# Complicated Diverticulitis
## *Is It Time to Rethink the Rules?*

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**Introduction:** Much of our knowledge and treatment of complicated diverticulitis (CD) are based on outdated literature reporting mortality rates of 10%. Practice parameters recommend elective resection after 2 episodes of diverticulitis to reduce morbidity and mortality. The aim of this study is to update our understanding of the morbidity, mortality, characteristics, and outcomes of CD.

**Methods:** Three hundred thirty-seven patients hospitalized for CD were retrospectively analyzed. Characteristics and outcomes were determined using chi-squared and Fisher exact tests.

**Results:** Mean age of patients was 65 years. Seventy percent had one or more comorbidities. A total of 46.6% had a history of at least one prior diverticulitis episode, whereas 53.4% presented with CD as their first episode. Overall mortality rate was 6.5% (86.4% associated with perforation, 9.5% anastomotic leak, 4.5% patient managed nonoperatively). A total of 89.5% of the perforation patients who died had no history of diverticulitis. Steroid use was significantly associated with perforation rates as well as mortality ($P < 0.001$ and $P = 0.002$). Comorbidities such as diabetes, collagen–vascular disease, and immune system compromise were also highly associated with death ($P = 0.006$, $P = 0.009$, and $P = 0.003$, respectively). Overall morbidity was 41.4%. Older age, gender, steroids, comorbidities, and perforation were significantly associated with morbidity.

**Conclusion:** Today, mortality from CD excluding perforation is reduced compared with past data. This, coupled with the fact that the majority of these patients presented with CD as their first episode, calls into question the current practice of elective resection as a stratagem for reducing mortality. Immunocompromised patients may benefit from early resection. New prospective data is needed to redefine target groups for prophylactic resection.

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Complicated diverticular disease is defined as diverticulitis with associated abscess, phlegmon, fistula, obstruction, bleeding, or perforation.[1–11,15] Complicated diverticulitis remains a significant cause of morbidity and mortality in patients afflicted with this problem. Much of our knowledge and parameters for the treatment of complicated diverticulitis are based on literature published over 2 or more decades ago. The majority of the published literature reports overall mortality rates between 6% and 17% after surgery for complicated diverticulitis.[1–11] However, perforated diverticulitis is associated with significantly increased mortality and morbidity rates. Studies have reported mortality rates between 22% and 39% for free perforation and fecal peritonitis.[10–12] Furthermore, multiple series have noted that perforation may be the first manifestation of complicated diverticulitis with a range of 50% to 70%.[1,2,4,5]

Despite this knowledge, prophylactic surgery has been recommended to prevent serious complications of recurrent colonic diverticulitis.[2,7,12,13,16] This practice parameter has been based on the assumption that multiple (2 or more) episodes will lead to complicated diverticulitis.[2,4,15–18] Elective resections have been associated with a low mortality rate of between 1% and 4%.[2,5,16] Early literature has reported recurrence rates of >40% after one episode of diverticulitis with complications occurring in 30% to 40% of patients.[7,17–19] Thus, the policy of prophylactic surgery has been based on the observation that episodes of diverticulitis often recur and may run a complicated course. Support for the practice of elective colon resection after 2 episodes of noncomplicated diverticulitis is elucidated by Ward Griffen, Jr.'s statement in a symposium on the management of complicated diverticulitis: ". . . rather than await the inevitable perforation with septic complications, once the patient has had 2 or more bouts . . . he should be advised to have an elective colectomy with primary anastomosis as the means of treating the diverticular disease before such a major complication as perforation occurs."[15]

Advances in diagnostic modalities, medical therapy, and surgical techniques has changed the management and outcome of diverticulitis in recent years. The aim of this study is to update our understanding of the morbidity, mortality, characteristics, and outcomes of patients with complicated diverticulitis in the current era. Moreover, we plan to examine the practice parameter of elective sigmoid resection

and its role in preventing the morbidity and mortality of complicated diverticulitis.

