

## Is laparoscopic surgery applicable to complicated colonic diverticular disease?

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### Abstract

**Background:** Expanding upon our experience with laparoscopic surgery for colonic benign and malignant processes and for bowel obstruction, we have reviewed our experience with minimal access laparoscopic surgery for complicated diverticular disease. We propose an approach of surgical care incorporating diagnostic laparoscopy in those not responding to medical therapy alone.

**Methods:** Our study includes data from two different surgical teams working in separate hospital-and-patient environments. Our theory that laparoscopy could be widely applicable to this complex disease process is borne out by experience in both locations. One hundred forty-eight patients were managed by laparoscopic or laparoscopically assisted methods with 18 patients requiring drainage only without resection.

**Results:** Our management of 148 of 164 patients (90%) by laparoscopic approach was successful, with a very acceptable morbidity of 5% in the elective cases and decreased ileus (20% of open vs 7% laparoscopic) in acute complicated cases. Elective resections required hospitalization of 4–5 days, demonstrating the benefits of incorporating laparoscopy in the care of these cases, particularly when compared to standard open procedures requiring 8 days' hospitalization.

**Conclusions:** We believe complications of diverticular disease including abscess, perforation, fistula, and bleeding can potentially be managed in this way by minimal access procedures, decreasing postoperative wound problems, decreasing length of hospitalization and overall morbidity, and improving patient care.

**Key words:** Laparoscopic colectomy — Complicated diverticulitis — Bleeding

While following standard protocols of care for patients with complicated diverticulitis (bleeding, obstruction, abscess or fistula formation, perforation with or without peritonitis), we have introduced the use of laparoscopy in the approach to this disease, making the minimally invasive techniques a cornerstone of our practice. We feel this can be used to decrease the morbidity of the necessary surgical procedures when selectively applied to these cases. Drainage of abscess, necessary colonic resection, placement of colostomy, and examination and lavage of the peritoneal cavity can be achieved by making use of laparoscopic or laparoscopically assisted approaches. We report here our experience with 164 patients with colonic diverticulitis to emphasize the minimally invasive aspects of our approach to this problem. Our experiences with laparoscopy for colorectal carcinoma [5, 12] and in acute bowel obstruction [4] have led us to apply diagnostic laparoscopy to complicated diverticular disease. We emphasize in this report 43 patients treated for specific complications of acute diverticulitis. We propose an approach to surgical care of complicated diverticular disease based on appropriate preoperative diagnostic studies such as CT scan, colonoscopy, contrast enema, and ultrasound, followed by diagnostic laparoscopy in those cases not responding to standard medical therapy. In this way complications of diverticular disease including abscess, perforation, fistula, and bleeding can potentially be managed by minimal access procedures resulting in decreased postoperative wound problems, early diagnosis, rapid treatment, avoidance of delay in treatment, decreased morbidity, and decreased hospital stay and subsequent costs.

### Materials and methods

Our experience with the laparoscopic approach to complicated colonic diverticulitis/diverticulosis (bleeding) from November 1991 until March 1996 is the basis of this study of 164 patients from two separate centers, involving two separate operating teams. The underlying medical problems in these patients were widely varied and often played a major role in management, as would be expected in this age group. Ages varied from 22

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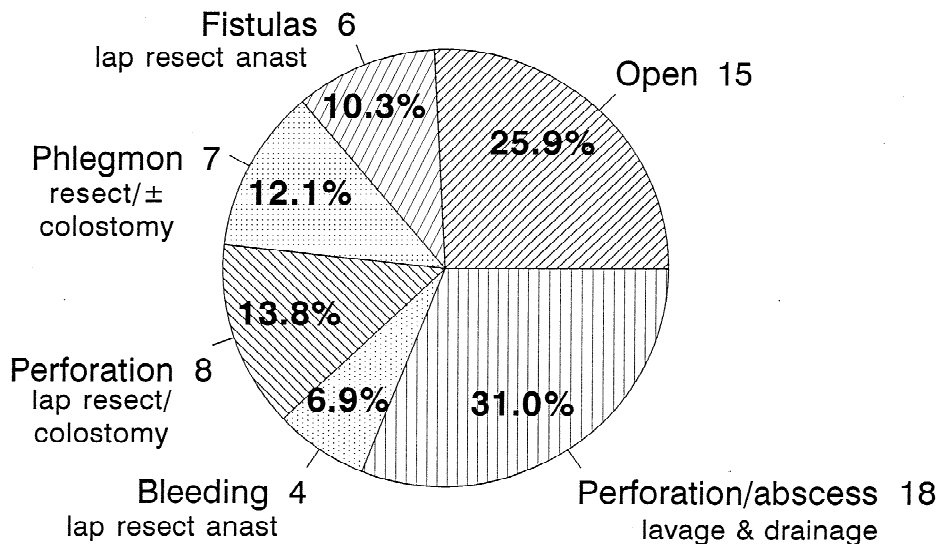


