recurrence, complications, hospital readmissions, and needed surgery compared to treatment without antibiotics.<sup>[30,31]</sup> Although these studies suggest antibiotic-free follow-up of patients with acute uncomplicated diverticulitis, more comprehensive studies are needed.

The study's limitations are that it was designed retrospectively, the number of patients was limited, and the surgeons who made the hospitalization decision had varying levels of clinical experience. Based on our clinic's approach to patients with acute uncomplicated diverticulitis, all patients received antibiotic treatment. Consequently, there was no antibiotic-free treatment group, and no comparison could be made.

## Conclusion

In patients with uncomplicated colon diverticulitis who are admitted to the emergency department without the use of clinical or imaging methods, the clinician's decision to admit the patient is based on physical examination findings as well as leukocyte and CRP levels. Patients with poor physical examination findings can be safely treated with oral antibiotic therapy on an outpatient basis.

## Disclosures

**Ethics Committee Approval:** For our study, research permission was obtained from the Local Ethics Committee on November 18, 2021, numbered E-17073117–50.06.99. This study was conducted in accordance with the Declaration of Helsinki.

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