## MATERIALS AND METHODS

Between 1990 and 2003, the charts of all patients who were hospitalized with the diagnosis of diverticulitis that was associated with perforation, abscess, obstruction, phlegmon, fistula, or bleeding at the Mayo Clinic, Rochester and Mayo Clinic, Scottsdale were retrospectively reviewed. Patients were excluded from analysis for the following criteria: diagnosis of diverticulitis changed on review of the operative, pathology, and radiologic reports; diagnosis of uncomplicated diverticulitis; patients refused to participate in research; and patient's chart had incomplete data such as missing pathology report or operative report. Nine hundred ninety-six patients had the diagnosis of diverticulitis at our institutions during the time period. After exclusion criteria were applied, 337 patients with complicated diverticulitis were identified and analyzed.

Data were collected with regard to mode of presentation, location of disease, physical findings, radiographic and laboratory findings, preoperative comorbidities, type of complicated diverticulitis, type of operation, morbidity, mortality, duration of hospitalization, and closure of ostomy. Determination of type of complicated diverticulitis was based on the following definitions: phlegmon was a symptomatic inflammatory mass not associated with pus; pericolic abscess was a collection of purulent material localized near the colon or in the pelvis; obstruction was characterized by obstructive symptoms and a stricture diagnosed by radiologic studies or pathologic evaluation; fistulas included colovaginal and colovesical connections; perforation was either a collection of contained air outside the bowel wall or a large amount of free intraabdominal air; and patients who required a transfusion for lower gastrointestinal hemorrhage associated with symptoms and signs of diverticulitis were designated in the bleeding category.[2,3,7,9–11,16]

Characteristics of patients and their outcomes were determined using statistical analysis. Parameters comprised of discrete, categorical variables were analyzed using chi-squared tests or Fisher exact tests when necessary and appropriate. All statistical tests were 2-sided, and the threshold of statistical significance was set at $P < 0.05$.

## RESULTS

### Patient Population

Of the 337 patients hospitalized for complicated diverticulitis, 162 were men and 175 were women. The mean age of the patients was 65.3 years (range, 18–94 years). The mean age of women (66.9 years) was higher than the mean age of men (63.6 years). Fifty patients were equal to or under the age 50.

### Coexistent Disease

At least one comorbid condition such as cardiovascular, pulmonary, diabetes, and collagen–vascular disease was identified in 70% of the patients. Cardiovascular disease such as hypertension or coronary artery disease was the most common comorbidity (41%). The mean number of comorbid conditions per patient was 1.43 ± 1.31. Eleven percent of patients were diabetic and 6.5% had collagen–vascular disease (polymyalgia rheumatica, rheumatoid arthritis, lupus, SICCA syndrome). Twenty-two percent of patients were taking steroids at the time of their complicated diverticulitis episode for a variety of indications (Table 1). Nine of the 337 patients (2.7%) were hospitalized for nonrelated medical problems when their complicated episode occurred.

**TABLE 1.** Comorbidities of the Patient Cohort

| Comorbidity | Percentage |
|---|---|
| Cardiovascular | 41% |
| Pulmonary | 23% |
| Diabetes | 11% |
| Collagen–vascular | 7% |
| Malignancy* | 8% |
| Steroids | 22% |

*Patients with recent malignancy diagnosis or metastatic disease and receiving treatment.

### Clinical Presentation

Complications of diverticular disease present on admission included acute phlegmon (22.3%; n = 75 patients), paracolic abscess (29.5%; n = 99 patients), colonic obstruction/stricture (22.6%; n = 76 patients), fistula (13.4%; n = 45 patients), diverticular bleeding (4.5%; n = 15), and perforation (44.5%; n = 150) (Table 2). Generalized peritonitis was present in 51 (15.1%) patients on admission. The majority of patients presented with abdominal pain (54.6%), and a significant correlation was identified between pain and perforation ($P < 0.001$). The site of complicated diverticulitis was the sigmoid colon in over 95% of the patients. Other sites involved with complicated diverticular disease included the descending (5), transverse (3), and ascending colon (4).

The average white blood cell count was 11.2 ± 6.0. Seventy-six percent of patients had normal vital signs at presentation and fever was seen in only 22.8% of the patients. The majority of patients (67.1%) underwent a computed tomography scan as part of their evaluation.