Fig. 1. Laparoscopic treatment of complicated colonic diverticulitis in 58 patients.

to 98 years. Average age was 62.1 years. There were 78 females and 86 males. Of the 164 patients, 15 underwent open procedures or were converted to open. Of the 149 laparoscopic/laparoscopic assisted patients, 106 patients had elective procedures after bowel preparation (included both intracorporeal laparoscopic and laparoscopic-assisted anastomosis). The 43 patients of the acute diverticulitis (specific complication) group included eight patients with colonic diverticular perforation (Hartmann's procedure in six, omental patch closure in two), 18 patients who underwent diagnostic laparoscopy with drainage and lavage only without resection, four patients with laparoscopic colonic resection for recurrent bleeding, six patients who underwent laparoscopic resection and reanastomosis for colonic fistula (three colovaginal, two colovesical, and one colocolic), and, finally, seven patients who underwent laparoscopic resection and colostomy for acute diverticulitis with obstructive phlegmon (Fig. 1).

#### Elective procedures/open cases

The elective procedures were performed on those patients who had diagnosed diverticular disease as a consequence of repeated attacks of symptoms (106 patients, 57 males, 49 females, ranging in age from 35 to 71 years [average 49.5 years]). All patients in this group had preoperative barium enemas and/or colonoscopy. Preoperative mechanical and antibiotic bowel preparations and intravenous antibiotics were given. Laparoscopic resection was accomplished (11 laparoscopic with intracorporeal stapled anastomosis, 95 laparoscopic assisted stapled anastomosis). Average length of hospital stay postoperatively was 4.5 days. One serious complication was noted with anastomotic stenosis over 30 days postoperatively, dealt with by open procedure and revision of anastomosis. The remainder of this study addresses those acute cases undergoing laparoscopy.

#### Open cases

Of the acutely complicated diverticulitis patients (58 cases), 15 patients were initially started laparoscopically but were opened for varying reasons including excessive adhesions, excessive purulence, inability to adequately visualize and mobilize the area of diverticular perforation, inability to visualize the ureter, friable bleeding tissue, and, in one case, circular stapler misfiring. Hospital stay varied from 8 to 17 days (average 13 days), with multiple complications noted (atelectasis in four, wound infection in one [6.6%], prolonged ileus greater than 7 days in three [20%]).

#### Laparoscopically managed acute complicated colonic diverticulitis (43 cases) acute diverticulitis with obstructive phlegmon (seven cases)

Seven patients underwent diagnostic laparoscopy after failure of medical management with obstructive diverticulitis phlegmon found. Abscess was

present in four of the seven cases and these underwent laparoscopic anterior resection of the inflammatory colon with diverting colostomy (Table 1). Complications were few but similar to those with open technique (pulmonary atelectasis in one, prolonged ileus of greater than 7 days in one, renal failure in one, urinary tract infection in one, and one with bleeding from the stomach requiring transfusion. Hospital stay ranged from 6 to 23 days (average 10.7 days). A single anastomotic stricture was responsive to dilatation.

#### Acute diverticulitis with perforation—eight patients/laparoscopic lavage and drainage only—18 patients

Additional findings at diagnostic laparoscopy revealed the primary complication of acute perforation of the sigmoid diverticular disease in eight patients. Hartmann's resection with descending colostomy was the mode of therapy in six cases; omental patch closure of the perforation and closed suction drainage/lavage achieved a satisfactory result in two cases.

The latter two cases were treated similarly to the 18 patients who underwent no resection but had extensive laparoscopic lavage and suction drainage of the area of abscess/perforation. This group entered the hospital with acute abdominal symptoms, elevated temperature, elevated WBC, and clinical evidence of diverticulitis with obvious peritoneal signs CT scan, sonogram, and/or water-soluble contrast study per rectum showed the pathology in four of the patients with laparoscopy done for clinical signs in the remainder (14 patients).

Follow-up has ranged from 4 to 34 months; three patients had subsequent resection of the diseased colonic segment performed or completed laparoscopically, primary anastomosis having totally avoided the need for ostomy. The remaining patients have done well with either surgical resection pending or avoided due to poor medical condition or refusal to have a procedure. Their diverticular disease is presently being well managed medically. Essential to this approach is the postoperative complete colonoscopy to rule out neoplasm. Complications in the patients with perforation (eight patients) and the laparoscopic lavage and drainage only (18 patients) have included bleeding requiring transfusion in two patients, ileus lasting more than 7 days in one, and urinary tract infection and pulmonary infection in one single patient. Another patient undergoing lavage and drainage had pneumonia and congestive heart failure. One patient suffered a postoperative cerebrovascular accident.

