



## Review

## Predictors of acute diverticulitis severity: A systematic review



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## HIGHLIGHTS

- We reviewed the literature to find predictors of severe acute diverticulitis.
- First episode and co-morbidities but not age or gender were predictors of diverticulitis.
- Severe acute diverticulitis was associated with steroid and NSAID use.
- High CRP on admission and CT criteria was associated with severe diverticulitis but not high WBC.

## ARTICLE INFO

## Article history:

Received 10 July 2015

Received in revised form

14 December 2015

Accepted 6 January 2016

Available online 9 January 2016

## Keywords:

Diverticulitis

Acute

Severity

Predictors

Score

## ABSTRACT

**Background:** Diverticulitis is a common condition with a broad spectrum of disease severity. A scoring system has been proposed for diagnosing diverticulitis, and a number of scoring systems exist for predicting prognosis associated with severe complications of diverticulitis such as peritonitis. However, predicting disease severity has not received as much attention. Therefore, the aim of this review was to identify the factors that are predictive of severe acute diverticulitis.

**Methods:** A systematic literature search was performed using Medline, PubMed, EMBASE, and the Cochrane Library to identify papers that evaluated factors predictive of severe diverticulitis. Severe diverticulitis was defined as complicated diverticulitis (associated with haemorrhage, abscess, phlegmon, perforation, purulent/faecal peritonitis, stricture, fistula, or small-bowel obstruction) or diverticulitis that resulted in prolonged hospital admission, surgical intervention or death.

**Results:** Twenty one articles were included. Studies were categorised into those that identified patient characteristics ( $n = 12$ ), medications ( $n = 5$ ), biochemical markers ( $n = 8$ ) or imaging ( $n = 3$ ) as predictors. Predictors for severe diverticulitis included first episode of diverticulitis, co-morbidities (Charlson score  $\geq 3$ ), non-steroidal anti-inflammatory drug use, steroid use, a high CRP on admission and severe disease on radiological imaging. Age and gender were not associated with disease severity.

**Conclusion:** A number of predictors exist for identifying severe diverticulitis, and CT remains the gold standard for diagnosing complicated disease. Patients who present with identified risk factors for severe disease warrant early imaging, closer in-patient observation and a lower threshold for early surgical intervention. Patients without these factors may be suitable for outpatient-based treatment.

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## 1. Introduction

Diverticular disease is a common condition with a prevalence that rises with age. It affects up to 10% in those aged less than 40

years, and up to 66% in those aged 80 years or older [1]. Acute colonic diverticulitis will develop in 20% of those patients with diverticular disease [2]. Thus, as the population ages, the incidence of diverticulitis will continue to rise.

The severity of diverticulitis can range from a mild, self-limiting disease, to a life-threatening condition complicated by abscess formation, sepsis or perforation requiring emergency surgery. However, the signs and symptoms of diverticulitis can be non-specific and mimicked by other conditions. A scoring system has

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recently been proposed which uses a combination of clinical features and biochemical markers to estimate the probability of a patient having a diagnosis of acute left-sided diverticulitis, with a reported diagnostic accuracy of 86% [3]. However, this scoring system does not predict the severity of the disease.

The Hinchey Classification was proposed in 1978 as a method to classify diverticular perforations [4]. Whilst such a classification is useful for guiding an operative approach, there are limitations. The grading system requires an operation to accurately distinguish between grade III and grade IV, and the classification does not guide non-surgical management. More recently, the usefulness of this classification system for guiding operative technique has been questioned, as one study has suggested that it is not the amount of peritoneal soiling but rather the status of the bowel that should determine treatment [5].

A number of other scoring systems are available for predicting prognosis associated with abdominal sepsis (e.g. APACHE II [6]), peritonitis (e.g. Mannheim Peritonitis Index [7]) or surgery (POSSUM [8]). However these tools are not specific for diverticulitis and are only useful in the most severe cases of the disease.