**TABLE 2.** 35-D Mortality Rate by Type of Complicated Diverticulitis in the Cohort

| | Overall (%) | Mortality Rate (%) |
|---|---|---|
| Perforation | 44.5 | 12.0 |
| Abscess | 29.5 | 1.0* |
| Obstruction | 22.6 | 0* |
| Phlegmon | 22.3 | 0 |
| Fistula | 13.4 | 0 |
| Bleeding | 4.5 | 0 |

*The mortality rate (%) excludes patients who died as a result of an anastomotic leak that led to sepsis. Without the exclusion for anastomotic leak, the adjusted mortality rate for abscess would be 5.1% and for obstruction 4.0%.

## Operative Management

The majority of patients (52.8%) were treated with segmental colon resection and primary anastomosis. A laparoscopic-assisted approach was used in 8 patients. Six patients did not undergo surgical intervention. One of these 6 patients was felt to be too unstable to proceed with surgical intervention and died. Three of the patients who did not undergo surgery had peridiverticular abscesses that improved with drainage and antibiotics. Two other patients had colonic fistulas. One hundred fifty-one patients (45.4%) underwent surgical diversion (Fig. 1).

The majority of patients with pericolic abscess were managed by resection and primary anastomosis (54.5% vs 42.4% diverted). Acute phlegmon was managed with resection and primary anastomosis in 73.3% of patients. Large bowel obstruction was treated by resection and anastomosis (69.7%) or by diversion procedures (30.0%). The principle operation for perforation was segmental colectomy and colostomy with Hartmann's (78.1%). Most fistulas and diverticular bleeding, in the setting of diverticulitis, were managed by resection and primary anastomosis (73.3% and 73.3%, respectively).

## Mortality

The overall mortality rate for the cohort was 6.5% (n = 22 patients). Mortality was associated with perforation at presentation in 86.4% of cases and with postoperative anastomotic leak in 9.5% of cases. The patient who died before surgical intervention also had a perforation. Therefore, perforation had an associated 12.6% mortality rate and pericolonic abscess had a 1.0% mortality rate. Eighty-nine percent of patients who died of a perforation had no history of diverticulitis. No deaths were seen in patients who presented with the other forms of complicated diverticulitis. The 2 patients who developed postoperative anastomotic leaks presented with large bowel obstruction and a pericolonic abscess. Both patients were treated with resection and primary anastomosis (Table 2).

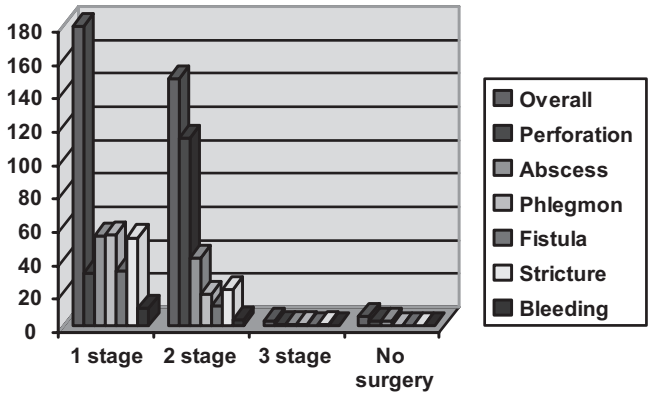


**FIGURE 1.** Operative management. The majority of patients (52.8%) were treated with a one-stage resection and primary anastomosis. Forty-five percent were treated with surgical diversion. For each form of complicated diverticulitis, the percentage of one-stage, 2-stage, 3-stage, and no surgery is shown. Some patients had more than one form of complicated diverticulitis, ie, abscess and a phlegmon.

Steroid use was significantly associated with both perforation rates as well as mortality ($P < 0.001$ and $P = 0.002$, respectively). Coexistent disease such as diabetes, collagen–vascular disease, and immunocompromise was significantly associated with death ($P = 0.006$, $P = 0.009$, and $P = 0.003$, respectively). Other than the 2 patients who died of anastomotic leak, all of the remaining patients had some form of immune system compromise such as steroid use (10 patients), extreme age (mean age, 78.9 years; range, 53–94 years), immunosuppressive medications (chemotherapy, Cytotec, methotrexate) (2 patients), malignancy (5 patients), and cirrhosis (one patient). Of note, female gender was found to be significantly associated with an increased mortality rate compared with men ($P = 0.01$).