Patients averaged 7.5 days postoperative hospitalization. Toxicity of the infection associated with their illness resolved on average in 4.5 days with continuation of antibiotics and bowel rest. (Temperature and WBC were used as criteria.)

#### Acute diverticulitis with fistula

Diverticulitis-induced fistulas were dealt with in six patients—three colovaginal in women with prior hysterectomy, two colovesical, and one with

**Table 1.** Complicated results—laparoscopic surgery for diverticular disease acutely complicated cases = 58/elective cases = 106

	Protective ileostomy or colostomy	Primary stapled reanastomosis
Open or converted to open (15)	8	1
Laparoscopic (43)		
1) Acute inflammation phlegmon (7)	4	5
2) Acute and chronic fistulas (6)	4	5
3) Acute perforation (8)	6	0
4) Bleeding (4)	0	4
5) Laparoscopic lavage and drainage only—abscess/localized peritonitis/sealed perforation (18)	0	0
Elective cases (106)	0	106

a colocolic fistula. Preoperative workup included colonic barium contrast x-ray, CT scan, and colonoscopy.

Each of the six cases underwent laparoscopic low anterior resection of the sigmoid/rectosigmoid; in five cases, reanastomosis was accomplished. One patient had resection and reanastomosis and diverting colostomy which was closed 5 months postoperatively. Two of the cases with primary reanastomosis had protective ileostomy. All anastomoses were accomplished intracorporeally. Follow-up ranges from 5 to 37 months (mean 21 months) with one patient lost to follow-up. One patient had colonic resection and colostomy for colovaginal fistula some 9 months after lung transplantation.

One patient with colocolic fistula and abscess had further peristomal abscess and acute renal failure which resolved postoperatively.

### *Diverticular disease with associated bleeding*

Four patients had intermittent bleeding associated with diverticular disease (age range 59–98). Colonoscopy, tagged red blood cell scan, CT scan, barium enema, and angiogram were among those tests used preoperatively. All four patients underwent mechanical and antibiotic bowel preparation preoperatively. Two patients had laparoscopic total colectomy with ileoproctostomy anastomosis performed intracorporeally. One patient underwent laparoscopic right hemicolectomy with reanastomosis. One 98-year-old patient with bleeding was taken to the operating room with angiogram catheter selectively placed showing the site of bleeding. Intraoperative on-table injection of methylene blue dye allowed for exact resection of a segment of the left colon containing the bleeding site. This patient had a 5-day postoperative hospitalization. Postoperative complications were confined to one patient who had pulmonary atelectasis, urinary tract infection, acute renal failure, and ileus of greater than 7 days. This patient was alive at 8 months without further bleeding after laparoscopic total colectomy with ileorectal anastomosis. Follow-up has been from 6 to 26 months without any evidence of rebleeding in this small series of four cases.

## **Compiled results**

### *Complicated colonic diverticulitis/diverticulosis*

Compiled results of laparoscopic/laparoscopic assisted colonic procedures are presented in Table 1. Diagnostic laparoscopy preceded subsequent laparoscopic management in 43 cases of complicated diverticulitis.

Eighteen cases underwent resolution of their acute problems by laparoscopic lavage and drainage of abscess; two had omental patch closure of the acute perforation laparoscopically. No acute reoperation was required in this group of 20 cases, and it should be pointed out that no colostomy was necessary and no fistulas developed.

The open cases had the highest rate of colostomy or

**Table 2.** Complicated diverticulitis: postoperative morbidity

	Open (15 cases)	Laparoscopic (43 cases)
Bleeding (transfusion)	4	2
Pneumonia/atelectasis	4	2 <sup>a</sup>
Urinary tract infection	1	2 <sup>a</sup>
Acute renal failure/azotemia	0	3 <sup>a</sup>
Postoperative ileus > 7 days	3	3
Wound infection	1	1
Ureteral injury	0	1
Trocar hernia	0	1
Mortality	0	0
Cerebrovascular accident	0	1

<sup>a</sup> Same 2 patients

protective ileostomy, but admittedly these were the most difficult cases of our series (eight out of 15, or 53% of the open cases vs 14 of 43, 32.6% of the laparoscopically managed cases).