Finally, recent studies have challenged the traditional concept of treating acute diverticulitis as an inpatient with intravenous antibiotic therapy, instead proposing that oral antibiotic therapy as an outpatient may be appropriate [9]. Thus, in order to safely triage patients into those that may be suitable for outpatient-based treatment, it is important to be able to predict the severity of disease at initial presentation.

The aim of this study therefore was to identify factors that predict the severity of acute diverticulitis. A systematic review of the literature was undertaken to summarise the current evidence available on the predictors of acute colonic diverticulitis severity.

## 2. Methods

Appropriate methodology according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement [10] was followed.

### 2.1. Search strategy

A literature search was performed independently by two authors using the search terms outlined in Table 1 with the following databases searched from 1980 to May 2015: Ovid MedLine, EMBASE, Cochrane and PubMed. Articles were restricted to the English language only. Conference abstracts and commentaries were excluded. Each reviewer judged papers as potentially relevant based on title and abstract. Papers judged as potentially relevant were read in full and assessed for inclusion with any disagreement over inclusion and exclusion resolved by consultation with the senior authors. Reference lists of all relevant articles were also screened to identify other relevant studies.

### 2.2. Synthesis of results

Papers were evaluated in a qualitative review. Outcomes were considered for a quantitative review (meta-analysis) if possible.

Odds ratios (ORs) for predictive factors were reported when studies provided these measures, however, when these were not given in the original study, ORs were calculated from given data [11]. Quality of individual studies was assessed using Newcastle-Ottawa Scale [12].

### 2.3. Definition of complicated diverticulitis

Complicated diverticulitis has been defined by several international guidelines. The American Society of Colon and Rectal Surgeons defined complicated diverticulitis as diverticular inflammation with free perforation, abscess, fistula, obstruction or stricture but not phlegmon [13]. The European Association for Endoscopic Surgeons defined complicated diverticulitis as acute diverticulitis associated with bleeding, abscess formation, phlegmon, colonic perforation, purulent and faecal peritonitis, stricturing, fistula and obstruction [14]. The definition of complicated diverticulitis for individual studies was compared with current guidelines. Correlation between novel definitions of diverticulitis and morbidity or mortality was explored.

## 3. Results

The search strategy extracted 378 studies for review (Table 1). A total of 21 studies were identified as suitable for inclusion, as outlined in the PRISMA flow diagram (Fig. 1). For analysis, studies were separated into those that examined patient characteristics, medications, biochemical markers or imaging as predictors of diverticulitis severity. A quantitative meta-analysis was not possible due to heterogeneity in study methods and outcome measures.

All the studies were rated as average to excellent quality based on the Newcastle-Ottawa Scale. Studies with lower quality tended to lack control of possible confounders (Table 2). Measures of diverticulitis severity differed between studies. The majority used complicated diverticulitis as a marker of severe disease, where complicated diverticulitis was defined as diverticulitis associated with haemorrhage, abscess, phlegmon, perforation, purulent faecal peritonitis, stricture, fistula, or small-bowel obstruction due to post inflammatory adhesions. Definitions for severe or complicated diverticulitis in individual studies were compared with definitions provided by international guidelines, with novel definitions highlighted (Table 2). The novel definitions were not compared individually nor validated against morbidity or mortality.

### 3.1. Patient characteristics

A number of patient-specific characteristics have been identified that can predict a more severe course of acute diverticulitis (Table 3).

The number of prior episodes of acute diverticulitis predicts severity, with patients presenting for the first time having more severe disease than those with recurrent presentations. Three studies identified perforation or complicated diverticulitis as being more common in patients presenting with a first or second episode of diverticulitis compared to those with more than two previous

**Table 1**  
Database search strategy.

Search strategy	Database	Articles retrieved
diverticulis\$	Ovid MedLine	74
AND	EMBASE	128
severity OR grad\$ OR predict\$ OR scor\$ OR tool\$	Cochrane	94
	PubMed	82

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