## Morbidity

The overall morbidity rate for the cohort was 41.4%. Forty-six patients (14%) had a complication postoperatively that required return to the operating room or a surgical debridement (Table 3). The anastomotic leak rate was 1.2%. Women had significantly more complications requiring reoperation than men ($P = 0.001$). Immune system compromise (excluding steroid use) and having one or more comorbid conditions increased the risk of having a postsurgical complication requiring repeat operation or debridement ($P = 0.001$ and $P < 0.02$, respectively).

Cardiac complications and ileus were the most common causes of postoperative morbidity in this series. Overall, pulmonary complications occurred in 14.6% of patients, 13.4% of patients developed an infection, 16.4% of patients had cardiac complications, 16.7% of patients experienced an ileus or partial small bowel obstruction (none requiring reoperation), and 13.8% of patients had a variety of other postoperative complications (Table 3). Older age, steroid use, preexisting comorbidities, and perforated diverticulitis were all significantly associated with increased postoperative morbidity ($P = 0.002$, $P < 0.01$, $P < 0.0001$, and $P < 0.001$, respectively).

Of the 151 patients who underwent diversion, 44.3% (67 patients) were known to have proceeded with closure of their ostomy. Thirty-two patients (21.2%) were not consid-

**TABLE 3.** Morbidity After Complicated Diverticulitis*

| Morbidity | Patients (%) |
|---|---|
| Operative | |
| Anastomotic leak | 4 (1.2%) |
| Wound dehiscence/infection (require debridement) | 29 (8.9%) |
| Intraabdominal abscess | 7 (2.1%) |
| Other (bleeding, splenic injury, and so on) | 6 (1.8%) |
| Nonoperative | |
| Pulmonary | 49 (14.6%) |
| Cardiac | 56 (16.6%) |
| Infection | 45 (13.4%) |
| Ileus/partial small bowel obstruction | 56 (16.6%) |
| Other (renal failure, cholecystitis, and so on) | 46 (13.7%) |

*Overall morbidity for the cohort (both operative and nonoperative) was 41.4%.

ered candidates for closure as a result of health concerns, and 34.4% (52 patients) of those diverted were lost to follow up.

### History of Diverticulitis and Complications

Forty-seven percent of patients (n = 157) had a history of at least one prior diverticulitis episode, whereas 53.4% (n = 180) presented with complicated diverticulitis as their initial event. Of the patients with a history of diverticulitis, 22% experienced one acute episode in the past, 14% had 2 prior episodes, and 10% had 3 or more episodes. Mortality from complicated diverticulitis was significantly associated with no history of diverticulitis compared with patients with previous diverticulitis episodes ($P = 0.02$). Analysis of the type of complicated diverticulitis showed that the development of pericolonic abscesses and inflammatory phlegmons were associated with a history of at least one prior episode of diverticulitis ($P = 0.007$ and $P = 0.005$, respectively). However, perforation (contained or free) occurred more often in patients with no history of diverticulitis ($P < 0.0001$). No significant predisposition was identified with the development of fistula, obstruction, or bleeding in patients and a history of diverticulitis (Figs. 2 and 3).

## DISCUSSION

Diverticulosis is a common condition and affects one third of patients older than age 45.[13] Ten percent to 25% of patients with diverticulosis will experience diverticulitis and its complications.[16–19] The development of complicated diverticulitis increases with age and has been estimated to develop in approximately one third of patients who have a history of acute diverticulitis.[17,20,21] Elective colectomy in good-risk patients carries a low mortality rate and has been the foundation for the promulgation of prophylactic resection to prevent recurrent episodes of diverticulitis and its associated complications.[2,12,14,16,17,21] However, this stratagem is based on multiple assumptions 1) that all forms of complicated diverticulitis increase morbidity and mortality rates, 2) that having diverticulitis begets having recurrent episodes and is associated with increased risk of the development of complicated diverticulitis, 3) all patients are at risk for a perforated diverticulitis episode, and 4) the risk of recurrent diverticulitis and colostomy is eliminated with elective surgical intervention.