Very effective lavage of the peritoneal cavity was accomplished in the lavage and drainage group as no subsequent abscesses resulted (Table 2). Wound infection occurred in one patient in the open procedure group (one of 15, or 6.6%) and in one patient who had laparoscopic management of diverticulitis with fistula (one of 43, or 2.3%) in whom peristomal abscess occurred. Interestingly, this patient had concomitant colocolic abscess drained at the time of the original laparoscopic surgery.

Operating times averaged 120 min (range 90–240 min) for elective procedures. Lavage and drainage procedures routinely required less than 60 min.

Prolonged ileus lasting more than 7 days remains a potential problem, occurring in three of the 15 open cases (20%) and in three of the 43 (7%) laparoscopic cases. Pneumonia/atelectasis accounted for two complications in laparoscopic cases (4.6%) and four complications in the open cases (27%). Bleeding requiring transfusion was noted in four of the 15 open cases and in two of the laparoscopic cases. Additionally, one laparoscopic patient suffered a postoperative cerebrovascular accident.

### *Approach to management and operative technique in complicated colonic diverticulitis*

We routinely have used bowel rest and antibiotics in our practice in patients with suspected acute diverticulitis, reserving operative intervention to those failing these measures: This has been the standard of care in the past and has been demonstrated to avoid surgery in as many as 70% of patients. Use of water-soluble contrast enema and CT scanning along with ultrasound remain important diagnostic studies to make the diagnosis as certain as possible.

Improvement in the patient's condition is the usual outcome of the above approach, but with increasing nonresolving abdominal pain, diffuse abdominal tenderness, tachycardia, sepsis, rising white blood cell count, or any sign of deterioration, we feel that a more aggressive approach is necessary in 24 to 48 h after diagnosis is suspected and treatment started. Percutaneous drainage of abscess has been shown an effective way to deal with localized intra-

abdominal abscess [6, 14, 15]. In patients who can tolerate general anesthesia and in instances where percutaneous approach is unsafe by virtue of overlying bowel loops, obesity, or multiple operations, diagnostic laparoscopy can afford several advantages. First, good visualization of the diseased area of colon is possible with the laparoscope introduced often in an alternative site in either upper quadrant or the midabdomen. Our preference is the use of the Veress needle for insufflation of CO<sub>2</sub> to 14–15 mmHg pressure. Use of the 5-mm cannula and 5-mm 0° laparoscope allows for determination of “free” areas in the abdominal wall for further placement of trocars (either 5 or 10 mm) and subsequent necessary dissection of abdominal wall adhesions.

Our approach to the operative management of the patient with acutely complicated colonic diverticulitis:

1. Three to five trocar sites are used, placed in a general “crescent” pattern with the opening of the crescent toward the pathology—that is, usually the sigmoid colon (highly variable and thus no standard of trocar location can be given).
2. Laparoscopic bowel clamps (Glassman) are preferred for gentle bowel handling.
3. Avoid dissection of friable bowel/mesentery where possible (lavage and drainage) to accomplish definitive single-stage procedure after infection is resolved at a later time.
4. Remove laparoscopically resected bowel in a reservoir bag if any possibility of neoplastic process.
5. Use trocar site (enlarged lower quadrant or alternatively the trocar site in the left rectus sheath) to remove the specimen and then place the proposed diverting ostomy at that site.
6. Lavage the peritoneal cavity/abscess cavity copiously with dilute Betadine/normal saline solution.
7. Colonoscopic evaluation of the colon is essential to evaluate for neoplasm in the postoperative period (used intraoperatively where necessary).
8. In feculent peritonitis, conversion to open procedure may be advisable for adequate management/resection.
9. Closed suction drainage is used on all cases with abscess.
10. Postoperative broad-spectrum antibiotics are guided by intraoperatively obtained cultures.
11. Postoperative nutritional support (parenteral or oral) depends on return of bowel function.

## Discussion

Our successful laparoscopic management of complicated diverticulitis was accomplished in 43 of 58 patients or 74% with an overall laparoscopic success rate of 90.2% (148 of 164 patients) when elective cases are added.

It appears from the early results of this brief experience that laparoscopy has a definite place in the treatment of acute complicated colonic diverticular disease—and in our practice a very vital role. Complicated colonic diverticular disease has proven a continued challenge in an attempt to convert a given patient from an emergent or urgent status to an elective operative status as suggested by Rothenberger and Wiltz [13]. We present our approach to complicated

diverticular disease and have used the Hughes [9] classification in an attempt to delineate the severity of disease found at operation. While lavage and drainage of purulent peritonitis is effective, we strongly recommend to the less experienced surgeon the conversion to open procedure for patients with feculent peritonitis.

