

Clinical Science

A comparison of outcomes of emergent, urgent, and elective surgical treatment of diverticulitis



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Abstract

BACKGROUND: There is a controversy regarding the best urgent surgical treatment of colonic diverticulitis. We sought to compare outcomes of patients who underwent surgery for diverticulitis by the type of admission.

METHODS: The National Surgical Quality Improvement Program databases were used to examine the clinical data of patients who underwent colorectal resection for diverticulitis during 2012 to 2013. Multivariate regression analysis was performed to identify outcomes of patients.

RESULTS: We sampled a total of 13,510 patients admitted for diverticulitis who underwent colorectal resection, of which 7.8% had emergent and 19.7% had urgent operation. Patients with perforation (adjusted odds ratio [AOR] 188.56, $P < .01$) and preoperative sepsis (AOR 28.17, $P < .01$) had significantly higher rates of emergent surgery. Patients who underwent emergent operation had higher mortality (AOR 4.08, $P = .04$) and morbidity (AOR 2.14, $P < .01$). Emergent operations had a significantly higher risk of anastomosis leakage compared with elective operation (AOR 3.92, $P = .02$).

CONCLUSIONS: Emergent treatment of diverticulitis is associated with a high morbidity and mortality. In the setting of emergent treatment of diverticulitis, colonic anastomosis without a stoma has a high risk of anastomosis leakage.

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Diverticulosis is among the most common gastrointestinal conditions which has had a dramatic increase over the past few decades. Approximately one third of the US population has diverticulosis and 20% of these patients develop diverticulitis.^{1,2} Patients with diverticulitis are at a lifetime risk for emergency colectomy and colostomy. It is

important to recognize factors that predict patients for whom emergent surgery is likely to allow consideration of an earlier elective operation when possible.

Overall, 19% of diverticulitis patients need surgical treatment² and emergency operation is required in 18% of those patients who need surgery.² However, given the risk of colostomy during an emergent operation, elective colectomy has been recommended for many patients who recover from nonsurgically treated episodes of diverticulitis.² Identifying high-risk patients for emergent surgery and considering elective resection in such high-risk patients may decrease mortality and morbidity. However, there are limited data regarding predictors of high-risk patients who may require emergent surgery.

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Emergent surgical treatment of diverticulitis is associated with higher mortality and morbidity compared with elective treatment.³ Also, the standard emergent surgical treatment of diverticulitis, which is a sigmoid colectomy and colostomy (Hartmann's procedure), is associated with high morbidity. Therefore, many studies investigating the surgical options suggest avoiding colostomy for diverticulitis patients,⁴ observing that urgent treatment of diverticulitis compared with emergent treatment may decrease postoperative complications of patients as well as the need for colostomy. However, there are limited published data investigating outcomes of patients with urgent treatment of diverticulitis.

The standard urgent/emergent treatment of diverticulitis is the resection of the diverticula affected colonic segment and formation of a colostomy.^{3,5} However, a colostomy increases the morbidity rate of patients. To decrease morbidity, alternative surgical methods have been explored which include colonic resections with primary anastomosis but with or without diverting ileostomy and colonic lavage.^{3,4,6,7} However, the role of primary anastomosis with or without a stoma as an alternative procedure remains unsettled.^{3,8,9} Although guidelines for emergent surgical treatment of sigmoid diverticulitis by the American Society of Colon and Rectal Surgeons suggest possible alternatives to Hartmann's procedure, such as primary anastomosis with or without intraoperative colonic lavage, the role and safety of primary anastomosis remains unclear and the traditional Hartmann's procedure is commonly performed by surgeons.⁸ A nationwide study comparing different types of urgent/emergent surgical treatment of diverticulitis is lacking. Using a nationwide database, this study aims to report outcomes of emergent, urgent, and elective surgical treatment of diverticulitis and compare different types of procedures used for the treatment of diverticulitis.

Patients and Methods

This study was performed utilizing the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database during 2012 to 2013.¹⁰ The American College of Surgeons NSQIP is a large validated outcome-based program which provides preoperative to 30-day postoperative surgical outcomes based on clinical data to improve the quality of surgical care in the United States.¹⁰ This study evaluated patients with diagnosis of diverticulitis who underwent colon resections using the appropriate procedural and diagnosis codes as specified by the International Classification of Diseases, 9th Revision, clinical modifications and Current Procedural Terminology. Patients who had colonic diverticulitis were defined based on the International Classification of Diseases, 9th Revision, clinical modification diagnostic code 562.11. Patients who had colon resection were defined based on the following

Current Procedural Terminology codes: 44140 to 44147, 44204 to 44208, 45110, and 45113. Patients who underwent colon surgery without colon resection and patients younger than 18 years were excluded from this study. We categorized patients into 3 groups of elective, emergent, and urgent operations according to the original variables of NSQIP.

Preoperative factors that were analyzed include patient characteristics (age, sex, and race) and comorbid conditions which include diabetes mellitus with oral agents or insulin, history of congestive heart failure within 30 days before surgery, history of severe chronic obstructive pulmonary disease, renal failure with need of dialysis, weight loss, history of dyspnea within the 30 days before surgery, bleeding disorder, steroid use within the past 30 days, preoperative sepsis (systemic inflammatory response syndrome or sepsis or septic shock within 48 hours before surgery), current smoker within 1 year, ascites (presence of fluid accumulation in the peritoneal cavity noted on physical examination, abdominal ultrasound, or abdominal computed tomography/magnetic resonance imaging before the operation), and hypertension requiring medication. Operative factors analyzed include the following: type of operation (emergent vs urgent vs elective), presence of colon perforation as the indication of surgery, surgical approach (open vs laparoscopic), type of procedure (colectomy with or without anastomosis), the American Society of Anesthesiologists (ASA) score, and operation length. Preoperative laboratory value of white blood cell (WBC) count (cells $\times 10^9/L$) was also investigated. Outcomes investigated include the following: 30-day mortality, overall morbidity, postoperative surgical site infection (superficial, deep incisional, and organ space), wound disruption, deep vein thrombosis, septic shock, pneumonia, unplanned intubation, anastomosis leakage, prolonged ileus, ventilator dependency more than 48 hours, pulmonary embolism, cardiac arrest requiring cardiopulmonary resuscitation, hemorrhagic complications, urinary tract infection, myocardial infarction, acute renal failure, unplanned reoperation, unplanned readmission, and prolonged hospitalization (longer than 30 days). The overall rates of each complication according to the type of surgery were examined. Risk-adjusted analysis was performed to compare outcomes of patients with different types of admission (emergent vs urgent vs elective). Male sex, age less than 70, Caucasian race, and elective operation were used as reference data points for comparison in line with the literature.

Statistical analysis

Statistical analysis was performed with the SPSS software, Version 22 (SPSS, Inc, Chicago, IL). Logistic regression analysis was used to estimate the association between preoperative types of surgery and each outcome, including in-hospital mortality and all the considered postoperative complications. *P* values less than .05 were

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