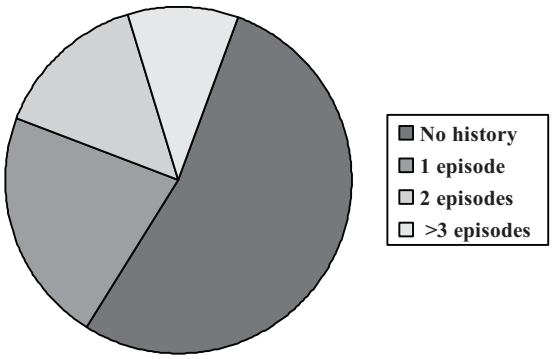


**FIGURE 2.** History of diverticulitis and development of complicated diverticulitis (overall).

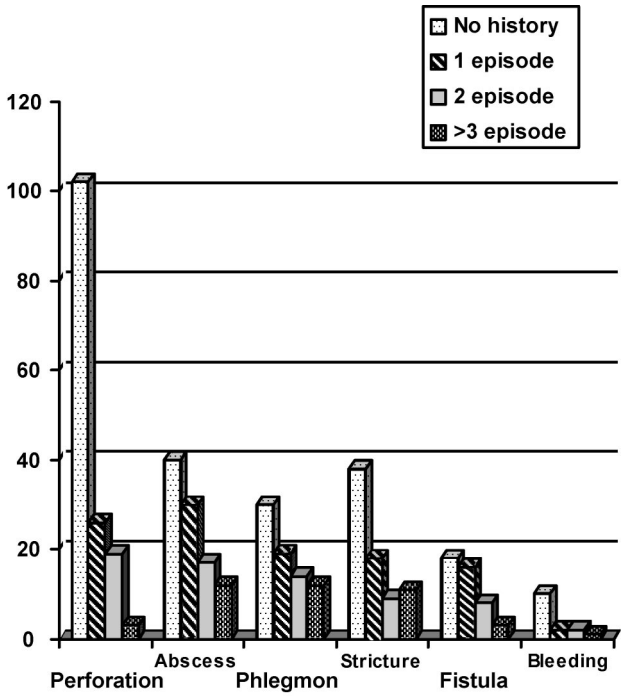


**FIGURE 3.** History of diverticulitis and development of complicated diverticulitis (by type of CD). The majority of patients (53.4%) presented with complicated diverticulitis as their first episode of diverticulitis.

In our study, the overall mortality rate of 6.5% was considerably lower than the majority of studies which report rates of >10%. If perforated diverticulitis was excluded, the overall mortality rate for the cohort would be <1.6%. This is less than the reported rates for elective sigmoid resection. In the analysis of each type of complicated diverticulitis, mortality was most significantly associated with perforated diverticulitis. Patients who experienced a pericolonic abscess carried a 1.0% mortality rate. For the other types of complicated diverticulitis (fistula, obstruction, inflammatory phlegmon, and bleeding), no increased risk of mortality was present.

This finding has been reported in other recent studies. Schwesinger et al evaluated 89 patients with complicated diverticulitis who underwent emergency operations.[9] The majority of deaths occurred in patients who presented with perforation. Obstructive diverticulitis was found to have a 1.0% mortality rate with the remaining complicated diverticulitis cases having no associated mortality. In Rodkey and Welch's analysis of patients with complicated diverticulitis between 1974 and 1983, patients with free perforation had a mortality rate of 21.6%, but the other forms of complicated diverticulitis carried mortality rates from 0% to 2.6%.[5]

Morbidity is a significant problem after the treatment of complicated diverticulitis. Our overall morbidity rate of 41% is similar to that found in other studies. However, we again identified a significant correlation between perforated diverticulitis and increased morbidity. This finding was also confirmed by the Schwesinger et al study.[9] The other forms of complicated diverticular disease were not found to have a

significant correlation with increased postoperative morbidity. The presence of preoperative comorbidities, especially older age, collagen–vascular disease, pulmonary disease, and cardiovascular disease, were all found to significantly increase the risk of development of a postsurgical complication. Therefore, it does not appear that all complicated diverticulitis increases postoperative morbidity. More likely, the patient's overall health before the episode of complicated diverticulitis and the sepsis that occurs as a result of free perforation is associated with the development of postsurgical morbidity during recovery.