Application of diagnostic laparoscopy has helped us to better evaluate the severity of the inflammatory response to allow drainage and lavage and to provide a means to resect disease while avoiding potential wound complications (one of 15 open cases—6.6% vs one in 43 laparoscopic cases—2.3%) in acute complicated cases. No infections were noted in the elective laparoscopic group (zero of 106).

The shift toward one-stage procedures for resection of colonic diverticular disease has made innovation, in the form of percutaneous drainage [6, 14, 15] of pericolic abscesses, an appealing modality initially in preparation for later resective procedure. In those cases particularly where radiologically directed percutaneous drainage is not possible because of intervening bowel, where obstruction is part of the clinical picture, and when there is an uncertainty of diagnosis and lack of response to conservative bowel rest and antibiotics, we feel that diagnostic laparoscopy provides an excellent option and potentially can be used to treat some of the complications of diverticulitis without an open procedure. Essential to the laparoscopic lavage and drainage approach is the use of postoperative complete colonoscopy to exclude neoplasm.

Management of acutely perforated left colon by primary resection with or without protective colostomy has been shown preferable to three-stage operation in reduction of morbidity and mortality [2]. We have shown in our experience that each of these options can be accomplished by minimal access means. Our experience parallels that of O’Sullivan et al. [11] in the laparoscopic management of generalized peritonitis secondary to perforated colonic diverticuli with similar hospitalization of 10.7 days, on average, postoperatively. In contrast to the lavage technique of O’Sullivan, we have chosen to place a closed suction drain in each of our cases.

Management of colocutaneous, colovesical, and colovaginal fistulas has been shown best handled by single-stage technique [3, 7, 10, 16] where possible, and our experience has shown this approach is quite feasible with laparoscopic technique. Preoperative workups with barium enema, CT scan, and cystoscopy remain valuable aids to diagnosis in colon-related fistulas. In a series of 92 patients, Fazio et al. [3] had 80% having one- or two-stage resection and anastomosis with 77% of patients without fistula or stoma postoperatively. This can be accomplished laparoscopically, as noted by Hewett [8] and as seen in our small series.

Comparing length of hospitalization is difficult to assess, but we feel our 10.7-day average for laparoscopic management of acute diverticulitis, 4.5 days for elective resection, and 13 days for our open resections compare very favorably with the open data of Alanis et al. [1]—16.2 days for primary resection and anastomosis, 19.4 days for primary resection with Hartmann procedure, and 26 days for first admission of delayed resection using three-staged procedure. Postoperative hospitalization in our acute complicated 58 cases was reflective of age and its associated medi-

cal problems: Those less than 70 years of age stayed 7.2 days and those greater than 70 years of age 14.2 days.

We continue our experience with laparoscopic resection of colonic diverticular disease and feel our success rate justifies this approach. Our low morbidity for elective procedures (less than 5%) and lessened morbidity for the laparoscopic approach compared to open approach to acutely complicated diverticulitis make this our preferred approach.

## Summary

Expanding upon our ongoing experience with laparoscopic surgery for colonic carcinoma and with bowel obstruction [4, 5, 12] we have reviewed our experience with minimal access surgery for complicated colonic diverticular disease. There were a total of 164 cases, 106 of which were laparoscopic elective resections. Fifteen required open or conversion to open and 43 were acute complications of diverticulitis managed laparoscopically or laparoscopically assisted. This experience bridges the time frame from November 1991 until March 1996, including the 43 patients treated by diagnostic laparoscopy and subsequent laparoscopic resection and/or lavage and drainage. Although this is not a randomized study, and we realize that there is difficulty in comparison, we feel application of diagnostic laparoscopy and of laparoscopic means for treatment in 43 of 58 patients led to improvement in postoperative patient status, decreasing the risk of wound infection, postoperative atelectasis, and the overall length of hospital stay. Diagnostic laparoscopy is the key new ingredient in our approach to this problem and resulted in primary laparoscopic resection and reanastomosis and in avoidance of ostomy in 29 of the 43 (67.4%) acute patients managed completely laparoscopically or laparoscopically assisted. No mortality was encountered. A select group of 18 patients were thus treated by diagnostic laparoscopy, lavage, and drainage only and have either been subsequently electively treated by laparoscopic resection and anastomosis or medically only, thus totally avoiding ostomy. We propose an approach of surgical care for complicated diverticular disease based on preoperative appropriate diagnostic studies such as CT scan, colonoscopy, contrast enema, and ultrasound, followed by diagnostic laparoscopy in those cases not responding to medical

therapy. In this way, complications of diverticular disease including abscess, perforation, fistula, and bleeding can potentially be managed by minimal access procedures, decreasing postoperative wound problems and overall morbidity.

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