Previous literature supports our finding that perforated diverticulitis is not only associated with increased morbidity and mortality, but is commonly the initial presentation of diverticular disease in many patients. In determining the incidence of perforated diverticulitis, Hart and colleagues performed a case-controlled study of this patient population between 1995 and 1997. They found that 78% of patients with perforated diverticulitis had no history of diverticulitis.[22] Analysis of our cohort determined that the majority of patients (53.4%) presented with complicated diverticulitis as the first manifestation of their diverticular disease. In those patients with no history of diverticulitis, over half presented with either a contained or free perforation as a result of complicated diverticulitis. Forty-four percent of these patients presented with peritonitis and free perforation. In comparison, patients with a history of diverticulitis tended to present with pericolonic abscess or inflammatory phlegmon rather than perforation. Only 21% of patients with a history of diverticulitis presented with free perforation and peritonitis. Furthermore, only 2 of the 22 patients who died in our study had a history of diverticulitis. These were the 2 patients who experienced a postoperative anastomotic leak. Thus, the patients who developed the worst outcome from complicated diverticulitis had no history of diverticular disease.

Several studies have examined the progression of diverticulitis to complicated diverticulitis. Chautems et al followed 118 patients after a first acute diverticulitis episode for a median of 9.5 years. Seventy-one percent of the patients had no recurrent episodes. None of the patients with subsequent episodes of diverticulitis died of complicated diverticulitis or required emergency surgery.[23] In an older study, 392 patients with a first episode of diverticulitis were followed from 2 to 12 years. Twenty-five percent of the patients developed recurrent episodes compared with 75% who had no further diverticulitis. Of the 25% who developed recurrent episodes, there were no perforations and medical management was successful in all. In this study, all perforations and complications of diverticulitis were seen only during the initial onset, and it was felt that after the first episode, the disease appeared to run a benign course.[24] A recent population-based study showed that only a small percentage (5.5%) of patients who recovered from an initial episode of nonsurgical diverticulitis progressed to requiring an emergency colectomy or colostomy.[25]

Prophylactic colectomy is associated with risks of mortality and colostomy as high as 2.3% and 14.2%, respectively.[26,27] Furthermore, the risk of recurrent diverticulitis is not eliminated after colectomy. Recurrent diverticulitis after colectomy has been reported to be 2.6% to 10.4%.[8,28,29] In a recent decision analysis using a Markov model, Salem et al determined that performing colectomy after the fourth episode of diverticulitis rather than the second episode in patients older than 50 years resulted in 0.5% fewer deaths, 0.7% fewer colostomies, and a reduction in cost per patient.[30]

The data used to support current (ASCRS) practice parameters of elective resection after 2 uncomplicated diverticulitis episodes is outdated.[16] Of the 83 documents used to determine the most recent ASCRS practice parameters for the surgical treatment of sigmoid diverticulitis, 68 pieces of the supporting evidence are more than 10 years old. Twenty-eight papers are more than 20 years old and only 15 documents were reported within the last 10 years. Furthermore, the majority of the published data on sigmoid diverticulitis is based on level 3 or 4 evidence. Changes in diagnosis (computed tomography imaging), treatment (percutaneous drainage), and medical therapy (antibiotics, critical care) may account for the disparate results we now see in complicated diverticulitis.

We conclude that prophylactic colectomy as a stratagem for reducing mortality and morbidity from complicated diverticulitis may be outmoded and needs to be reevaluated. Our study reveals that the majority of patients with complicated diverticulitis had no history of diverticulitis. Perforated diverticulitis, which carries the highest risk of mortality and morbidity, most commonly was the first manifestation of complicated diverticular disease.

Investigation is needed to identify who is at risk for the development of perforated diverticulitis as the initial manifestation of diverticular disease. In our analysis, we identified a significant association between perforated diverticulitis and increased mortality and morbidity in patients who are immunocompromised. Over half of the patients (59%) who died in our cohort were on immunosuppressive medications such as steroids, methotrexate, or chemotherapy. Excluding the anastomotic leaks, the remaining patients who developed severe complications had other forms of immune system compromise such as extreme age (>90 years old), cirrhosis, or systemic malignancy. Many studies have shown a significant correlation between immunosuppression and perforation as well as poor outcomes.[11,31,32] In a review of 209 patients with acute diverticulitis, Tyau and colleagues identified a significantly higher proportion of immunocompromised patients developing perforated diverticulitis (43%) compared with nonimmunocompromised patients (14%).[13] Postoperative morbidity was 65% in the immunocompromised patients versus 24% in immune-competent patients. Mortality was 39% in the immunocompromised compared with 2% in the nonimmunocompromised patients. Therefore, immune system-compromised patients, including elderly patients, may benefit from early sigmoid resection. Strategies to identify patients truly at risk for catastrophic perforation should be developed.

Today, there are many issues regarding the treatment of diverticulitis for which there exists a need for reexamination. The role of surgery is receiving much scrutiny in patients

with diverticulitis under the age of 50 and in patients who have recurrent episodes. In this study, we have attempted to examine the role of antecedent episodes of diverticulitis and the subsequent development of complicated diverticulitis. It does not appear from our study that the current practice parameter of prophylactic colectomy after 2 episodes of diverticulitis will prevent complicated diverticulitis. Moreover, current advances in postoperative and critical care have apparently significantly reduced the mortality from all forms of complicated diverticulitis except for perforation. Other issues such as prevention of morbidity of future episodes of acute diverticulitis, the place of elective resection, and the question of elective resection after percutaneous drainage of a diverticular abscess cannot be addressed in this study. We hope that prospective trials will be conducted in the near future to answer these questions and to better define target groups for prophylactic resection in this very prevalent and pervasive disease.

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# Discussions

DR. ROBERT D. FRY (PHILADELPHIA, PENNSYLVANIA): Especially noteworthy from this group are previous studies that have indicated the importance of excising the distal segment of the sigmoid for prevention of subsequent attacks of diverticulitis. The present study supplies data that may help us and clarify our current thoughts about diverticular disease.

For me, a confusing indicator of complicated diverticulitis in this study is phlegmon. Certainly there are all degrees of phlegmon. You can argue that you can't make a diagnosis of diverticulitis without a phlegmon, so surely all cases of uncomplicated diagnosis are phlegmons to some extent. So what makes a phlegmon a complicated case?

I thought that a phlegmon caused by diverticulitis was an indication for antibiotics and perhaps later surgery, depending upon the circumstances (such as the number of prior attacks). But in this series, 22% of complicated cases were complicated solely because of the phlegmon. Could you elaborate on that a bit?

I can't tell from this study how a patient with an abscess was treated. You state that the majority of patients with pericolic abscesses were managed by resection and primary anastomosis. But weren't these patients treated first by draining the abscess percutaneously? Are you recommending that a patient with a pelvic abscess should be taken to the operating room for primary resection and anastomosis 54% of the

time? Or should the excess be drained first and if so, then when should the resection be done?

I would also appreciate a little clarification on the complication of obstruction. In my experience, it is really quite rare to encounter colonic obstruction because of diverticulitis, but it is quite common to have to deal with small bowel obstruction, or ileus, secondary to the inflammation associated with phlegmon or an abscess. Isn't the standard treatment for this type of obstruction to drain the abscess, treat the phlegmon with antibiotics, and decompress with nasogastric suction until the obstruction absolves? Could you clarify your recommendations for treating a patient with intestinal obstruction caused by diverticulitis?

Dr. Chapman, you provided convincing evidence that free perforation may be the first presentation of diverticulitis, and this is especially true of patients that are immunocompromised. And your data imply that subsequent attacks of diverticulitis are not likely to present with free perforation.

This is in agreement with Flum's study that was presented last year at the American College of Surgeons, reporting that only about 6% of patients afflicted with a subsequent attack of diverticulitis ever require emergency colectomy or colostomy. But is this the reason that we recommend resection after 2 attacks? Isn't the person with 2, or say 3 attacks, at substantial risk of having a third or a fourth attack, and would that be reason enough to recommend resection? If so, does this study really change our present recommendation for resection after 2 attacks?

Dr. Jennifer R. Chapman (Rochester, Minnesota): In response to your first question regarding phlegmon, we defined phlegmon as a symptomatic inflammatory mass that was not associated with an abscess and many times these patients were operated on because they could not exclude an inflammatory cancer. This diagnosis was made by both CT scan as well as by pathologic review. We did not include inflammatory stranding which is usually treated with antibiotics alone as complicated diverticulitis.

Historically the majority of literature has included and made a distinction between phlegmon or inflammatory mass and the other forms of complicated diverticulitis. In the majority of papers used to support the practice parameter of elective sigmoid resection they describe abscess, phlegmon or inflammatory mass, stricture or obstruction, perforation or generalized peritonitis, fistula and hemorrhage as forms of complicated diverticulitis. Therefore we investigated these types of complicated diverticulitis in our study.

Regarding how a patient with an abscess should be treated, in our series we had 99 patients with diverticular abscesses. Sixty-four patients proceeded to immediate surgery. Twenty-seven patients underwent percutaneous drainage. And 8 patients were treated with antibiotics alone. Twenty-five of the percutaneously drained patients and 7 of the antibiotic patients underwent subsequent elective colectomy. Therefore it is not possible with this data to develop a schema for the treatment of diverticular abscesses. Again, our aim was to determine the morbidity, the mortality, the characteristics and the outcomes of complicated diverticulitis in this current era. I think it is essential that a randomized prospective trial be done on patients with diverticular abscesses so we can better understand the correct management of these patients.

In response to your question on obstruction, obstruction in our series was characterized by obstructive symptoms and a stricture or narrowing diagnosed by radiologic exams, colonoscopy, and pathologic review. We did not include any other forms of obstruction. Most studies report a 5–19% occurrence of large bowel obstruction due to diverticular stricture narrowing. The majority of patients in our study were treated with resection and primary anastomosis. Again, we don't feel that we can comment on what is the best operative management for these complications. We can comment that operating for attacks of diverticulitis may not prevent complicated diverticulitis.

Regarding your final question pertaining to the number of previous diverticulitis attacks increasing the risk of subsequent episodes of diverticulitis, I again cannot comment on the risk of patients developing recurrent diverticulitis from our series since we analyzed only patients with complicated diverticulitis.

In Flum's decision analysis, they deemed that elective colectomy had the lowest mortality, morbidity, and cost to patient if performed after the fourth attack instead of the second attack as is currently recommended. Our series supports this conclusion as shown by the finding that patients with no prior history of diverticulitis had a higher likelihood of perforation, mortality, and morbidity compared to patients with one or more episodes of diverticulitis. Furthermore, the patients with multiple episodes of diverticulitis who developed complicated diverticular episode tended to have similar mortality and morbidity rates to patients undergoing elective resection. We are not able to address in this study the natural history of uncomplicated diverticulitis, and patients may still require elective colectomy for the debilitation of pain from future episodes.

Dr. Merril T. Dayton (Buffalo, New York): I do have a question that you alluded to in your final remarks. Your paper really doesn't address uncomplicated diverticulitis. What about the large number of patients at the Mayo Clinic that have had 2 attacks of diverticular disease, have had an elective sigmoid resection and had no complications?

I remind you that in the early part of your presentation you decried the absence of type 1 data to answer that question; your paper is also not type 1 data, of course. Do we need a prospective randomized study in which patients that have had one attack are allowed to have 2, 3, 4, or 5 attacks

to really establish whether surgery is the right thing to do? I am not sure that this presentation answers that question.

DR. JENNIFER R. CHAPMAN (ROCHESTER, MINNESOTA): This presentation does not answer that question. And part of the point of the presentation is to try to keep challenging our minds and our thinking about diverticulitis and the disease itself.

A lot of our data on the natural history of diverticulitis is outdated, it was published in the 1960s and the 1970s, and there have been so many changes in the management of diverticulitis that I think we need to investigate this with prospective data. I 100% agree. Studies are coming out based on decision analysis, based on very short follow-ups, but we really don't know the natural history of uncomplicated diverticulitis.